3.0 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT AND SYSTEMS

3.1 Conformance with NRC General Design Criteria

Section 3.1 of the Fermi 3 Combined License (COL) Final Safety Analysis Report (FSAR), Revision 4, incorporates by reference, with no departures or supplements, Section 3.1, "Conformance with NRC General Design Criteria," of Revision 9 of the Economic Simplified Boiling-Water Reactor (ESBWR) Design Control Document (DCD). The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Fermi 3 COL application are documented in NUREG–1966, the Final Safety Evaluation Report (FSER) related to the certified ESBWR DCD.

3.2 Classification of Structures, Components, and Systems

3.2.1 Introduction

Nuclear power plant structures, systems, and components (SSCs) important to safety are to be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. Important to safety SSCs are defined in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities, "Appendix A, "General Design Criteria for Nuclear Power Plants," as those SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Important to safety SSCs include safety-related SSCs that perform safety-related functions to ensure: (1) the integrity of the reactor coolant pressure boundary (RCPB); (2) the capability to shut down the reactor and maintain it in a safe shutdown condition; and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. The earthquake for which these safety-related plant features are designed is defined as the safe shutdown earthquake (SSE). The SSE is based on an evaluation of the maximum earthquake potential for the site and is an earthquake that produces the maximum vibratory ground motion for which SSCs are designed to remain functional. The regulatory treatment of nonsafety systems (RTNSS) process is applied to define seismic requirements for SSCs that are nonsafety-related but perform risk significant functions.

Nuclear power plant SSCs important to safety are to be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. SSCs important to safety are those that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Risk-significant nonsafety-related fluid systems that are important to safety are evaluated under the RTNSS process.

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[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.

3.2.2 Summary of Application

Section 3.2 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference Section 3.2 of the ESBWR DCD, Revision 9. Section 3.2 of the DCD includes Subsections 3.2.1, "Seismic Classification" and 3.2.2, "Quality Group Classification.

The system seismic and quality group classifications, as discussed in the ESBWR DCD addresses the requirement that nuclear power plant SSCs important to safety are to be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions and designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

This requirement is applicable to both pressure-retaining and non-pressure-retaining SSCs that are part of the RCPB, and other systems important to safety, when reliance is placed on these systems to (1) prevent or mitigate the consequences of accidents and malfunctions originating within the RCPB, (2) permit shutdown of the reactor and maintain it in a safe-shutdown condition, and (3) retain radioactive material. Regulatory Guide (RG) 1.29, Revision 4, "Seismic Design Classification" describes an acceptable method of identifying and classifying those plant features that should be designed to withstand the effect of SSE. RG 1.26, Revision 4, "Quality Group Classification and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," provides the regulatory guidance for designing safety-related SSCs to quality standards. Risk-significant nonsafety-related SSCs that are important to safety are evaluated under the RTNSS process described in FSAR Chapter 19 and reviewed in ESBWR DCD Chapter 22, "Regulatory Treatment of Nonsafety Systems."

In addition, Fermi 3 COL FSAR, Section 1.9 includes the following information related to quality group:

- In FSAR Table 1.9-201, Conformance with Standard Review Plan (SRP), the applicant added a line for SRP Section 3.2.1, stating that the Fermi 3 application conforms to Revision 2 of the SRP for Section 3.2.1, Seismic Classification. In this table applicant also added a line for SRP Section 3.2.2, stating that the Fermi 3 application conforms to Revision 2 of the SRP for Section 3.2.2, System Quality Group Classification. In addition, these items are discussed to address COL departure item EF3 COL 1.9-3-A.

- In FSAR Table 1.9-202, Conformance with RGs, the applicant added a line for RG 1.29, Revision 4, "Seismic Design Classification", stating that Fermi 3 application conforms to RG 1.29. This is evaluated in Appendix 17AA, "Quality Assurance Program Description" (QAPD), Part IV. In this table applicant also added a line for RG 1.26, Revision 4, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants", stating that Fermi 3 application conforms to RG 1.26. This is evaluated in Appendix 17AA, QAPD, Part IV. In addition, these items are discussed to address COL departure item EF3 COL 1.9-3-A.

- In FSAR Table 1.9-203, Conformance with the FSAR Content Guidance in RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)", the applicant added a line for SRP Section C.III.1 3.2.1, stating that Fermi 3 application conforms to SRP Section C.III.1 3.2.1, Seismic Classification. In this table applicant also added a line for SRP Section C.III.1 3.2.2, stating that Fermi 3 application conforms to SRP

Section C.III.1 3.2.2, System Quality Group Classification. In addition, these items are discussed to address COL departure item EF3 COL 1.9-3-A.

There are no additional safety-related or RTNSS SSCs subject to system quality group classification beyond those addressed in the DCD. FSAR Section 3.2 was also similarly revised to state that there are no site-specific safety-related or nonsafety-related RTNSS systems beyond the scope of the DCD.

In addition, in Fermi 3 COL FSAR, Revision 4, Section 3.2, the applicant provides the following:

Conceptual Design Information

- STD CDI Classification Summary – RTNSS

  There are no site specific safety related or nonsafety-related RTNSS systems beyond the scope of the DCD.

- STD CDI Classification Summary – Hydrogen Water Chemistry

  The site-specific plant design includes the HWCS.

- STD CDI Classification Summary – Zinc Injection System

  The site-specific plant design does not include the Zinc Injection System.

The applicant provided additional information in the Fermi 3 COL FSAR, Revision 4 stating that there are no site-specific safety-related or nonsafety-related RTNSS systems beyond the scope of the ESBWR DCD. Additionally, the applicant stated in the Fermi 3 COL FSAR, Revision 4, that the site-specific plant design includes the Hydrogen Water Chemistry System (HWCS), and the site-specific plant design does not include the Zinc Injection System.

3.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.2.1, and for quality group classification, are given in Section 3.2.2 of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, (LWR Edition).“

The applicable regulatory requirements for seismic classification of SSCs are as follows:

- 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2

10 CFR Part 50, Appendix A, GDC 2 requires (in part) that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes.

The related acceptance criteria are as follows:

- RG 1.29

RG 1.29 establishes an acceptable regulatory basis for meeting GDC 2 relative to seismic classification. RG 1.29 which classifies SSCs which are to be designed to withstand earthquakes.

- RG 1.206

The applicant should identify those SSCs important to safety that are outside the scope of the referenced certified design and that are designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. The applicant should designate plant features that are outside the scope of the referenced certified design and that are designed to remain functional in the event of an SSE or surface deformation as seismic Category I. The applicant should identify portions of SSCs outside the scope of the referenced certified design that are not required to continue functioning, but whose failure could reduce the functioning of any seismic Category I plant feature to an unacceptable safety level or could result in incapacitating injury to control room occupants. The design and construction of these SSCs should ensure that the SSE would not cause such failure. The applicant should also list or otherwise clearly identify all SSCs or portions thereof that are outside the scope of the referenced certified design and are intended to be designed for an Operating Basis Earthquake (OBE).

The applicable regulatory requirements for quality group classification of SSCs are as follows:

- 10 CFR Part 50, Appendix A, GDC 1

10 CFR Part 50, Appendix A, GDC1 requires (in part) that SSCs important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function.

The related acceptance criteria are as follows:

- RG 1.26

RG 1.26 establishes an acceptable regulatory basis for meeting GDC 1 relative to quality group classification. RG 1.26 which classifies fluid systems and their supports that are important to safety, which are to be designed to quality standards commensurate with their safety function.

- RG 1.206

The applicant should identify those fluid systems or portions thereof that are important to safety and outside of the certified design scope, as well as the applicable industry codes and standards for each pressure-retaining component.

3.2.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.2 of the certified ESBWR DCD. The staff reviewed Section 3.2 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the North Anna application were equally applicable to the Fermi COL application, the staff undertook the following reviews:

- The staff compared the North Anna 3 COL FSAR, Revision 1, to the Fermi COL FSAR. In performing this comparison, the staff considered changes made to the Fermi COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs) and open and confirmatory items identified in the North Anna SER with open items.

- The staff confirmed that the applicant endorsed all responses to RAIs identified in the corresponding standard content (the North Anna SER) evaluation.

- The staff verified that the site-specific differences were not relevant to this section.

The staff has completed its review and found the evaluation performed for the North Anna standard content to be directly applicable to the Fermi COL application. This standard content material is identified in this SER by use of italicized, double indented formatting.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

Conceptual Design Information

- STD CDI Classification Summary

The NRC staff reviewed the additional information related to the seismic classification of safety-related SSCs included under Section 3.2.1 of the Fermi 3 COL FSAR, which states the following:

- There are no site specific safety related or nonsafety-related RTNSS systems beyond the scope of the DCD.

- The site-specific plant design includes the HWCS.

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[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 site-specific plant design does not include the Zinc Injection System

Seismic Classification

This standard content material is identified in this SER by use of italicized, double indented formatting.

The following portion of this technical evaluation section is reproduced from Subsection 3.2.1.4, "Technical Evaluation", of North Anna Unit 3 SER (Agency wide Documents Access and Management System Accession No. ML092010530):

Seismic Classification of Site Specific RTNSS SSCs

GDC 2 identifies, in part, that SSCs important to safety shall be designed to withstand the effects of earthquakes. FSAR Section 3.2.1 identifies no departures or supplements relative to the seismic classification of SSCs, and the standardization matrix identifies no site specific information that applies to Section 3.2. However, certain potential RTNSS-important SSCs, such as the plant service water system (PSWS) and makeup water system, are identified as site specific and makeup sources for the ultimate heat sink. Also, it is not clear whether there are any nonsafety-related SSCs outside of the DCD scope that may be important to safety.

*The staff issued **RAI 03.02.01-6**, which requested the applicant to clarify whether there are any site specific, non-safety-related SSCs outside of the DCD scope that are important to safety and, if so, to identify the appropriate seismic classification of those SSCs. For example, certain site specific defense in depth RTNSS SSCs, such as the PSWS and the intake structure, may be considered non-safety-related but may be important to safety and should be categorized as designed to withstand the effects of earthquakes. This seismic concern for RTNSS SSCs was also identified during the concurrent ESBWR design certification review. If the applicant decides to resolve this issue in the DCD rather than in the COL for all plant SSCs, including those that are site specific, the staff has asked the applicant to so advise the NRC. The applicant's response to the RAI stated that there are no non-safety-related SSCs important to safety (RTNSS SSCs) that are outside of the DCD scope. This response also clarified that the seismic classification of RTNSS SSCs is within the DCD scope, and Appendix 19A of the DCD has undergone substantial changes in DCD Revision 5. The staff concurred that the seismic classification of site specific RTNSS SSCs can be evaluated in the DCD. Therefore, this COL concern is closed.*

Seismic Classification of Other Site Specific SSCs

Section 1 of the DCD identifies only limited site specific SSCs that are outside the scope of the DCD, and for which the COL applicant is expected to provide site specific information. COL application Table 1.9-203 indicates that there are no safety-related or RTNSS SSCs that are not included in the DCD. It is not clear, however, whether there are any other nonsafety-related SSCs that are considered important to safety but are not included in the DCD that will be addressed in the COL application.

*The staff issued **RAI 03.02.01-5** which requested the applicant to clarify whether there are any site specific SSCs outside of the DCD scope that are not included in DCD*

Table 3.2-1 and are to be seismically classified in the COL. For example, site specific structures such as the stack and miscellaneous items such as the reactor vessel insulation, which may or may not be site specific, are not included in the tables. If so, the RAI requested the applicant to identify the appropriate seismic classification of those SSCs or clarify when those SSCs will be classified. The applicant's response to the RAI stated that there are no non-safety-related SSCs important to safety (RTNSS SSCs) outside of the DCD scope, and there are no site specific SSCs not in the DCD that are to be seismically classified. In regard to the stack (changed to three stacks in DCD Revision 5) and reactor vessel insulation, the applicant clarified that these SSCs are not site specific. Because no site specific SSCs will be classified in the COL, the staff concurred that this COL concern is closed.

Quality Assurance for seismic Category II SSCs

It is not clear in either the DCD or the FSAR how 10 CFR Part 50, Appendix B applies to seismic Category II SSCs, including those that may be site specific. FSAR Table 1.9-202 identifies conformance to RG 1.29. However, seismic Category II SSCs are not designated as QA Requirement B in either the DCD or the COL application. DCD Section 17.3 states that the COL applicant will address the QA Program, but it is not clear how the QA Program will include provisions for seismic Category II SSCs. The staff issued ***RAI 03.02.01-4****, which requested the applicant to clarify the extent to which pertinent QA requirements of Appendix B to 10 CFR Part 50 in Regulatory Position C.4 of RG 1.29 apply to the activities affecting safety-related functions of those portions of SSCs covered under Regulatory Positions 2 and 3 of RG 1.29, including any site specific SSCs. This concern was also cited in an RAI for the ESBWR design certification review, and a special class was designated for important nonsafety-related SSCs. But SSCs that are designated as a special class are not specified for review at this time. If the applicant decides to resolve this issue in the DCD rather than in the COL for all plant SSCs, including those that are site specific, the staff has asked the applicant to so advise the NRC. The applicant's response to the RAI stated that this issue will be resolved in the DCD, and General Electric-Hitachi (GEH) has included this information in DCD Section 3.2 and in DCD Appendix 19A for all SSCs, including those that are site specific. The staff concurred that this COL can be reviewed in the design certification, and therefore this RAI is closed.*

Consistency with Regulatory Guidance

FSAR Table 1.9-201 points out that the seismic classification conforms to SRP Section 3.2.1, Revision 2, and that SRP Section 3.2.1 references RG 1.29 (currently Revision 4) for seismic classification. SRP Section 3.2.1 identifies that the applicant should provide a list of SSCs that are necessary for continued safe operation that must remain functional without undue risk to the health and safety of the public and within applicable stress, strain, and deformation limits during and following an OBE, if the applicant has set the OBE ground motion to the value of one-third of the safe shutdown earthquake (SSE) ground motion. The list of SSCs may be addressed either in this section or in the operational programs for pre-earthquake planning in COL FSAR Section 3.7.4. Other than the three CDIs noted above, Section 3.2 of FSAR Revision 0 does not identify any departures or supplements relative to the seismic classification in the DCD and the conformance to RG 1.29 Revision 3 in the DCD.

*The staff issued **RAI 03.02.01-3**, which requested the applicant to clarify the extent to which site specific seismic classifications of SSCs are consistent with RG 1.29, Revision 4. The applicant's response to the RAI clarified that the FSAR is incorrect. The classification of site specific SSCs is consistent with the DCD that references RG 1.29 Revision 3, and COL FSAR Table 1.9-202 will be revised accordingly. In addition, the staff has indicated to the applicant that there are no site specific SSCs requiring classification in the COL application or changes to the methodology. Therefore, the staff finds that use of RG 1.29, Revision 3 is acceptable.*

*However, in order to be consistent with SRP Section 3.2.1, Revision 2, the staff has indicated to the applicant that a list of SSCs necessary for continued operation when subjected to an OBE should be available for review if the applicant has set the OBE ground motion equal to one-third of the SSE ground motion. Since the COL applicant has not deviated from the DCD, which sets the OBE ground motion equal to one-third of the SSE ground motion, the applicant should submit a list of SSCs necessary for continued operation either in this section or in the operational programs for pre-earthquake planning in COL FSAR Section 3.7.4. Therefore, resolution of this issue is pending as **Open Item 03.02.01-3.***

The staff issued **RAI 03.02.01-2** to Detroit Energy Company (DTE) requesting additional information regarding site-specific SSCs. The applicant, DTE, in a letter (ML102660141) dated September 21, 2010, states the following:

> FSAR Section 3.2 incorporates DCD Table 3.2-1 by reference with two changes. One change is the identification that the site-specific plant design includes the HWCS. DCD Table 3.2-1 includes the classification information for the HWCS; thus, the only detail included in the FSAR is to identify that the HWCS is included in the site-specific plant design. As shown in DCD Table 3.2-1, the HWCS is nonsafety-related and non-seismic. The second change is the identification that the site-specific design does not include the Zinc Injection System.
>
> DCD Appendix 19A demonstrates that the ESBWR design adequately addresses RTNSS issues. DCD Appendix 19A defines the criteria that are applied to the ESBWR design to determine the systems that are candidates for regulatory oversight. Based on the criteria, DCD Appendix 19A, Table 19A-2 identifies the RTNSS functions. DCD Appendix 19A Table 19A-3 identifies the structures housing the RTNSS functions identified in DCD Table 19A-2. There are no site-specific RTNSS functions or structures housing RTNSS functions outside the scope of the DCD. Additionally, there are no site-specific SSCs not in the DCD that are important to safety.

The staff finds the applicant's response conforms with the guidance in RG 1.206 and the requirements in 10 CFR 50, Appendix A, GDC 1, and is acceptable, and accordingly, Fermi 3 site-specific **RAI 03.02.01-2** is closed.

The following portion of this technical evaluation section is reproduced from Subsection 3.2.1.4, "Technical Evaluation", of North Anna Unit 3 SER (Agency wide Documents Access and Management System Accession No. ML092010530):

> *List of RTNSS SSCs*
>
> *DCD Revision 5, Section 3.2.1 refers to Table 19A-1 for a list of RTNSS SSCs. However, Table 19A-1 in Revision 5 of the DCD has been deleted. It is not clear whether this list includes site specific SSCs. The staff issued **RAI 03.02.01-2**, which requested the applicant to identify the appropriate reference for the list of site specific RTNSS SSCs. The applicant's response to the RAI agrees that there is an inconsistency and has notified GEH accordingly. The correct reference for risk-significant RTNSS SSCs is in Table 3 of NEDO-33411, which documents the list of risk-significant RTNSS SSCs. NRC staff concurred that this list of RTNSS SSCs can be reviewed in the design certification for site specific SSCs, so this RAI is closed.*
>
> *RTNSS SSCs Classified as Non-Seismic*
>
> *DCD Revision 4 Table 3.2-1 identifies various nonsafety-related potential RTNSS SSCs as either Seismic II or non-seismic (NS). It is not clear whether any of these potential RTNSS SSCs are considered site specific. DCD Section 19A.8.3 classifies RTNSS Criterion B-SSCs, as a minimum, seismic Category II, and are qualified to the Institute of Electrical and Electronics Engineers (IEEE)-344-1987. These SSCs must be available following a seismic event. Relative to any site specific RTNSS-important SSCs that are required to withstand the effects of earthquakes and are qualified to the IEEE-344, NRC staff issued **RAI 03.02.01-1**, which requested the applicant to clarify the basis for the Seismic II or NS classification or identify an appropriate departure. The applicant's response to the RAI stated that there are no site specific, RTNSS-important SSCs beyond those identified in the DCD. Because there are no site specific, RTNSS-important SSCs included in the COL, the staff concurred that this concern can be reviewed in the design certification. Therefore, this RAI is closed.*

The applicant's response stated that there are no site-specific, RTNSS-important SSCs beyond those identified in the DCD. Because there are no site-specific, RTNSS-important SSCs included in the COL, the staff concurred that this concern can be reviewed in the design certification. Additionally, the applicant states they have selected carbon steel that meets ASTM standards for underground piping in the PSWS rather than fiberglass reinforced polyester piping. Therefore, ***RAI 03.02.01-2*** (North Anna SER), and ***Open Item 03.02.01-3*** (North Anna SER) are closed.

The staff issued **RAI 03.02.01-1** to DTE to explain and justify why the seismic classification of site-specific SSCs in FSAR Table 1.9-202 uses Revision 3 of RG 1.29 rather than the current Revision 4. The applicant, DTE, in a letter [ML102660141] dated September 21, 2010 states the following:

> ESBWR SSCs, including all site-specific SSCs, for Fermi 3 have been classified in the DCD in accordance with Revision 3 of RGs 1.29 (refer to DCD Table 3.2-1). There are no additional site-specific SSCs beyond those listed in the DCD. Therefore, FSAR Revision 2, Table 1.9-202 takes exceptions to Revision 4 of RGs 1.29. The justification for these exceptions, as stated in FSAR Table 1.9-202, are that the requirements for the

seismic classifications for systems and structures are defined by the DCD, which implements Revision 3 of RG 1.29.

The response to **RAI 17.5-23**, (ML102570700) submitted in Detroit Edison letter NRC3-10-0036, dated September 2, 2010, provided a proposed markup to FSAR Table 1.9-202 to clarify that conformance with Revision 4 of RG 1.29 is limited to site-specific SSCs that are outside the scope of the DCD. The staff finds the applicant's response conforms with the guidance in RG 1.29 and is acceptable, and accordingly, Fermi 3 site-specific **RAI 03.02.01-1** is closed.

Based on the above evaluation of the information provided by the applicant related to the site-specific design information, the NRC staff considers there is reasonable assurance that the information is adequate to meet the requirements in GDC 2, "Design Bases for Protection Against Natural Phenomena", concerning seismic classification and is consistent with the guidance in RG 1.29 and RG 1.206.

Quality Group Classification

The NRC staff's review of Subsection 1.1.1.7 of the Fermi 3 COL FSAR, Revision 4, found that the applicant incorporated by reference Subsection 3.2.2 of ESBWR DCD, Revision 9. The NRC staff's review confirmed that the information in the application and the information incorporated by reference addresses the required information relating to the quality group classification of SSCs.

NRC staff determined that the departures/supplements that include site-specific information related to the hydrogen water chemistry and zinc injection systems do not affect the quality group classifications.

There are no COL information items in Subsection 3.2.2 of the ESBWR DCD. DCD Section 1.10 identifies that the COL applicant is required to provide site-specific information.

The staff reviewed the COL applicant information to determine whether the application contains sufficient information on the system quality group classification of site-specific SSCs that are outside of the DCD scope. Several RAIs were prepared to determine whether the scope of the SSCs that are considered site-specific is essentially complete, and whether sufficient information concerning the quality group classification of those SSCs is included in the application. The staff has completed its review and found the evaluation performed for the North Anna standard content to be directly applicable to the Fermi COL application.

The following italicized portions of this technical evaluation section are reproduced from Subsection 3.2.2.4, "Technical Evaluation", of North Anna Unit 3 SER (ML092010530):

<u>Consistency with Regulatory Guidance</u>

*FSAR Table 1.9-201 shows that the seismic classification conforms to SRP Section 3.2.2, Revision 2 and that SRP Section 3.2.2 references RG 1.26 (currently Revision 4) for quality group classification. Section 3.2 of the FSAR Revision 0 does not identify any departures or supplements relative to the quality group classification identified in the DCD and compliance with RG 1.26 Revision 3 in the DCD. But FSAR Table 1.9-202 references conformance to Revision 4, dated March 2007. QA Program AR-NA-30 references Revision 4 to RG 1.26 with the DCD exception, but incorrectly references February 1976 rather than March 2007. NRC staff issued **RAI 03.02.02-1**, which*

requested the applicant to clarify whether classifications of site specific SSCs are consistent with RG 1.26 Revision 4.

The applicant's response to the RAI clarified that the FSAR is incorrect. The classification of site specific SSCs is consistent with the DCD that references RG 1.26 Revision 3. COL FSAR Table 1.9-202 and Appendix 17BB will be revised accordingly. COL applicants should supplement generic DCD information on conformance to RGs to address those that were issued since the time the standard design was approved. There are no site specific SSCs classified in the COL application, so the effective RGs are appropriately referenced in the DCD. Therefore, this is ***Confirmatory Item 03.02.02-1****.*

FSAR Subsection 3.2 does not identify any departures or supplements relative to quality group classification identified in the ESBWR DCD and conformance with RG 1.26, Revision 4, but FSAR Table 1.9-202 identifies an exception to Revision 4, dated March 2007, and Revision 3 is implemented rather than Revision 4. RG 1.206, Part C.IIJ. 1, Subsection C.J. 1 .9.1 states that, for site-specific portions of the facility design that are not included in the referenced certified design, a COL applicant should address conformance with RGs in effect 6 months before the submittal date of the COL application. In **RAI 03.02.02-1** DTE was requested to explain and justify why the quality group classification of any site-specific SSCs are based on RG 1.26, Revision 3 rather than the current Revision 4.

The response to **RAI 17.5-23** (ML102570700) stated that ESBWR Structures, Systems and Components (SSCs), including all site-specific SSCs, for Fermi 3 have been classified in the DCD in accordance with Revision 3 of RG 1.26 (refer to DCD Table 3.2-1). There are no additional site-specific SSCs beyond those listed in the DCD. Therefore, FSAR Revision 2 Table 1.9-202 takes exceptions to Revision 4 of RG 1.26. The justification for these exceptions, as stated in FSAR Table 1.9-202, are that the requirements for the quality group classifications for systems and structures are defined by the DCD, which implements Revision 3 of RG 1.26. The response to **RAI 17.5-23**, submitted in Detroit Edison letter NRC3-10-0036, dated September 2, 2010, provided a proposed markup to FSAR Table 1.9-202 to clarify that conformance with Revision 4 of RG 1.26 is limited to site specific SSCs that are outside the scope of the DCD. Confirmation that the FSAR has been updated is included in the Chapter 17 review. Conformance with RG 1.26 Revision 4 is acceptable for site-specific SSCs, since that is the current revision and all issues associated with **RAI 03.02.02-1** are resolved.

Staff has reviewed the changes to the FSAR, and concludes that the application of the current version of RG 1.26 to any site-specific systems outside the scope of the DCD is consistent with regulatory guidance and is acceptable.

The following italicized portions of this technical evaluation section are reproduced from Subsection 3.2.2.4, "Technical Evaluation", of North Anna Unit 3 SER (ML092010530):

Codes and Standards

The NRC staff requirements memorandum (SRM) dated July 21,1993, concerning SECY-93-087, stated that the staff will review passive plant design applications using the newest codes and standards endorsed by the NRC, and unapproved revisions to the codes will be reviewed on a case-by-case basis. Editions of various codes and standards referenced in DCD Section 3.2.6 are not current, and newer codes and standards are not referenced in COL applicant Sections 3.2 or 1.8. The staff issued ***RAI 03.02.02-2****, which requested the applicant to clarify the specific code editions the applicant has referenced that are currently endorsed by the NRC. The applicant was also asked to clarify whether current editions of codes and standards will be applied to the detailed design and procurement of ESBWR SSCs, so that these editions may be reviewed on a case-by-case basis. If the applicant decides to resolve this issue in the DCD rather than in the COL for all plant SSCs, including those that are site specific, the staff has asked the applicant to so advise the NRC.*

The applicant's response to the RAI stated that DCD Table 1.8-22 identifies industrial codes and standards and adjustments that have been made to these codes and standards. The applicant also indicated that questions regarding versions of codes and standards should be addressed to GEH. COL applicants should supplement generic DCD information on compliance with RGs to address those that have been issued since the time the standard design was approved.

Although there are no site specific SSCs that are not classified in the DCD, effective regulatory guidance for site specific SSCs should be identified in the COL application rather than in the DCD, so that the effective RG revision is applied to site specific SSCs, including those added in the future. COL Table 1.9-204 identifies industrial codes and standards applicable to portions of the design that are beyond the scope of the DCD or SSAR, but the editions referenced in this list are different from the earlier editions referenced in Table 1.8-22 of the referenced DCD. In addition, the staff indicated that the applicant should more clearly identify which editions of industrial codes and standards are applicable to specific SSCs and whether those editions have been endorsed by the NRC. This is identified as ***Open Item 03.02.02-2.***

Staff Requirements Memorandum (SRM), dated July 21, 1993, concerning SECY-93-087 "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs" identifies that the staff will review passive plant design applications using the newest codes and standards endorsed by the NRC and unapproved revisions to the codes will be reviewed on a case by case basis. RG 1.206, Part CIII identifies that COL applicants that reference a certified design do not need to include additional information on codes and standards. However, if the applicant deviates from the DCD or there are site-specific SSCs, codes and standards would be expected to be identified. Editions of various codes and standards are referenced in FSAR Table 1.9-204, but it is not clear if the list of codes and standards applies only to site-specific SSCs or if the list is a comprehensive list. For example, the American Society of Mechanical Engineers (ASME) B31 .1 Code and supplemental standards used for the plant-specific fiberglass pressure pipe and the applicable editions are not referenced in FSAR Table 1.9-204. In **RAI 03.02.02-2** DTE was requested to clarify which editions of codes and standards apply to any site-specific SSCs, such as fiberglass piping, and if those editions are NRC endorsed or need to be reviewed on a case by case basis.

The applicant's response states that industrial codes and standards which are applicable to the design and procurement of ESBWR SSCs are provided in DCD Revision 7, Table 1.9-22. As described in FSAR Section 1.9.2, under Industrial Codes and Standards: "Table 1.9-204 identifies the Industrial Codes and Standards that are applicable to those portions of the Fermi 3 design that are beyond the scope of the DCD, and to the operational aspects of the facility." Therefore, the codes and standards referenced in FSAR Table 1.9-204 apply to the portions of the Fermi 3 design beyond the scope of the DCD and to operational aspects of the facility, and are not a comprehensive list of all codes and standards applicable to Fermi 3. As described in the supplemental response to **RAI 09.02.01-3** submitted in Detroit Edison letter NRC3-10-0029, dated July 9, 2010 (ML101930518), Detroit Edison has elected not to pursue the use of fiberglass reinforced polyester piping for the Plant Service Water System (PSWS). Alternatively, Detroit Edison has selected carbon steel that meets ASTM standards for underground piping in the PSWS. As described in the response to **RAI 09.02.01-3** quality and seismic requirements for the underground piping for the PSWS are dictated by DCD Table 3.2-1. The codes and standards for the underground carbon steel piping are included in DCD Table 1.9-22. FSAR Table 1.9-202 evaluates conformance with NRC RGs. In Table 1.9-202, the term "Conforms" means that no exception is being taken to the guidance in the regulatory positions as they apply to site-specific design information, operation aspects of the facility, or siting information in the FSAR. DCD Table 1.9-21 addresses applicability of NRC RGs to the ESBWR.

Since there is no nonmetallic piping used for PSWS piping, there are no augmented code requirements applicable, and the industrial codes and standards identified in the FSAR are applicable to any site-specific SSCs not included in the DCD. All issues related to codes and standards for site-specific systems are resolved.

The following italicized portions of this technical evaluation section are reproduced from Subsection 3.2.2.4, "Technical Evaluation", of North Anna Unit 3 SER (ML092010530):

> *Special Treatment for Risk-Significant SSCs*
>
> *GDC 1 identifies (in part) that SSCs important to safety shall be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. Supplemental quality standards and the QA Program applicable to passive SSCs used in non-safety-related RTNSS systems that may be important to safety are not clearly defined in the COL application for site specific SSCs.*

NRC staff issued **RAI 03.02.02-3**, which requested the applicant to clarify what supplemental quality standards are applied to non-safety-related, site specific SSCs that are important to safety to ensure that all SSCs important to safety are designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. For example, FSAR subsection 9.2.1.2 identifies that fiberglass pressure pipe that meets ASME B31.1 and other supplemental standards will be applied, but it is not obvious which supplemental quality standards apply to site-specific SSCs, such as fiberglass piping in either the DCD 3.2 tables or FSAR Section 3.2. The applicant's response (ML102660141) dated September 21, 2010 stated that there are no site-specific safety-related or non-safety related RTNSS systems beyond the scope of the DCD. The response also referenced the response (ML082730763) dated September 18, 2008, to **RAI 09.02.01-3** that stated Detroit Edison has elected not to pursue the

use of fiberglass reinforced polyester piping for the Plant Service Water System (PSWS). The applicant also proposed a revision to FSAR Section 3.2 to clearly state that there are no site specific safety-related or nonsafety-related RTNSS systems beyond scope of the DCD.

Since the applicant has revised FSAR Section 3.2 to state there are no site-specific SSCs not classified in the DCD that are important to safety and has elected not to use nonmetallic materials for the RTNSS C PSWS, all issues associated with **RAI 03.02.02-3** are resolved.

GDC I identifies, in part, that structures SSCs important to safety shall be designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. RG 1.206, Part C.III, Subsection C.I.3.2.2 states that the COL applicant is to identify those fluid systems or portions that are important to safety and outside the scope of the certified design, as well as the applicable codes and standards for each pressure-retaining component. SRP Section 3.2.2 also specifically states that the staff reviews quality standards including application of the QA program and codes and standards applicability. Supplemental quality standards and QA program applicable to passive SSCs used in nonsafety-related RTNSS systems that may be important to safety are not clearly defined in Subsection 3.2 of the COL application for site-specific SSCs. In **RAI 03.02.02-3**, DTE was requested to clarify in FSAR 3.2 or include a pointer to another FSAR chapter to define what supplemental quality standards are applied to nonsafety-related site-specific SSCs that are important to safety to ensure that all SSCs important to safety are designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. For example, FSAR Subsection 9.2.1.5 identifies that fiberglass pressure pipe that meets ASME B31. 1 and other supplemental standards will be applied, but it is not obvious which supplemental quality standards apply to site-specific SSCs, such as fiberglass piping, in either the DCD Tables 3.2 or FSAR Section 3.2.

The applicant's response states that FSAR Section 3.2 incorporates DCD Table 3.2-1 by reference with two changes. The first change is the identification that the site-specific plant design includes the HWCS. DCD Table 3.2-1 includes the classification information for the HWCS; thus, the only detail included in the FSAR is to identify that the HWCS is included in the site-specific plant design. As shown in DCD Table 3.2-1, the HWCS is nonsafety-related and non-seismic. The second change is the identification that the site-specific design does not include the Zinc Injection System. The ESBWR DCD Table 3.2-1 specifies the extent to which the quality assurance requirements apply to nonsafety-related SSCs. General Electric-Hitachi (GEH) has included this information in DCD Section 3.2 and Appendix 19A. These requirements are applied to all SSCs, including those that are site-specific. In addition, FSAR Table 1.9-203 states: "There are no additional safety-related or RTNSS SSCs subject to seismic classification beyond those addressed in the DCD. There are no SSCs outside the referenced certified design that are required to be designed for an OBE." There are no site-specific safety-related or nonsafety-related RTNSS systems beyond the scope of the DCD. Therefore, there is no need to define supplemental quality standards for site-specific SSCs.

As described in the supplemental response to **RAI 09.02.01-3** submitted in Detroit Edison letter NRC3-10-0029, dated July 9, 2010 (ML1019305180), Detroit Edison has elected not to pursue the use of fiberglass reinforced polyester piping for the Plant Service Water System (PSWS). Alternatively, Detroit Edison has selected carbon steel that meets ASTM standards for underground piping in the PSWS. Quality assurance and seismic requirements for the

underground piping for the PSWS are dictated by DCD Table 3.2-1. The codes and standards for the underground carbon steel piping are included in DCD Table 1.9-22.

Since the applicant has revised FSAR Section 3.2 to state there are no site-specific SSCs not classified in the DCD that are important to safety and has elected not to use nonmetallic materials for the RTNSS C PSWS, all issues associated with special treatment for risk-significant site-specific systems are resolved.

Based on the above evaluation of the information provided by the applicant related to the site-specific design information, the NRC staff considers there is reasonable assurance that the information is adequate to meet the requirements in GDC 1, "Quality Standards and Records", concerning quality group classification and is consistent with the guidance in RG 1.26 and RG 1.206.

3.2.5 Post Combined License Activities

There are no post COL activities related to this section.

3.2.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1966. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and 10 CFR Part 52, Appendix [X], Section VI.B.1, all nuclear safety issues relating to this section that were incorporated by reference have been resolved.

In addition, the staff compared the additional COL information in the application to the relevant NRC regulations, the guidance in Sections 3.2.1 and 3.2.2 of NUREG–0800, RG 1.26, RG1.29, RG 1.206, GDC 1 and GDC 2, and concluded that Fermi 3 COL FSAR, Revision 4, Sections 3.2.1 and 3.2.2 is acceptable and meets NRC regulatory requirements and acceptance criteria in Sections 3.2.1 and 3.2.2 of NUREG-0800.

3.3 Wind and Tornado Loadings

Section 3.3 of the Fermi 3 COL SAR, Revision 4, incorporates by reference, with no departures or supplements, Section 3.3, "Wind and Tornado Loadings," of Revision 9 of the ESBWR DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Fermi 3 COL application are documented in NUREG–1966, the FSER related to the certified ESBWR DCD.

3.4 Water Level (Flood) Design

Section 3.4 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference, with no departures or supplements, Section 3.4, "Water Level (Flood) Design," of Revision 9 of the

[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.

ESBWR DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. [1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Fermi 3 COL application are documented in NUREG–1966, the FSER related to the certified ESBWR DCD.

3.5 Missile Protection

3.5.1 Introduction

SSCs important to safety are analyzed for and designed to be protected from a wide spectrum of missiles, such as internally generated missiles from rotating equipment, high energy fluid systems, and gravitational missiles; externally generated missiles from tornado winds and extreme winds; and missiles from proximate site sources and aircraft hazards.

Method of protection must be provided for all SSCs that are necessary to perform functions required to attain and maintain safe shutdown or to otherwise mitigate the consequences of an accident. These methods may consist of (1) locating the system or component in a missile-proof structure, (2) isolating redundant systems or components in the missile's path or range, (3) providing local shields and barriers for SSCs, or (4) designing the equipment to withstand the impact of the most damaging missile.

The specific reactor site location determines the potential for missile hazards from nearby industrial sources and the hazards from aircraft operating in the region.

3.5.2 Summary of Application

Section 3.5 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference Section 3.5 of the ESBWR DCD, Revision 9. In addition, in Fermi 3 COL FSAR, Revision 4, Subsections 3.5.1.5 and 3.5.1.6, the applicant provided the following:

Supplemental Information

- STD SUP 3.5-1 Site-Specific Missile Sources

  Site-specific missile sources are addressed in Section 2.2 of the Fermi 3 COL FSAR, Revision 4.

- STD SUP 3.5-2 Site-Specific Aircraft Analysis and the Site-Specific Critical Areas

  Site-specific aircraft hazard analysis and the site-specific critical areas are addressed in Section 2.2 of the Fermi 3 COL FSAR, Revision 4.

[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.

3.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

The applicable regulatory requirements for turbine missiles are as follows:

- GDC 4 of Appendix A to 10 CFR Part 50

In addition, the relevant guidance for compliance with the Commission regulations for turbine missiles and the associated acceptance criteria are described in Section 3.5.1.3 of NUREG-0800.

The applicable regulatory requirements for protection against site proximity missiles are as follows:

- GDC 4 of Appendix A to 10 CFR Part 50

In addition, the relevant guidance for compliance with the Commission regulations for nearby site-generated missiles and the associated acceptance criteria are described in Section 3.5.1.5 of NUREG-0800.

The applicable regulatory requirements related to aircraft hazards are as follows:

- GDC 4 of Appendix A to 10 CFR Part 50

In addition, the relevant guidance for compliance with the Commission regulations for evaluating aircraft hazards and the associated acceptance criteria are described in Section 3.5.1.6 of NUREG-0800.

3.5.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.5 of the certified ESBWR DCD. The staff reviewed Section 3.5 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

Supplemental Information

- STD SUP 3.5-1 Site Specific Missile Sources (Site Proximity Missiles)

[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.

NRC staff reviewed STD SUP 3.5-1, which states that the site-specific missile sources are addressed in Section 2.2 of the Fermi 3 FSAR.

The staff's technical evaluation of this portion of the application is limited to reviewing the supplemental information pertaining to STD SUP 3.5-1.

The staff reviewed the conformance of Section 3.5 of the Fermi 3 COL FSAR to the guidance in RG 1.206, Section C.III.1, Chapter 3, C.I.3.5.1.3, "Turbine Missiles". The staff's review of the Fermi 3 COL FSAR, Section 3.5 found that it appropriately incorporates by reference Section 3.5.1.1.1.2 of the ESBWR DCD, Revision 9.

The staff requested additional information (**RAI 03.05.01.05-1**) from the applicant to provide an assessment of the potential for the turbine missile generation from existing Unit 2 that may affect the safe operation of the proposed Unit 3. The applicant responded in a letter (ML100290010) on January 27, 2010 and stated that based on strike angles from the Fermi 2 site layout, beginning at the southeast corner of the Fermi 2 Turbine Building, that there are no Fermi 3 essential systems within the strike zone. Therefore, it is concluded that because of turbine orientation and offsets related to the Fermi 2 Turbine Building to Fermi 3 targets, turbine missiles from Fermi 2 would not affect the safe operation of Fermi 3. The staff accepted the applicant's explanation as reasonable and concluded the information in the FSAR and RAI response meets GDC 4 and Section 3.5.1.5 of NUREG-0800.

The staff concluded that the relevant information presented in the COL FSAR is acceptable and meets the requirements of GDC 4 of Appendix A to 10 CFR Part 50. The staff based this conclusion on the following:

STD SUP 3.5-1, "Site Proximity Missiles", is acceptable because the applicant has identified potential accidents related to the generation of site proximity missiles (except aircraft) in the site vicinity that could affect a nuclear power plant or plants of the specified type that might be constructed on the proposed site. The applicant has appropriately determined those potential accidents that should be considered as design-basis events and has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to the design-basis accidents. The staff reviewed the information in the FSAR. For the reasons given above, the staff concluded that the applicant has established that the construction and operation of Unit 3 of the specified type on the proposed site location is acceptable and meets the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance with respect to determining the acceptability of the site.

- STD SUP 3.5-2 Site Specific Aircraft Analysis (Aircraft Hazards)

NRC staff reviewed STD SUP 3.5-2 which states that the site-specific aircraft analysis and site-specific critical areas are addressed in Section 2.2 of the Fermi 3 FSAR.

The staff's technical evaluation of this portion of the application is limited to reviewing the supplemental information pertaining to STD SUP 3.5-2.

The applicant performed the aircraft hazards evaluation in Fermi 3 COLA FSAR, Section 2.2.3.1.3.1. The applicant addressed and evaluated potential aircraft hazards following the approach and methodology outlined in the NUREG-0800, SRP Section 3.5.1.6, "Aircraft Hazards." The applicant simulated an aircraft crash into the effective plant areas of the safety-related structures on the site. The applicant determined the probability of aircraft

accidents resulting in radiological consequences greater than the 10 CFR Part 100 exposure guidelines to be 2.3 x 10^{-7} per year from Mills Field Airport or Detroit Metropolitan Wayne County Airport.

The applicant addressed the evaluated Airways in Fermi 3 COLA FSAR, Section 2.2.3.1.3.2, and calculated the aircraft hazards probability for the Airways V383 and V10-176-188. However, the applicant did not provide enough information with regard to the effective area used in the probability calculation. Therefore, the staff requested the applicant for additional information (**RAI 03.05.01.06-1**) to provide data, assumptions, annual flight operations and effective area used in the calculation of the aircraft hazards probabilities. The applicant responded in a letter (ML100290010) on January 27, 2010 and provided information and revisions to the FSAR Section. The staff reviewed the applicant provided information and performed confirmative probability calculations using annual average flight operations data from 2004-2009 obtained from Federal Aviation Administration within 5 miles of Fermi Site. On the basis of the review of the applicant response and the confirmatory calculations, the staff concludes that the applicant's approach reasonable and conclusion acceptable as the aircraft hazards probability is within the acceptable criterion of on the order of magnitude of 1 x 10^{-7} per year.

STD SUP 3.5-2, "Aircraft Hazards", is acceptable because the applicant has identified potential accidents related to the aircraft hazards in the site vicinity that could affect a nuclear power plant or plants of the specified type that might be constructed on the proposed site. The applicant has appropriately determined those potential accidents that should be considered as design-basis events and has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to the design-basis accidents. The staff reviewed the information in the FSAR. For the reasons given above, the staff concluded that the applicant has established that the construction and operation of Unit 3 of the specified type on the proposed site location is acceptable and meets the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance with respect to determining the acceptability of the site. Accordingly, **RAI 03.05.01.05-1** and **RAI 03.05.01.06-1** are closed.

3.5.5 Post Combined License Activities

There are no post COL activities related to this section.

3.5.6 Conclusion

The NRC staff's finding related to information incorporated by reference is in NUREG–1966. NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information, and no outstanding information is expected to be addressed in the COL FSAR related to this section. Pursuant to 10 CFR 52.63(a)(5) and 10 CFR Part 52, Appendix [X], Section VI.B.1, all nuclear safety issues relating to this section that were incorporated by reference have been resolved.

In addition, the staff compared the COL information in the application to the relevant NRC regulations, the guidance in Section 3.5 of NUREG–0800, and other NRC regulatory guides (RGs). The staff reviewed Fermi 3 COL FSAR, Subsection 3.5.1 and concluded that Subsection 3.5.1 is acceptable and meets NRC regulatory requirements. The staff concludes that the relevant information presented in Section 3.5 of Fermi 3 COL FSAR, Revision 4, is acceptable and meets the regulatory guidance in Sections 3.5 of NUREG-0800.

3.6 Protection against Dynamic Effects Associated with the Postulated Rupture of Piping

Section 3.6 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference, with no departures or supplements, Section 3.6, "Protection against Dynamic Effects Associated with the Postulated Rupture of Piping," of Revision 9 of the ESBWR DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Fermi 3 COL application are documented in NUREG–1966, the FSER related to the certified ESBWR DCD.

3.7 Seismic Design

Section 3.7 will not be completed until the SSI Analysis RAIs have been evaluated.

3.7.1 Seismic Design Parameters

Seismic design of the ESBWR seismic Categories I and II structures, systems, equipment, and components are based on the SSE. Low level seismic effects are included in the design of certain equipment potentially sensitive to a number of such events based on a percentage of the responses calculated for the SSE.

Criteria for evaluating the need to shut down the plant following an earthquake are established. For the purposes of the shutdown criteria the OBE for shutdown is considered to be one third of the SSE.

Seismic Category I SSCs are designed to withstand the effects of the SSE event and to maintain the specified design functions. Seismic Category II and nonseismic (NS) structures are designed or physically arranged (or both) so that the SSE could not cause unacceptable structural interaction with or failure of seismic Category I SSCs.

3.7.1.1 Introduction

The input seismic design ground motion response spectra (GMRS) for the SSE in the free field at plant grade is addressed. The horizontal and vertical design GMRS for the ESBWR were developed based on the response spectra in Revision 1 of RG 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," with consideration of high frequency amplification effects.

The bases for the seismic design of safety-related SSCs and equipment include the following:

- Design GMRS
- Design ground motion time histories
- Percentage of critical damping values
- Supporting media for seismic Category I structures
- COL action items

[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.

3.7.1.2 Summary of Application

Section 3.7 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference Section 3.7 of the ESBWR DCD, Revision 9. In addition, in Fermi 3 COL FSAR, Revision 4, Subsection 3.7.1.1, the applicant provided the following:

Supplemental Information

- EF3 SUP 3.7-1 Site-Specific Design Ground Motion Response Spectra

  In the SASSI 2000 model for the Fermi 3 site-specific SSI analyses, the RB/FB and CB are modeled as partially embedded structures that penetrate into the Bass Islands Group bedrock.

- EF3 SUP 3.7-2 Site-Specific Design Ground Motion Time History

  Two sets of three orthogonal time histories (two horizontal and one vertical component) were generated to match the horizontal and vertical SSI FIRS (Subsection 3.7.1.1.4.6) for the RB/FB and CB, respectively, in accordance with the criteria of NUREG/CR-6728 (Reference 2.5.2-270).

- EF3 SUP 3.7-3 Supporting Media for Seismic Category I Structures

  Subsection 2.5.4 provides site-specific engineering properties of subsurface materials.

- EF3 SUP 3.7-7 Design Ground Motion

  The Certified Seismic Design Response Spectra (CSDRS), which envelopes the site-specific design ground motions (FIRS) developed in Subsection 2.5.2 for the Reactor Building/Fuel Building (RB/FB) and Control Building (CB) and is used for design of the ESBWR RB/FB and CB.

3.7.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD, Revision 9.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.7.2 of NUREG-0800 and includes the following:

- 10 CFR Part 50, GDC 2 - The design basis shall reflect appropriate consideration of the most severe earthquakes that have been historically reported for the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data have been accumulated.

- 10 CFR Part 100, Subpart A, which is applicable to power reactor site applications before January 10, 1997, refers to Appendix A of this part for seismic criteria. 10 CFR Part 100, Appendix A indicates that the SSE and the OBE shall be considered in the design of safety-related SSCs. 10 CFR Part 100, Appendix A further states that the design used to ensure that the required safety functions are maintained during and after the vibratory ground motion associated with the SSE shall involve the use of either a suitable dynamic analysis or a suitable qualification test to demonstrate that SSCs can withstand the seismic and other concurrent loads, except where it can be demonstrated that the use of an equivalent static load method provides adequate conservatism.

- 10 CFR Part 100, Subpart B which is applicable to power reactor site applications on or after January 10, 1997, refers to 10 CFR 100.23 of this part for seismic criteria. Section 100.23 describes the criteria and nature of investigations required to obtain the geologic and seismic data necessary to determine the suitability of the proposed site and the plant design bases. 10 CFR 100.23 also indicates that applications to engineering design are contained in 10 CFR Part 50, Appendix S.

- 10 CFR Part 50, Appendix S is applicable to applications for a design certification or COL to 10 CFR Part 52 or a construction permit or operating license pursuant to 10 CFR Part 50 on or after January 10, 1997. For SSE ground motions, SSCs will remain functional and within applicable stress, strain, and deformation limits. The required safety functions of SSCs must be assured during and after the vibratory ground motion through design, testing, or qualification methods. The evaluation must take into account soil-structure interaction effects and the expected duration of the vibratory motion. If the OBE is set at one-third or less of the SSE, an explicit response or design analysis is not required. If the OBE is set at a value greater than one-third of the SSE, an analysis and design must be performed to demonstrate that the applicable stress, strain, and deformation limits are satisfied. Appendix S also requires that the horizontal component of the SSE ground motion in the free-field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least. 0.1g.

- 10 CFR 52.47(b)(1), which requires that a design certification application (DCA) contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC’s regulations.

3.7.1.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.7 of the certified ESBWR DCD, Revision 9. The staff reviewed Section 3.7 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information

in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

Supplemental Information

- EF3 SUP 3.7-1 Site-Specific Design Ground Motion Response Spectra
- EF3 SUP 3.7-2 Site-Specific Design Ground Motion Response Spectra
- EF3 SUP 3.7-3 Supporting Media for Seismic Category I Structures
- EF3 SUP 3.7-7 Design Ground Motion

By letter dated January 18, 2012, the staff issued RAIs 3.7.1-3, 3.7.1-4, 3.7.1-5, 3.7.1-6, 3.7.1-7 and 3.7.1-8 concerning the seismic design parameters in support of the review of supplemental information items EF3 SUP 3.7-7, EF3 SUP 3.7-1, EF3 SUP 3.7-2 and EF3 SUP 3.7-3. DTE provided the following RAI responses: ML12052A059, dated February 16, 2012; ML12065A194, dated March 1, 2012; ML12086A091, dated March 23, 2012; ML121220287, dated April 30, 2012; and ML12173A407, dated June 15, 2012. The staff is currently reviewing the RAI responses. Therefore, RAIs 3.7.1-3 through 3.7.1-8 are considered open items and are being tracked as **Open Items** 3.7.1-3 through 3.7.1-8, accordingly.

3.7.1.5 Post Combined License Activities

There are no post COL activities related to this section.

3.7.1.6 Conclusion

Subsection 3.7.1 will not be completed until the SSI Analysis RAIs have been evaluated.

3.7.2 Seismic System Analysis

Section 3.7.2, "Seismic System Analysis", applies to building structures that constitute primary structural systems. The reactor pressure vessel is not a primary structural component but, due to its dynamic interaction with the supporting structure, it is considered as another part of the primary system of the RB for the purpose of dynamic analysis.

3.7.2.1 Introduction

Section 3.7.2 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference, Section 3.7.2, "Seismic System Analysis," of Revision 9 of the ESBWR DCD with additional supplemental information. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[2] The NRC staff's review

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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.

2 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.

confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Fermi 3 COL application are documented in NUREG–1966, the FSER related to the certified ESBWR DCD.

3.7.2.2 Summary of Application

Section 3.7 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference Section 3.7 of the ESBWR DCD Revision 9. In addition, in Fermi 3 COL FSAR, Revision 4, Subsection 3.7.1.1, the applicant provided the following:

Supplemental Information

- EF3 SUP 3.7-4 Soil-Structure Interaction

  This subsection presents the Fermi 3 site-specific SSI analyses performed in accordance with SRP Section 3.7.2 for the seismic Category I RB/FB and CB.

- EF3 SUP 3.7-5 Interaction of Non-Category I Structures with Seismic Category I Structures

  The interfaces between seismic Category I and non-seismic Category I SSCs are designed for the dynamic loads and displacements produced by both the Category I and non-Category I SSCs.

- EF3 SUP 3.7-6 Seismic Instrumentation

  [START COM 3.7-001] The seismic monitoring program described in this subsection, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site. **[END COM 3.7-001]**

3.7.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.7.2 of NUREG-0800 and includes the following:

- 10 CFR Part 50, GDC 2 - The design basis shall reflect appropriate consideration of the most severe earthquakes that have been historically reported for the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data have been accumulated.

- 10 CFR Part 100, Subpart A, which is applicable to power reactor site applications before January 10, 1997, refers to Appendix A of this part for seismic criteria. 10 CFR Part 100, Appendix A indicates that the SSE and the OBE shall be considered in the design of safety-related SSCs. 10 CFR Part 100, Appendix A further states that the design used to ensure that the required safety functions are maintained during and after the vibratory ground motion associated with the SSE shall involve the use of either a

suitable dynamic analysis or a suitable qualification test to demonstrate that SSCs can withstand the seismic and other concurrent loads, except where it can be demonstrated that the use of an equivalent static load method provides adequate conservatism.

- 10 CFR Part 100, Subpart B which is applicable to power reactor site applications on or after January 10, 1997, refers to 10 CFR 100.23 of this part for seismic criteria. Section 100.23 describes the criteria and nature of investigations required to obtain the geologic and seismic data necessary to determine the suitability of the proposed site and the plant design bases. 10 CFR 100.23 also indicates that applications to engineering design are contained in 10 CFR Part 50, Appendix S.

- 10 CFR Part 50, Appendix S is applicable to applications for a design certification or COL to 10 CFR Part 52 or a construction permit or operating license pursuant to 10 CFR Part 50 on or after January 10, 1997. For SSE ground motions, SSCs will remain functional and within applicable stress, strain, and deformation limits. The required safety functions of SSCs must be assured during and after the vibratory ground motion through design, testing, or qualification methods. The evaluation must take into account soil-structure interaction effects and the expected duration of the vibratory motion. If the OBE is set at one-third or less of the SSE, an explicit response or design analysis is not required. If the OBE is set at a value greater than one-third of the SSE, an analysis and design must be performed to demonstrate that the applicable stress, strain, and deformation limits are satisfied. Appendix S also requires that the horizontal component of the SSE ground motion in the free-field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least. 0.1g.

- 10 CFR 52.47(b)(1), which requires that a DCA contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC's regulations.

3.7.2.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.2 of the certified ESBWR DCD. The staff reviewed Section 3.2 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained 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, Revision 4, as follows:

Supplemental Information

- EF3 SUP 3.7-4 Soil-Structure Interaction

  This subsection presents the Fermi 3 site-specific SSI analyses performed in accordance with SRP Section 3.7.2 for the seismic Category I RB/FB and CB.

- EF3 SUP 3.7-5 Interaction of Non-Category I Structures with Seismic Category I Structures

  The interfaces between seismic Category I and non-seismic Category I SSCs are designed for the dynamic loads and displacements produced by both the Category I and non-Category I SSCs.

- EF3 SUP 3.7-6 Seismic Instrumentation

  [START COM 3.7-001] The seismic monitoring program described in this subsection, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site. **[END COM 3.7-001]**

By letter dated January 18, 2012, the staff issued RAIs 3.7.2-5, 3.7.2-6, 3.7.2-7 and 3.7.2-8 concerning the seismic system analysis in support of the review of supplemental information items EF3 SUP 3.7-4, EF3 SUP 3.7-5 and EF3 SUP 3.7-6. DTE provided the following RAI responses: ML12052A059, dated February 16, 2012; ML12065A194, dated March 1, 2012; ML12086A091, dated March 23, 2012; ML121220287, dated April 30, 2012; and ML12173A407, dated June 15, 2012. The staff is currently reviewing the RAI responses. Therefore, RAIs 3.7.2-5 through 3.7.2-8 are considered open items and are being tracked as **Open Items** 3.7.2-5 through 3.7.2-8, accordingly.

3.7.2.5 Post Combined License Conditions

[COM 3.7-001] The seismic monitoring program described in this subsection, including the necessary test and operating procedures, will be implemented prior to receipt of fuel on site.

3.7.2.6 Conclusions

Section 3.7.2 will not be completed until the SSI Analysis RAIs have been evaluated.

3.8 Seismic Category I Structures

Section 3.8 will not be completed until the SSI Analysis RAIs have been evaluated.

The seismic Category I structures include the Concrete Containment, RB/FB, CB and Firewater Service Complex.

3.8.1 Introduction

Section 3.8 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference, Section 3.8, "Seismic Category I Structures," of Revision 9 of the ESBWR DCD with additional supplemental information. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. [1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Fermi 3 COL application are documented in NUREG–1966, the FSER related to the certified ESBWR DCD.

3.8.2 Summary of Application

Section 3.8 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference Section 3.8 of the ESBWR DCD, Revision 9. In addition, in Fermi 3 COL FSAR, Revision 4, Subsection 3.8.5.5.1, the applicant provided the following:

Supplemental Information

- EF3 SUP 3.8-1 Foundation Stability

  The main structural criteria for the containment portion of the foundation are to provide adequate strength to resist loads and sufficient stiffness to protect the containment liner from excessive strain.

3.8.3 Regulatory Requirements

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.8 of NUREG-0800 and includes the following:

- 10 CFR Part 50, GDC 2 - The design basis shall reflect appropriate consideration of the most severe earthquakes that have been historically reported for the site and surrounding area with sufficient margin for the limited accuracy, quantity, and period of time in which historical data have been accumulated.

- 10 CFR Part 100, Subpart A, which is applicable to power reactor site applications before January 10, 1997, refers to Appendix A of this part for seismic criteria. 10 CFR Part 100, Appendix A indicates that the SSE and the OBE shall be considered in the design of safety-related SSCs. 10 CFR Part 100, Appendix A further states that the design used to ensure that the required safety functions are maintained during and after the vibratory ground motion associated with the SSE shall involve the use of either a suitable dynamic analysis or a suitable qualification test to demonstrate that SSCs can withstand the seismic and other concurrent loads,

[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.

except where it can be demonstrated that the use of an equivalent static load method provides adequate conservatism.

- 10 CFR Part 100, Subpart B which is applicable to power reactor site applications on or after January 10, 1997, refers to 10 CFR 100.23 of this part for seismic criteria. Section 100.23 describes the criteria and nature of investigations required to obtain the geologic and seismic data necessary to determine the suitability of the proposed site and the plant design bases. 10 CFR 100.23 also indicates that applications to engineering design are contained in 10 CFR Part 50, Appendix S.

- 10 CFR Part 50, Appendix S is applicable to applications for a design certification or COL to 10 CFR Part 52 or a construction permit or operating license pursuant to 10 CFR Part 50 on or after January 10, 1997. For SSE ground motions, SSCs will remain functional and within applicable stress, strain, and deformation limits. The required safety functions of SSCs must be assured during and after the vibratory ground motion through design, testing, or qualification methods. The evaluation must take into account soil-structure interaction effects and the expected duration of the vibratory motion. If the OBE is set at one-third or less of the SSE, an explicit response or design analysis is not required. If the OBE is set at a value greater than one-third of the SSE, an analysis and design must be performed to demonstrate that the applicable stress, strain, and deformation limits are satisfied. Appendix S also requires that the horizontal component of the SSE ground motion in the free-field at the foundation level of the structures must be an appropriate response spectrum with a peak ground acceleration of at least. 0.1g.

- 10 CFR 52.47(b)(1), which requires that a DCA contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC’s regulations.

The regulatory basis for acceptance of the additional information defining the scope of safety-related SSCs is established in GDC 2, “Design Bases for Protection Against Natural Phenomena,” which requires that all SSCs important to safety be designed to withstand the effects of natural phenomena, including earthquakes and guidance on how to meet this requirement is in RG 1.29.

3.8.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.8 of the certified ESBWR DCD. The staff reviewed Section 3.8 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the

ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

- EF3 SUP 3.8-1 Foundation Stability

By letter dated January 18, 2012, the staff issued RAIs 3.8.5-1, 3.8.5-2, 3.8.5-3, 3.8.5-4 and 3.8.5-5 concerning site foundation stability in support of the review of supplemental information item EF3 SUP 3.8-1. DTE provided the following RAI responses: ML12052A059, dated February 16, 2012; ML12065A194, dated March 1, 2012; ML12086A091, dated March 23, 2012; ML121220287, dated April 30, 2012; and ML12173A407, dated June 15, 2012. The staff is currently reviewing the RAI responses. Therefore, RAIs 3.8.5-15 through 3.8.5-5 are considered open items and are being tracked as **Open Items** 3.8.5-1 through 3.8.5-5, accordingly.

3.8.5 Post Combined License Conditions

There are no post COL activities related to this section.

3.8.6 Conclusion

Subsection 3.8 will not be completed until the SSI/Backfill Analysis RAIs have been evaluated.

3.9 Mechanical Systems and Components

3.9.1 Introduction

Section 3.9 of the Fermi 3 COL FSAR, Revision 4, addresses the structural integrity and functional capability of mechanical SSCs.

3.9.2 Summary of Application

Section 3.9 of the Fermi 3 COL FSAR, Revision 4, incorporates by reference Section 3.9 of the ESBWR DCD, Revision 9. In addition, in Fermi 3 COL FSAR, Revision 4, the applicant provided the following:

COL Items

- EF3 COL 3.9.9-1-A Reactor Internals Vibration Assessment Program

The NRC staff evaluation of the following three COL information items are discussed in the SER sections titled, "Snubber Preservice and Inservice Examination and Testing, Snubber Support Data, and Inservice Examination and Testing", and "Functional design, qualification, and inservice testing programs for pumps, valves, and dynamic restraints", respectively.

[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.

- STD COL 3.9.9-2-A Piping Stress Reports

- STD COL 3.9.9-4-A Snubber Preservice and Inservice Examination and Testing, Inservice Examination and Testing, and Snubber Support Data

- STD COL 3.9.9-3-A Inservice Test of Valves, Valve Testing, Valve Exercise Tests, Valve Replacement, Repair and Maintenance, and Non-Code Testing of Power-Operated Valves

Supplemental Information

The NRC staff evaluation of the following supplemental item is discussed in the SER sections titled, "Functional design, qualification, and inservice testing programs for pumps, valves, and dynamic restraints."

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

The applicant stated the following:

> No relief from or alternative to the ASME OM Code is being requested.

- STD SUP 3.9-2 Risk-Informed Inservice Testing

The applicant stated the following:

> Risk informed inservice testing is not being utilized.

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

The applicant stated the following:

> Risk informed inservice inspection is not being utilized.

Therefore, there is no technical evaluation needed for the above three supplemental items.

3.9.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.9 of NUREG-0800, which includes the following:

- The guidance associated with the reactor internals startup testing is given 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, GDC 1, 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, which requires, in part, that components important to safety be designed to withstand seismic events without loss of capability to perform their safety functions.

- GDC 14, which requires that the RCPB be designed, fabricated, erected and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

- GDC 15, which requires that the reactor coolant system and associated auxiliary, control and protection systems be designed with sufficient margin 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, 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 NRC staff 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 SER on the ESBWR DCD, GDC 1, 2, 4, 14, 15, 37, 40, 43, 46, and 54 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 QA criteria in 10 CFR Part 50, Appendix B provide assurance that the design, tests, and documentation related to functional design, qualification, and 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 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) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow the 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 those 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 and with an increasing level of detail where implementation choices could materially and negatively affect the program’s effectiveness and acceptability. The Commission approved SECY-05-0197, including the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR, in the SRM for SECY-05-0197, dated February 22, 2006.

The NRC staff followed the applicable subsections in SRP Section 3.9 in its review of the Fermi 3 COL application. 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, NRC staff reviewed and approved Section 3.9 of the certified ESBWR DCD. The staff reviewed Section 3.9 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

Initial Startup Flow-Induced Vibration Testing of Reactor Internals

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

COL Items

- EF3 COL 3.9.9-1-A Reactor Internals Vibration Assessment Program

In addressing COL Item 3.9.1-1-A, the applicant incorporated by reference the following GEH topical reports listed in ESBWR DCD Appendix 3L:

- NEDE-33259P, "Reactor Internals Flow Induced Vibration Program"
- NEDE-33312P, "Steam Dryer – Acoustic Load Definition"
- NEDE-33313P, "Steam Dryer – Structural Evaluation"
- NEDC-33408P, "ESBWR Steam Dryer – Plant Based Load Evaluation Methodology"
- NEDC-33408P, Supplement 1, "ESBWR Steam Dryer – Plant Based Load Evaluation Methodology Supplement 1"

The staff reviewed COL Item EF3 COL 3.9.9-1-A and considered the reference ESBWR DCD. Of the referenced topical reports (TRs)above, NEDE-33312P, NEDE-33313P, NEDC-33408P and NEDC-33408P, Supplement 1 are being reviewed by the staff as part of the continued review of the design certification. Therefore, until these TRs are accepted by the staff in the design certification review, **COL Item 3.9.9-1-A is being tracked as an open item**.

[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 classification of the Fermi 3 reactor internals. The Fermi 3 reactor internals classification has the following two scenarios. In Scenario 1, the Fermi 3 reactor internals are classified as the ESBWR prototype for reactor internals testing. In Scenario 2, should a comprehensive vibration assessment program for an ESBWR unit other than Fermi 3 be completed and approved by the NRC as valid prototype prior to initiation of startup testing at Fermi 3, Fermi 3 reactor internals will be classified as non-prototype, Category I. COL FSAR Part 10 lists a license condition for COL Item STD COL 14.2.3-A, "Preoperational and Startup Test Procedures." This license condition will ensure that the applicant implements the initial test program (ITP), which includes the reactor internals initial start up flow-induced vibration testing. In commitment COM-FSAR 3.9-001, the applicant commits to provide a summary of the vibration analysis program and description of the vibration measurement and inspection phase of the comprehensive vibration inspection program to the NRC six months prior to implementation. In commitment COM-FSAR 3.9-006, the applicant commits to provide the preliminary and final reports (as necessary) of the results of the vibration analysis, measurement and inspection programs to the NRC within 60 days and 180 days, respectively, following the completion of the programs in accordance with RG 1.20.

Based on the review, the staff concludes that the license conditions and commitments adequately address COL Item EF3 COL 3.9.9-1-A. The staff finds that the information related to reactor internals classification and testing is adequate in meeting RG 1.20 guidance and NRC regulatory requirements, and thus is acceptable. Because of the continued review of the design certification TRs, COL Item EF3 COL 3.9.9-1-A remains an **Open Item 3.9-1**.

Loading Combinations, Design Transients and Stress Limits

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

- STD COL 3.9.9-2-A Piping Stress Reports

The NRC staff reviewed the information in Fermi 3 COL FSAR, Revision 4, Subsection Subsection 3.9.3.1, "Loading Combinations, Design Transients and Stress Limits", for information item, STD COL 3.9.9-2-A, which states the following:

> **[START COM 3.9-002]** The piping stress reports identified in this DCD section will be completed within six months of completion of DCD ITAAC Table 3.1-1. **[END COM 3.9-002]**
>
> **[START COM 3.9-004]** The FSAR will be revised as necessary in a subsequent update to address the results of this analysis. **[END COM 3.9-004]**

Snubber Preservice and Inservice Examination and Testing, Snubber Support Data, and Inservice Examination and Testing

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

- STD COL 3.9.9-4-A Snubber Preservice and Inservice Examination and Testing, Inservice Examination and Testing, and Snubber Support Data

The NRC staff reviewed the information provided by the applicant related to the snubber preservice and inservice examination and testing program included under Subsection 3.9.3.7.1(3)e of the Fermi 3 COL FSAR, which states:

> 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.

[START 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. **[END COM 3.9-003]**

[START COM 3.9-005] This information will be included in the FSAR as part of a subsequent FSAR update. **[END COM 3.9-005]**

The NRC staff reviewed the information in Fermi 3 COL FSAR, Revision 4, Subsection 3.9.6, "Inservice Testing of Pumps and Valves", provided by the applicant in information items STD COL 3.9.9-2-A and STD COL 3.9.9-4-A, and determined the information meets the requirements of 10 CFR Part 50, Appendix A, GDC-2, GDC-14, GDC-15 and 10 CFR Part 50, Appendix S, and the guidance in RG-1.206.

Functional design, qualification, and inservice testing 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 DCA, GEH revised the ESBWR DCD to specify provisions for the IST Program to support COL applications referencing the ESBWR design. In letters dated February 16, 2009, July 19, 2010, and September 21, 2010, Detroit Edison notified the NRC that it had assumed the role of reference COL application (R-COLA) for the ESBWR design and that it adopted the RAI responses related to FSAR Section 3.9.6 provided by Dominion Power for the previous R-COLA plant. The NRC staff review of the description of the IST program for Fermi 3 is provided below in this SER section.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

- STD COL 3.9.9-3-A Inservice Test of Valves, Valve Testing, Valve Exercise Tests, Valve Replacement, Repair and Maintenance, and Non-Code Testing of Power-Operated Valves

The NRC staff reviewed Section 3.9.6 of the ESBWR DCD on Docket No. 52-010. 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 SER on the DCA for the ESBWR. ESBWR DCD Tier 2, Section 3.9.6 provides a general description of the IST Operational Program to be developed for an ESBWR plant. ESBWR DCD Tier 2, Section 3.9.9 specifies COL Information Item STD COL 3.9.9-3-A, which states that the COL applicant shall provide a full description of the IST Program and a milestone for full program implementation, as identified in Section 3.9.6.1.

ESBWR DCD Section 3.9.3.5, "Valve Operability Assurance," describes the process for the functional design and qualification of valves to be used in the ESBWR. Section 3.9.3.5 in ESBWR DCD Tier 2 specifies that valve designs that were not previously qualified will meet the requirements of the ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." For valve designs that were previously qualified to standards other than ASME QME-1-2007, ESBWR DCD Tier 2, Section 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 staff 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," that 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 2003 Addenda, is the basis for the IST program to be described in COL applications referencing the ESBWR design. DCD Tier 2, Table 3.9-8, "Inservice Testing," provides a list of the valves to be included in the IST program for an ESBWR plant, including 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 its response to COL Information Item 3.9.9.3-A, Detroit Edison 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 the ESBWR DCD, Table 3.9-8. ESBWR DCD Tier 2, Section 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 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 NRC staff reviewed the description of the ASME OM Code requirements provided in the Fermi 3 FSAR on the IST Program that supplements the provisions in the ESBWR DCD. For example, Fermi 3 FSAR Section 3.9.6.1 describes the IST provisions for (a) the establishment of reference values; (b) the prohibition of preconditioning that undermines the purpose of IST activities; (c) comparison of stroke time to the reference value except for fast-acting valves for which a stroke-time limit of 2 seconds is assigned; (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 check valve tests; (i) post-maintenance testing for check valves; (j) check valve disassembly and testing; (k) re-establishment of reference values following maintenance; and (l) valve replacement, repair, and maintenance. The NRC 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 is acceptable.

ESBWR DCD Tier 2, Section 3.9.6 specifies that 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 2001 Edition, with the 2003 Addenda of the ASME OM Code for use in the ESBWR design. The Fermi 3 FSAR incorporates by reference these provisions in the ESBWR DCD. As Supplemental Information STD COL 3.9-1, Fermi 3 FSAR Section 3.9.6.6, "10 CFR 50.55a Relief Requests and Code Cases," states 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 the 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, 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 Nonsafety Systems in Passive Plant Designs." The availability of systems relied on after 72 hours, addressed under the RTNSS Program, is discussed in Section 22 of this SER.

In **RAI 03.09.06-1** for the previous R-COLA plant, the NRC staff requested Dominion to discuss the process for implementing the provisions specified in ESBWR DCD Tier 2, Section 3.9.3.5 for the functional design and qualification of valves and dynamic restraints. 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 NRC 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 EQ operational programs by COL applicants. As discussed in an NRC memorandum dated September 1, 2009 (ML092390403), the NRC 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 such aspects as the valve types identified in the IST Program table and the consideration of lessons learned from valve operating experience. In its response to the audit follow-up items in a letter dated September 21, 2009, 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, 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 NRC staff conducted a follow-up audit at the GEH office in Washington, DC, to review the implementation of the actions specified by GEH in its letter dated September 21, 2009. Based on the GEH letter dated September 21, 2009, and the NRC follow-up audit on March 19, 2010, the NRC staff considers GEH to have resolved the audit follow-up actions related to functional design and qualification of valves in support of the ESBWR DCA. The staff finds that the ESBWR DCD provisions for 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-COLA plant, the NRC 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. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that the ASME OM Code, 2001 Edition with the 2003 Addenda, is the basis for the IST Program for the R-COLA plant. The NRC staff finds the RAI response to clarify 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.

In **RAI 03.09.06-3** for the previous R-COLA plant, the NRC staff 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. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that 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 Regulatory Issue Summary 2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design-Basis Conditions," which also references NRC staff 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 to re-verify the capability of the valve to perform its required functions, if necessary, 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 NRC 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, Section 3.9.3.7, "Component Supports," discusses piping supports, spring hangers, struts, and snubbers (dynamic restraints). To address COL Information 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, "Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Nuclear Power Plants," and provides specific examples of the program content to supplement the ESBWR DCD.

ESBWR DCD Tier 2, Section 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, Section 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, Section 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 inspection and test program. ESBWR DCD Tier 2, Section 3.9.9 specifies COL Information Item STD COL 3.9.9-4-A, which states 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 Section 3.9.3.7.1(3)f. Fermi 3 FSAR Section 3.9.9 states that COL Information Item STD COL 3.9.9-4-A is addressed in Sections 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 closure of ITAAC Table 3.1-1. Section 3.9 in the Fermi 3 FSAR describes the snubber Inservice Examination and Testing Program, including specifying that the program will satisfy ASME OM Code Subsection ISTD and provides 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 the ASME OM Code, Subsection ISTD. 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 **RAI 03.09.06-4** for the previous R-COLA plant, the NRC 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. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that referenced an RAI response from GEH indicating that the specifications to ASME BPV Code, Section XI, would be deleted from this section in the ESBWR DCD Tier 2. Subsequently, the NRC staff found that the ESBWR DCD Tier 2 had been revised 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 where the

operational program is fully described (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 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 percent reactor power operation and will be completed within 12 calendar months after attaining 5 percent reactor power."

In **RAI 03.09.06-5** for the previous R-COLA plant, the NRC staff requested Dominion to discuss the commencement of the PST Program. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that stated 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 COL has been issued and will be updated every 6 months until 12 months before the 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. According to the RAI response, commencement of preservice testing will be concurrent with the operational status of the equipment and its readiness to support PST, with completion of the preservice testing 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 NRC staff finds that the RAI response clarifies the commencement of the PST Program. Therefore, **RAI 03.09.06-5** is resolved.

In **RAI 03.09.06-6** for the previous R-COLA plant, the NRC 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. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, stating the intent to use the overall 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 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, Section 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 with piping vibration, thermal expansion, and dynamic effects testing performed during both phases, as described in ESBWR DCD Tier 2, Chapter 14. ESBWR DCD Tier 2, Section 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 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, Section 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, Sections 3.9.3.7 and 3.9.3.8, require analyses or tests for component supports to assure their structural capability to 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 the NRC regulations. ESBWR DCD Tier 2, Section 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, Section 14.2.8.2.10, "System Vibration Test," describes the applicable preoperational and startup tests for plant systems. Based on this information, the NRC 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. The implementation of the provisions in ESBWR DCD Tier 2, Chapter 14 will be reviewed 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 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 NRC staff requested that Detroit Edison 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, 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 NRC 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. Revision 3 (and Revision 4) to Fermi 3 COL FSAR in Item (4), "Special Tests," of Subsection 3.9.6.1.4, "Valve Testing," 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 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, 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 a supplemental license condition, based on operating experience with SLC squib valves in current boiling-water reactor nuclear power plants.

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 NRC 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 found 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 NRC staff determined that two license conditions related to the IST program description are needed, based on its review of the Fermi 3 COL application, and are listed in Subsection 3.9.5, "Post Combined License Activities", of this SER.

3.9.5 Post Combined License Activities

The NRC staff determined that two license conditions related to the IST program description are needed based on its review of the Fermi 3 COL application as follows:

1. 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. A license condition will include the specific commitments related to the operational program schedules.

2. 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.

In Section 3.9, "Mechanical Systems and Components", of the Fermi 3 COL FSAR, Revision 4, the applicant provides the following commitments:

[COM-FSAR-3.9-001] 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.

[COM-FSAR-3.9-006] 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.

In Subsection 3.9.3.1, “Load Combinations, Design Transients and Stress Limits”, of the Fermi 3 COL FSAR, Revision 4, the applicant provides the following commitments:

[COM 3.9-002] The piping stress reports identified in this DCD section will be completed within six months of completion of DCD ITAAC Table 3.1-1. **[COM 3.9-004]** The FSAR will be revised as necessary in a subsequent update to address the results of this analysis.

[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. **[COM 3.9-005]** This information will be included in the FSAR as part of a subsequent FSAR update.

3.9.6 Conclusion

The NRC staff reviewed the information in ESBWR DCD Section 3.9.6 on Docket No. 52-010. The results of the staff’s technical evaluation of the information related to the functional design, qualification, and IST Programs for safety-related pumps, valves, and dynamic restraints, incorporated by reference in the Fermi 3 COL FSAR, is documented in the staff SER on the DCA for the ESBWR.

Due to **Open Item 3.9-1**, the staff is unable to finalize its conclusion related to COL Item EF3 COL 3.9.9-1-A, “Reactor Internals Vibration Assessment Program.”

3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

3.10.1 Introduction

Seismic and dynamic qualification of seismic Category I equipment includes the following types:

- Safety-related active mechanical equipment that performs a mechanical motion while accomplishing a system safety-related function. Examples include pumps, valves, and valve operators.

- Safety-related, non-active mechanical equipment whose mechanical motion is not required while accomplishing a system safety-related function, but whose structural integrity must be maintained in order to fulfill its design safety-related function.

- Safety-related instrumentation and electrical equipment and certain monitoring equipment.

Mechanical and electrical equipment (including instrumentation and controls), and where applicable, their supports classified as seismic Category I must demonstrate that they are capable of performing their intended safety-related functions under the full range of normal and accident (including seismic) loadings. This equipment includes devices associated with systems essential to safe shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or are otherwise essential in preventing significant release of radioactive material to the environment or in mitigating the consequences of accidents.

The criteria for the seismic and dynamic qualification include the following considerations:

- Adequacy of seismic and dynamic qualification input motions.
- Methods and procedures for qualifying electrical equipment, instrumentation, and mechanical components.
- Methods and procedures for qualifying supports of electrical equipment, instrumentation, and mechanical components.
- Documentation.

3.10.2 Summary of Application

Section 3.10 of the Fermi 3 FSAR, Revision 4, incorporates by reference Section 3.10 of the ESBWR DCD, Revision 9. In addition, in Fermi 3 COL FSAR, Revision 4, the applicant provided the following:

COL Items

- STD COL 3.10.4-1-A Dynamic Qualification Report

Supplemental Information

- STD SUP 3.10-1 Quality Assurance Program for Equipment Qualification

3.10.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

In addition, the acceptance criteria associated with the relevant requirements of the Commission regulations for the seismic classification are given in Section 3.10 of NUREG-0800, which includes the following:

- GDC 1 and 30 as they relate to qualifying equipment to appropriate quality standards commensurate with the importance of the safety functions to be performed.
- GDC 2 and Appendix S to 10 CFR Part 50 as they relate to designing equipment to withstand the effects of natural phenomena such as earthquakes.
- GDC 4 as it relates to qualifying equipment as capable of withstanding the dynamic effects associated with external missiles and internally generated missiles, pipe whip, and jet impingement forces.
- GDC 14 as it relates to qualifying equipment associated with the reactor coolant boundary so that there is an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

- 10 CFR Part 50, Appendix B, as it relates to qualifying equipment using the quality assurance criteria provided.

- 10 CFR Part 50, Appendix B, Criterion III, as it relates to verifying and checking the adequacy of design, such as by the performance of a suitable test program, among other things, and which specifically requires that a test program used to verify the adequacy of a specific design feature shall include suitable qualifications testing of a prototype unit under the most adverse design conditions.

- 10 CFR 52.47(b)(1), which requires that a DCA contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

- 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC's regulations.

3.10.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.10 of the certified ESBWR DCD. The staff reviewed Section 3.10 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the North Anna application were equally applicable to the Fermi COL application, the staff undertook the following reviews:

- The staff compared the North Anna 3 COL FSAR, Revision 1, to the Fermi COL FSAR. In performing this comparison, the staff considered changes made to the Fermi COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs and open and confirmatory items identified in the North Anna SER with open items.

- The staff confirmed that the applicant endorsed all responses to RAIs identified in the corresponding standard content (the North Anna SER) evaluation.

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[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 verified that the site-specific differences were not relevant to this section.

The staff has completed its review and found the evaluation performed for the North Anna standard content to be directly applicable to the Fermi COL application. This standard content material is identified in this SER by use of italicized, double indented formatting.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

COL Items

- STD COL 3.10.4-1-A Dynamic Qualification Report

The NRC staff reviewed the information provided by the applicant related to the dynamic qualification report included under Subsection 3.10.1.4 of the Fermi 3 COL FSAR, which states the following:

> **[COM 3.10-003]** Detroit Edison shall submit to the NRC, no later than 1 year after issuance of the combined license or at the start of construction as defined in 10 CFR 50.10(a), whichever is later, its implementation schedules for completing of the following ITAACs. Detroit Edison shall submit updates to the ITAAC schedules every 6 months thereafter and, within 1 year of its scheduled date for initial loading of fuel, and shall submit updates to the ITAAC schedules every 30 days until the final notification is provided to the NRC under paragraph (c)(1) of this section.
>
> **[COM 3.10-001]** The Dynamic Qualification Report and documentation that describe the seismic and dynamic qualification methods will be made available for NRC staff review, inspection, and audit. Information that verifies the seismic and dynamic qualification will be made available to the NRC to facilitate reviews, inspections, and audits throughout the process. **[COM 3.10-002]** FSAR information will be revised, as necessary, as part of a subsequent FSAR update.

The staff's review found that the applicant's response adequately addresses 3.10.4-1-A and the guidance in RG 1.206.

Supplemental Information

- STD SUP 3.10-1 Quality Assurance Program for Equipment Qualification

The NRC staff reviewed the information provided by the applicant related to the quality assurance program for equipment qualification included under Subsection 3.10.1.4 of the Fermi 3 COL FSAR, which states the following:

> Section 17.5 defines the Quality Assurance Program requirements that are applied to equipment qualification files, including requirements for handling safety-related quality records, control of purchased material, equipment and services, test control, and other quality related processes.

The following portion of this technical evaluation section is reproduced from Subsection 3.10.4, "Technical Evaluation", of North Anna Unit 3 SER (ML091730304):

The staff reviewed the conformance of Section 3.10 of the North Anna COL FSAR to the guidance in RG 1.206, Chapter 3, Sections C.I.3.10 and C.III.1.3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment." The staff's review of Section 3.10 of the North Anna COL FSAR found that the applicant has appropriately incorporated by reference Section 3.10 of the ESBWR DCD, Revision 5 except that the standard COL item described above is not acceptable in accordance with the guidance in Section C.I.3.10.4 of RG 1.206. RG 1.206 Sections C.I.3.10.4 and C.III.3.10.4 state that the applicant should provide the results of tests and analyses to demonstrate adequate seismic qualification of equipment. However, RG 1.206 acknowledges that this level of detail may not be available and provides an alternative provision for an implementation plan that includes milestones and completion dates.

*The staff reviewed the North Anna COL FSAR and found that it does not provide either the results of qualification or an implementation plan. This information is necessary for the staff to make a reasonable assurance safety finding for licensing (i.e., to find that the design is in accordance with the regulations). The information included with this plan should address those planning details not addressed in the DCD. Those details include, for example, a listing of the equipment to be qualified, the method of qualification, who will be performing the qualification, the timing, etc. The expectation is that all information for the phases would be completed before procurement would be available for review prior to licensing. For example, the list of equipment and qualification method can be provided now with wording for a license condition which will require provision of the name of the organization qualifying the equipment and details on timing post procurement six months before the qualification process is expected to be completed. It is expected that this information would be available to be audited by the NRC Staff prior to equipment installation. In **RAI 3.10-1**, the NRC requested the applicant to provide an implementation plan that includes the level of detail that will be completed prior to procurement and the plan for completing equipment qualification as called for in RG 1.206 and the example described above.*

As stated in Fermi 3 COL FSAR, Revision 4, Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment, Commitments COM 3.10-001, COM 3.10-002 and COM 3.10-003 meet the alternative provision for an implementation plan that includes milestones and completion dates as described in RG 1.206. Therefore **RAI 3.10-1** is closed. Based on the evaluation above, the NRC staff finds the information on STD SUP 3.10-1 acceptable.

3.10.5 Post Combined License Activities

[COM 3.10-003] Detroit Edison shall submit to the NRC, no later than 1 year after issuance of the combined license or at the start of construction as defined in 10 CFR 50.10(a), whichever is later, its implementation schedules for completing of the following ITAACs. Detroit Edison shall submit updates to the ITAAC schedules every 6 months thereafter and, within 1 year of its scheduled date for initial loading of fuel, and shall submit updates to the ITAAC schedules every 30 days until the final notification is provided to the NRC under paragraph (c)(1) of this section.

[COM 3.10-001] The Dynamic Qualification Report and documentation that describe the seismic and dynamic qualification methods will be made available for NRC staff review, inspection, and audit. Information that verifies the seismic and dynamic qualification will be made available to

the NRC to facilitate reviews, inspections, and audits throughout the process. **[COM 3.10-002]** FSAR information will be revised, as necessary, as part of a subsequent FSAR update.

3.10.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff's review confirmed that the applicant addressed the required information relating to Seismic and dynamic qualification of seismic Category I equipment, and there is no outstanding information expected to be addressed in the Fermi 3 FSAR, Revision 4, related to this section.

In addition, the staff compared the additional COL information in the application to the relevant NRC regulations, the guidance in Section 3.10 of NUREG–0800, and other NRC RGs. The staff concluded that Fermi 3 COL FSAR, Revision 4, Section 3.10 is acceptable and meets NRC regulatory requirements and acceptance criteria in Section 3.10 of NUREG-0800, including GDC 1, GDC 2 and Appendix S to 10 CFR Part 50, GDC 4, GDC 14, as well as RG 1.206, "Combined License Applications for Nuclear Power Plants", 10 CFR Part 50, Appendix B, Criterion III, 10 CFR 52.47(b)(1), and 10 CFR 52.80(a).

3.11 Environmental Qualification of Mechanical and Electrical Equipment

3.11.1 Introduction

Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," in the Fermi 3 FSAR describes the EQ Program to be used at Fermi 3 for the electrical and mechanical equipment important to safety. The objective of the EQ Program is to reduce the potential for common failure due to specified environmental events and to demonstrate that the equipment within the scope of the EQ Program is capable of performing its intended design function under all conditions, including environmental stresses resulting from design-basis events. During plant operation, the COL licensee implements the EQ Program, which specifies the replacement frequencies of affected safety-related equipment in harsh environments and nonsafety-related equipment whose failure under the postulated environmental conditions could prevent satisfactory performance of the safety functions of the safety-related equipment, and certain post-accident monitoring equipment.

This equipment must perform its safety functions under all normal environmental conditions, abnormal operational occurrences, design-basis events, post-design-basis events, and containment test conditions. This capability is demonstrated through qualification testing and analysis of similar equipment under the temperature, pressure, humidity, chemical effects, radiation, and submergence conditions under which the equipment will be expected to operate. The qualification information shall include identification of the equipment required to be environmentally qualified. Each component shall have, on site in auditable form, the designated functional requirements; the definition of the applicable environmental parameters; the periodic maintenance to support the qualified life; the accident that the component is required to mitigate; the required operation time; and the documentation of the qualification process employed to demonstrate the required environmental capability. This information shall be maintained current.

3.11.2 Summary of Application

Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment", of the Fermi 3 FSAR, Revision 4, incorporates by reference Section 3.11 of the ESBWR DCD, Revision 9. In addition, in Fermi 3 FSAR, Revision 4, the applicant provided the following:

COL Items

- STD COL 3.11-1-A Environmental Qualification Documentation

  The applicant provided additional information in STD COL 3.11-1-A to address COL Information Item 3.11-1-A. The applicant stated that a description of the EQ program is provided in ESBWR DCD Tier 2, Section 3.11. The Fermi 3 FSAR also specifies that implementation of the EQ program, including development of the Environmental Qualification Document (EQD), will be in accordance with the milestone schedule provided in Section 13.4, "Operational Program Implementation."

3.11.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

The relevant requirements of the Commission regulations for the EQ operational program and EQD and the associated acceptance criteria are described in Section 3.11 of NUREG-0800.

The applicable regulatory requirements for the EQD are as follows:

- 10 CFR 50.49, "Environmental qualification of electrical equipment important to safety for nuclear plants," requires an applicant for a license for a nuclear power plant to establish a program for qualifying electrical equipment for environmental effects.

Appendix A to 10 CFR Part 50

- GDC 1, "Quality Standards and Records", requires that components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

- GDC 2, "Design Bases for Protection Against Natural Phenomena," requires that components important to safety be designed to withstand the effects of natural phenomena without loss of capability to perform their safety function.

- GDC 4, "Environmental and Dynamic Effects Design Bases", requires that components important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss of coolant accidents.

- GDC 23, "Protection System Failure Modes," requires that protection systems be designed to fail in a safe state, or in a state demonstrated to be acceptable on some

other defined basis, if conditions such as postulated adverse environments (e.g., extreme heat or cold, pressure, steam, water, or radiation) are experienced.

Appendix B to 10 CFR Part 50

- Criterion III, “Design Control”, of Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” to 10 CFR Part 50 requires that measures be established to ensure that applicable regulatory requirements and the associated design bases are correctly translated into specifications, drawings, procedures, and instructions. These measures should include provisions to ensure that appropriate quality standards are included in design documents and that deviations from established standards are controlled. A process should also be established to determine the suitability of equipment that is essential to safety-related functions and to identify, control, and coordinate design interfaces between participating design organizations. Where a testing program is used to verify the adequacy of a specific design feature, the test shall include suitable qualification testing of a prototype unit under the most adverse design conditions.

- Criterion XI, “Test Control,” requires that a test control plan be established to ensure that all tests needed to demonstrate a component's performance capability be identified in accordance with required procedures and acceptance limits in applicable design documents.

- Criterion XVII, “Quality Assurance Records,” requires maintaining sufficient records to furnish evidence of activities affecting quality. The records must include inspections, tests, audits, monitoring of work performance, and materials analysis. Records must be identifiable and retrievable.

The related acceptance criteria are as follows:

- In accordance with SECY-05-0197 as accepted in the Commission’s SRM dated February 22, 2006, Equipment Qualification is an Operational Program that will be reviewed in the COL application. The NRC staff reviews this program to make a reasonable assurance finding on the program. A COL applicant should fully describe EQ and other Operational Programs as defined in SECY-05-0197 to avoid the need for ITAAC to implement those programs. The term “fully described” for an operational program should be understood to mean that the program is clearly and sufficiently described in terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, Operational Programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

3.11.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.11 of the certified ESBWR DCD. The staff reviewed Section 3.11 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in

the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

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 description of the EQ program for mechanical and electrical equipment to determine whether the Fermi 3 COL application meets the regulatory requirements to provide reasonable assurance that the applicable equipment at Fermi 3 will be capable of performing their intended functions. In letters dated February 16, 2009, July 19, 2010, and September 21, 2010, Detroit Edison notified the NRC that it had assumed the role of reference COL application (R-COLA) for the ESBWR design and that it adopted the RAI responses related to FSAR Section 3.11 provided by Dominion Power for the previous R-COLA plant. The NRC staff review of the description of the EQ Program for Fermi 3 is provided below in this SER section.

The NRC staff reviewed Section 3.11 of the ESBWR DCD on Docket No. 52-010. The staff's technical evaluation of the information related to the EQ of mechanical and electrical equipment is documented in the staff SER on the DCA for the ESBWR. The staff reviewed the information in the Fermi 3 COL FSAR as follows:

COL Items

- STD COL 3.11-1-A Environmental Qualification Documentation

The NRC staff reviewed the additional information related to environmental qualification documentation under Section 3.11 of the Fermi 3 COL FSAR, Revision 4, which states the following:

> This COL item is addressed in Subsection 3.11.4.4.

COL Item 3.11-1-A states that the COL applicant will provide a full description and a milestone for program implementation of the EQ Program that includes completion of the plant-specific EQD per ESBWR DCD Tier 2, Section 3.11.4.4, "Environmental Qualification Documentation." In STD COL 3.11-1-A, the applicant stated that a description of the EQ program is provided in ESBWR DCD Tier 2, Section 3.11. The applicant also specified that implementation of the EQ program, including development of the EQD, will be in accordance with the milestone schedule provided in Section 13.4. NRC staff reviewed the applicant's response to the ESBWR COL Information Item 3.11-1-A as provided in STD COL 3.11-1-A in the Fermi 3 FSAR. In addition to the review of the Fermi 3 COL application, the staff reviewed the ESBWR DCA. The provisions in the ESBWR DCD support the Fermi 3 COL application in fully describing the EQ Operational Program for Fermi 3.

Fermi 3 FSAR Section 3.11 incorporates by reference ESBWR DCD Tier 2, Section 3.11 with supplemental information. In **RAI 03.11-1** for the previous R-COLA plant, the NRC staff requested Dominion to provide or reference certain information or indicate the status of and schedule for its availability, related to the EQ Program for safety-related mechanical equipment.

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[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.

Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that noted that ESBWR DCD Tier 2, Section 3.11 had been revised to provide substantial additional information. For example, ESBWR DCD Tier 2, Table 3.11-1, "Electrical and Mechanical Equipment for Environmental Qualification," identifies the environment in which a component within the scope of the EQ Program will be located. The RAI response stated that there is no site-specific, safety-related equipment to be used beyond that described in the ESBWR DCD. Section 3.11.4.1, "Harsh Environment Qualification," in ESBWR DCD Tier 2, Section 3.11.4, "Qualification Program, Methods and Documentation," indicates that qualification of mechanical equipment includes materials that are sensitive to environmental effects (e.g., seals, gaskets, lubricants, and fluids for hydraulic systems). The RAI response stated that completion of the plant-specific EQD will be accomplished as specified in FSAR Section 3.11.4.4. Further, the RAI response indicated that completion of the EQ Program for plant equipment will be confirmed by close-out of the ITAAC, which is specified in ESBWR DCD Tier 1, Table 3.8-1, "ITAAC for Environmental Qualification of Mechanical and Electrical Equipment." As noted in SER Section 3.9.6, GEH is responsible for the design and qualification of mechanical equipment, and the GEH procurement specifications and processes were made available for NRC review.

In July 2009, the NRC staff conducted an audit of the design and procurement specifications for valves and EQ (ML092390403) 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 EQ operational programs by COL applicants. As discussed in an NRC memorandum dated September 1, 2009 (ML092390403), the NRC staff reviewed ESBWR DCD IST Table 3.9-8, and several design and purchase specifications. In its response to the audit follow-up items in a letter dated September 21, 2009, GEH indicated that the ESBWR DCD IST table and component specifications would be revised to incorporate the necessary clarifications identified during the audit. On March 19, 2010, the NRC staff conducted a follow-up audit at the GEH office in Washington, DC, to review the implementation of the actions specified by GEH in its letter dated September 21, 2009. During the follow-up audit, the staff found that GEH had issued the design specification for the EQ of mechanical and electrical equipment. Based on the GEH letter dated September 21, 2009, and the NRC follow-up audit on March 19, 2010, the NRC staff considers GEH to have resolved the audit follow-up actions related to EQ of mechanical equipment in support of the ESBWR DCA. The staff finds that the ESBWR DCD provisions for the EQ of mechanical equipment are being implemented in the design specifications in an adequate manner to support the Fermi 3 COL application. Therefore, **RAI 03.11-1** is resolved.

ESBWR DCD Tier 2, Section 3.11.4.1 states that active EQ safety-related mechanical equipment will be qualified by the qualification methods of IEEE 323-1974. ESBWR DCD Tier 2, Section 3.11.4.2, "Mild Environment Qualification," states that the environmental design bases will be specified in the design/purchase specifications to assure that EQ safety-related equipment located in a mild environment meets its safety-related functional requirements during normal environmental conditions and anticipated operational occurrences. For EQ safety-related equipment (except computer-based instrumentation and control systems), a Certificate of Conformance from the vendor of the safety-related equipment to be located in a mild environment will certify performance to the environmental design basis for normal environmental conditions and anticipated operational occurrences at the equipment location for the time that the safety-related function is required.

In **RAI 03.11-2** for the previous R-COLA plant, the NRC staff requested Dominion to discuss the implementation of the EQ approach. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that referenced ESBWR DCD Tier 2, Section 3.11 for more detailed provisions for the EQ Program. The RAI response also noted that the qualification of safety-related mechanical equipment will be performed by GEH, and that the qualification processes used by GEH would be available for audit by the NRC.

As discussed above, the NRC conducted an audit to determine the acceptability of specific aspects of the EQ program. The scope of the audit included the concerns expressed in **RAI 03.11-2** as well as **RAI 03.11-1** noted above. The audit report concludes that the GEH approach to EQ as documented in the ESBWR DCD is adequately being implemented in the design specifications to support the Fermi 3 COL application. Therefore, **RAI 03.11-2** is resolved.

In **RAI 03.11-3** for the previous R-COLA plant, the NRC staff requested Dominion to clarify whether the FSAR would be updated to include additional equipment not identified in the ESBWR DCD Tier 2, Table 3.11-1. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that there is no safety-related equipment or safe shutdown equipment outside the scope of the ESBWR design. As a result, there is no additional equipment covered by the EQ Program not identified in DCD Table 3.11-1. Therefore, **RAI 03.11-3** is resolved.

ESBWR DCD Tier 2, Section 3.11 references the NRC-approved proprietary licensing Topical Report NEDE-24326-1-P, "General Electric Environmental Qualification Program." In a letter dated November 19, 2007 (MFN 07-174, Supplement 2), GEH stated that the NRC staff review of NEDE-24326-1-P was addressed in NUREG-1503, "Final Safety Evaluation Report Related to the Certification of the Advanced Boiling Water Reactor Design." On page 3-90 of NUREG-1503, NRC staff found that the topical report conforms to 10 CFR 50.49 and its associated standards, except for the position on the time margin. In **RAI 03.11-4** for the previous R-COLA plant, the NRC staff requested Dominion to describe the implementation of NEDE-24326-1-P for the EQ of safety-related mechanical equipment, including the exception to its acceptance indicated in NUREG-1503. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that the ESBWR DCD had been revised to incorporate the provisions of NEDE-24326-1-P and to address the time margin issue. The staff reviewed ESBWR DCD, Revision 9 and found the time margin issue had been acceptably addressed and conforms to 10 CFR 50.49 requirements. Therefore, **RAI 03.11-4** is resolved.

ESBWR DCD Tier 2, Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," addresses methods of test and analysis employed to ensure the capability of mechanical and electrical equipment under the full range of normal and accidental loadings to ensure conformance with the NRC regulations. Operating experience from nuclear power plants has revealed the potential for adverse flow effects during normal plant operation that can impact safety-related components (such as safety relief valves). As a result, equipment qualification programs need to address these adverse flow effects to provide confidence that safety-related equipment will be capable of performing their safety functions.

In **RAI 03.11-5** for the previous R-COLA plant, the NRC staff requested Dominion to describe the consideration of FIV in the qualification of safety-related mechanical equipment, including acoustic resonance and hydraulic loading. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that ESBWR DCD Tier 2, Section 3.9.3.5 requires that the ESBWR general valve requirement specification include requirements related to the design and functional qualification of safety-related valves that incorporate lessons learned from nuclear

power plant operations and research programs. ESBWR DCD Tier 2, Section 3.10 addresses methods of test and analysis employed to ensure the capability of mechanical and electrical equipment under the full range of normal and accident loadings. The RAI response indicated that testing, as described in ESBWR DCD Tier 2, Section 3.9.2 and FSAR Section 14.2, will provide confidence in the capability of safety-related equipment to perform its safety functions. For example, ESBWR DCD Tier 2, Section 3.9.2.1.1 discusses vibration and dynamic effects testing that will be performed during the ITP, as described in DCD Sections 14.2.8.1.42 and 14.2.8.2.10. The objective of these tests will be 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-stated FIV and anticipated operational transient conditions. The NRC staff considers that the actions specified in the ESBWR DCD will address potential adverse flow effects on safety-related valves and dynamic restraints including the consideration of lessons learned from nuclear power plant operating experience. Therefore, **RAI 03.11-5** is resolved.

Fermi 3 FSAR Section 13.4, "Operational Program Implementation," includes FSAR Table 13.4-201, "Operational Programs Required by NRC Regulations," that lists each Operational Program, the regulatory source for the program, the FSAR section where the operational program is described, and the associated implementation milestones. FSAR Table 13.4-201 specifies the implementation milestone for the EQ Program as "prior to fuel load." In **RAI 03.11-6** for the previous R-COLA plant, the NRC staff requested Dominion to clarify the commencement of the EQ Program and its transition into an operating reactor program. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that stated that the COL will contain a license condition that will require the COL licensee to submit a schedule to the NRC 12 months after issuance of the COL, which will support planning and conducting NRC inspections of operational programs, including the EQ Program, with periodic updating of the schedule. This schedule will address additional program implementation details, such as commencement of the EQ Program. The transition of the EQ Program into an operating program will occur as part of the plant turnover process. The staff found that the RAI response clarified the plans for implementation and turnover of the EQ Program during plant construction and startup. Therefore, **RAI 03.11-6** is resolved.

ESBWR DCD Tier 1, Section 3.8, "Environmental Qualification of Mechanical and Electrical Equipment," specifies the EQ ITAAC for safety-related mechanical and electrical equipment in Table 3.8-1, "ITAAC for Environmental Qualification of Mechanical and Electrical Equipment." The inspections, tests, and analyses for safety-related mechanical equipment located in a harsh environment state that (i) analyses will be performed to identify the environmental design bases, including the definition of anticipated operational occurrences and normal, accident, and post-accident environments; (ii) type tests and/or analyses of material data will be performed on safety-related mechanical equipment identified as located in a harsh environment; and (iii) inspections will be performed to verify proper non-metallic materials of the as-installed, safety-related mechanical equipment located in a harsh environment. In **RAI 03.11-7** for the previous R-COLA plant, the NRC staff requested Dominion to describe the plan for the implementation of the ITAAC for safety-related mechanical equipment located in a harsh environment, as specified in the ESBWR DCD, Tier 1. Detroit Edison adopted Dominion's RAI response dated September 11, 2008, that ESBWR Tier 1, Section 1.1.2.2 provides a general plan description of ITAAC implementation. Part 10 of the Fermi 3 COL application incorporates the DCD ITAAC by reference. With respect to specific ITAAC implementation, the NRC regulations in 10 CFR 52.99 require the licensee to submit, no later than 1 year after COL issuance or the start of construction as defined in 10 CFR 50.10(b), whichever is later, a schedule for completing the inspections, tests, or analyses in the ITAAC, with subsequent

updates to the ITAAC schedule. The RAI response stated that plans and schedules for implementing ITAAC will be provided in accordance with 10 CFR 52.99. The NRC staff finds these provisions for addressing the EQ ITAAC to be consistent with the regulations and thus acceptable. Therefore, **RAI 03.11-7** is resolved.

ESBWR DCD Tier 2, Section 3.11 describes the program for the initial EQ of electrical and mechanical equipment within the EQ program for nuclear power plants applying the ESBWR reactor design. An NRC audit at the GEH office in Wilmington, NC, in July 2009 found that the ESBWR DCD does not address the transition from the initial EQ program to the operational aspects of the EQ program. As discussed in RG 1.206 and Commission Paper SECY-05-0197, COL applicants must fully describe their operational programs to avoid the need for ITAAC regarding those programs. Therefore, the NRC staff requested in **RAI 03.11-8** for the previous R-COLA plant that Dominion address the operational aspects of the EQ Program in the FSAR. Detroit Edison adopted Dominion's RAI response dated February 4, 2010, that provided a proposed revision to the FSAR to enhance the EQ Program description and to address the operational aspects of the program. The NRC staff found that the planned revision to the COL FSAR would provide an acceptable description of the transition from the initial EQ program to the operational aspects of the EQ program. This issue was tracked as **Confirmatory Item 03.11-8** for incorporation of the Fermi 3 FSAR changes. Subsequently, Revision 3 (and Revision 4) to Fermi 3 FSAR in Section 3.11.4.4, "Environmental Qualification Documentation," incorporates the provisions for the EQ operational program as specified in the RAI response. For example, the FSAR specifies that the documentation necessary to support the continued qualification of the equipment installed in the plant that is within the EQ Program scope will be available in accordance with 10 CFR Part 50, Appendix A. The FSAR also describes the EQ Master Equipment List (EQMEL) that identifies the electrical and mechanical equipment that must be environmentally qualified for use in a harsh environment. The FSAR describes the control of revisions to the EQ files and EQMEL. The FSAR specifies that the operational aspect of the EQ Program will include: (1) evaluation of EQ results for design life to establish activities to support continued EQ; (2) determination of surveillance and preventive maintenance activities based on EQ results; (3) consideration of EQ maintenance recommendations from equipment vendors; (4) evaluation of operating experience in developing surveillance and preventive maintenance activities for specific equipment; (5) development of plant procedures that specify individual equipment identification, appropriate references, installation requirements, surveillance and maintenance requirements, post-maintenance testing requirements, condition monitoring requirements, replacement part identification, and applicable design changes and modifications; (6) development of plant procedures for reviewing equipment performance and EQ operational activities, and for trending the results to incorporate lessons learned through appropriate modifications to the EQ operational program; and (7) development of plant procedures for the control and maintenance of EQ records. Therefore, **Confirmatory Item 03.11-8** is closed. Based on the evaluation above, the NRC staff finds the information on STD COL 3.11-1-A 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 3.11 for the supporting interface area of environmental design of mechanical and electrical equipment. The staff reviewed the Fermi 3 COL application for interfacing requirements with the ESBWR standard design regarding the EQ of mechanical and electrical equipment using the review procedures described in SRP Section 3.11. The NRC staff found the applicant's consideration of design interface items to be acceptable based on compliance

with 10 CFR 50.49, “Environmental qualification of electrical equipment important to safety for nuclear plants,” as discussed in above.

License Conditions

Fermi 3 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 in which the Operational Program is fully described, as discussed in RG 1.206. Listed in Fermi 3 COL Table 13.4-201, Operational Program #3 is identified as the EQ Program and it reflects a committed implementation milestone for this Operational Program as prior to fuel loading.

RG 1.206, Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit a schedule to the NRC 12 months after issuance of the COL, which supports planning and conducting NRC inspections of Operational Programs. 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.

The applicant proposed the following:

> Prior to initial fuel load, the licensee shall submit a schedule, no later than 12 months after issuance of the COL, and updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational program for the ITP in FSAR Table 13.4-201, Item 19, has been fully implemented or the plant has been placed in commercial service, whichever comes first. This schedule shall support implementation details of the ITP and planning for the conduct of NRC inspections of operational programs listed in FSAR Table 13.4-201, Item 19.

The NRC staff reviewed the above proposed license condition in Subsection 13.4.4 “Technical Evaluation” of this SER.

3.11.5 Post Combined License Activities

There are no post COL activities related to this section.

3.11.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The NRC staff’s review confirmed that the applicant addressed the required information relating to the EQ Program, and there is no outstanding information expected to be addressed in the Fermi 3 FSAR, Revision 4, related to this section.

Based on its review described in this SER section, the NRC staff concludes that the Fermi 3 COL FSAR, with the incorporation by reference of the ESBWR DCD, provides an acceptable description of the EQ of electrical and mechanical equipment to be used at Fermi 3 that provides reasonable assurance that the electrical and mechanical equipment within the scope of the Fermi 3 EQ Program will be capable of performing their safety functions in accordance with the NRC regulations.

3.12 Piping Design Review

3.12.1 Introduction

This section covers the design of the metallic piping system and piping support for seismic Category I, Category II, and nonsafety systems. It also discusses the adequacy of the structural integrity, as well as the functional capability, of the safety-related piping system, piping components, and their associated supports. The design of piping systems should ensure that they perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. This includes pressure retaining piping components and their supports, buried piping, instrumentation lines, and the interaction of NS Category I piping and associated supports with seismic Category I piping and associated supports. This section covers the design transients and resulting loads and load combinations with appropriate specified design and service limits for seismic Category I piping and piping support, including those designated as ASME Code Class 1, 2, and 3.

3.12.2 Summary of Application

Section 3.12, Piping Design of the Fermi 3 FSAR, Revision 4, references Chapter 3, "Design of Structures, Components, Equipment, and Systems", and Chapter 5, "Reactor Coolant System and Related Systems", of the ESBWR DCD, Revision 9 in the supplemental information that follows.

Supplemental Information

- STD SUP 3.12-1 Piping Design Review

  Information on seismic Category I and II, and non-seismic piping analysis and their associated supports is presented in DCD Sections 3.7, 3.9, 3D, 3K, 5.2 and 5.4.

3.12.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is in NUREG–1966, the FSER related to the certified ESBWR DCD.

In addition, the regulatory basis for pipe and support analysis is established in NUREG-0800, Section 3.12, "ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Their Associated Supports."

3.12.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Chapter 3 of the ESBWR DCD. The staff reviewed Section 3.12 of the Fermi 3 COL FSAR, Revision 4, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the

complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

The staff reviewed the supplemental information STD SUP 3.12-1 ("Piping Design Review"). The ESBWR DCD does not have Section 3.12. Therefore, this supplemental information is being considered as an editorial change to provide a map for the piping design information. The staff finds this change acceptable.

The staff also reviewed COL application FSAR Subsection 3.7 to verify that the site-specific in structure response spectra are enveloped by the response spectra of the ESBWR DCD and the evaluation will be documented in Section 3.7.2 of this SER. On the basis of that site-specific response spectra are enveloped by the ESBWR DCD response spectra, the staff finds that the ESBWR standard plant design is acceptable at the Fermi 3 site.

In addition to piping DAC ITAAC provided in Tier 1, the staff also reviewed COL 14.3A-1-1 which provides schedule for the piping DAC ITAAC completion. On the basis of that the applicant proposed DAC that are sufficient to provide reasonable assurance to meet 10 CFR 52.80(a), the staff finds this acceptable.

3.12.5 Post Combined License Activities

The following activities will be implemented following issuance of the COL:

- Piping DAC
  - The ASME Code piping and support design reports are completed on a system-by-system basis for applicable systems in order to support closure of the DAC ITACC.
  - Reconciliation of the as-built piping.

3.12.6 Conclusion

The NRC staff concludes that the information pertaining to Fermi 3 COL FSAR is within the scope of the design certification and adequately incorporates by reference the ESBWR DCD, and is thus acceptable. In addition, the staff has compared the additional COL information within the application to the relevant NRC regulations, and acceptance criteria defined in NUREG-0800, Section 3.12, "ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Their Associated Supports" and concludes that the applicant is in compliance with the NRC regulations. COL information item involving piping DAC ASME Design Reports completion is adequately addressed by the applicant. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 52 requirements by providing reasonable assurance that the piping system will be designed and built in accordance with the certified ESBWR design.

3.13 <u>Threaded Fasteners – ASME B&PV Code Class 1, 2 and 3</u>

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[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.

3.13.1 Introduction

This section covers the selection of materials, design, inspection and testing for threaded fasteners prior to initial service and during service and is limited to threaded fasteners in ASME BPV Code Class 1, 2 or 3 systems.

The ESBWR DCD, Revision 9 does not contain Section 3.13, “Threaded Fasteners,” since the DCD application was submitted before the new SRP section was issued in March 2007. However, ESBWR DCD Tier 2, Section 3.9.3.9, “Threaded Fasteners - ASME B&PV Code Class 1, 2 and 3,” provided sufficient information for the staff to conclude acceptable selection of materials, design, inspection and testing for threaded fasteners prior to initial service and during service. Therefore, the Fermi 3 FSAR, Revision 4, Section 3.13 provides supplemental information that references ESBWR DCD Tier 2, Section 3.9.3.9.

3.13.2 Summary of Application

Section 3.13, “Threaded Fasteners”, of the Fermi 3 FSAR, Revision 4, references Section 3.9.3.9 of the ESBWR DCD, Revision 9. Section 3.9, “Mechanical Systems and Components,” of the Fermi 3 FSAR, Revision 4, incorporates by reference Section 3.9.3.9 of the ESBWR DCD, Revision 9. In addition, Section 3.13 of the Fermi 3 COL FSAR, Revision 4, provided the following:

Supplemental Information

- STD SUP 3.13-1 Threaded Fasteners – ASME Code Class 1, 2, and 3

  Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in DCD Section 3.9.3.9, with supporting information in DCD Sections 4.5.1, 5.2.3, and 6.1.1.

3.13.3 Regulatory Basis

- 10 CFR Part 50, Appendix A, GDC 1 and 30, as they relate to the requirement that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

- GDC 4, as it relates to the compatibility of components with environmental conditions.

- GDC 14, as it relates to the requirement that the RCPB be designed, fabricated, erected, and tested in a manner that provides assurance of an extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture.

- GDC 31, as it relates to the requirement that the RCPB be designed with sufficient margin to ensure that when stressed under operating, maintenance, testing, and postulated accident conditions the boundary behaves in a non-brittle manner and the probability of rapidly propagating fracture is minimized.

- 10 CFR Part 50, Appendix B, as it relates to controlling the cleaning of material and equipment to prevent damage or deterioration.

- 10 CFR Part 50, Appendix G, as it relates to materials testing and acceptance criteria for fracture toughness of reactor pressure boundary components.

- 10 CFR 50.55a incorporates by reference the design criteria of ASME Code, Section III, Class 1, 2, and 3 components. The selection of materials, design, testing, fabrication, installation and inspection of threaded fasteners and mechanical joints are acceptable if they meet the criteria of the ASME Code, Section III, Class 1, 2, and 3 components. However, 10 CFR 50.55a(b)(4) permits use of code cases that have been adopted by the staff in RG 1.84 in lieu of applicable criteria of ASME Code, Section III, Class 1, 2, and 3 component.

- 10 CFR 52.47(b)(1), which requires that a DCA contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations.

- 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act, and the NRC's regulations.

3.13.4 Technical Evaluation

As documented in NUREG–1966, NRC staff reviewed and approved Section 3.9.3.9 of the certified ESBWR DCD. The staff reviewed Section 3.13 of the Fermi 3 COL FSAR, Revision 4, which references ESBWR Section 3.9.3.9, and checked the referenced ESBWR DCD to ensure that the combination of the information in the ESBWR DCD and the information in the Fermi 3 COL FSAR, Revision 4, appropriately represents the complete scope of information relating to this review topic.[1] The staff's review confirmed that the information contained in the application and the information incorporated by reference address the relevant information related to this section.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER with open items issued for the North Anna application were equally applicable to the Fermi COL application, the staff undertook the following reviews:

- The staff compared the North Anna 3 COL FSAR, Revision 1, to the Fermi COL FSAR. In performing this comparison, the staff considered changes made to the Fermi COL FSAR (and other parts of the COL application, as applicable)

[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.

resulting from RAIs and open and confirmatory items identified in the North Anna SER with open items.

- The staff confirmed that the applicant endorsed all responses to RAIs identified in the corresponding standard content (the North Anna SER) evaluation.

- The staff verified that the site-specific differences were not relevant to this section.

The staff has completed its review and found the evaluation performed for the North Anna standard content to be directly applicable to the Fermi COL application. This standard content material is identified in this SER by use of italicized, double indented formatting.

The staff reviewed the information in the Fermi 3 COL FSAR, Revision 4, as follows:

Supplemental Information

- STD SUP 3.13-1 Threaded Fasteners – ASME Code Class 1, 2, and 3

The NRC staff reviewed the information provided by the applicant related to threaded fasteners included under Section 3.13 of the Fermi 3 COL FSAR, which states the following:

Criteria applied to the selection of materials, design, inspection and testing of threaded fasteners (i.e., threaded bolts, studs, etc.) are presented in DCD Section 3.9.3.9, with supporting information in DCD Sections 4.5.1, 5.2.3, and 6.1.1.

The following portion of this technical evaluation section is reproduced from Subsection 3.13.4, "Technical Evaluation", of North Anna Unit 3 SER (ML092010530):

NRC staff reviewed STD SUP 3.13-1 related to the criteria for the selection of materials, design, inspection, and testing of threaded fasteners included under Section 3.13 of the North Anna 3 COL FSAR. STD SUP 3.13-1 points to ESBWR DCD Tier 2, Sections 4.5.1, 5.2.3, and 6.1.1. Those sections provide additional and specific requirements concerning threaded fasteners used in reactor internals, the reactor coolant system, and other engineered safety features. The staff found that STD SUP 3.13-1 appropriately points out the DCD sections that identify the specific use of threaded fasteners in reactor internals, the reactor coolant system, and other engineered safety features.

The staff reviewed the conformance of Section 3.13 of the North Anna 3 COL FSAR to the guidance of RG 1.206, Section C.III.1, Chapter 3, C.I.3.13, "Threaded Fasteners." The staff's review of Section 3.13 of the North Anna 3 COL FSAR found that the applicant has appropriately incorporated by reference Section 3.9.3.9 of ESBWR DCD, Revision 5.

3.13.5 Post Combined License Activities

There are no post COL activities related to this section.

3.13.6 Conclusion

NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the relevant information relating to threaded fasteners for ASME Code Class 1, 2, and 3; and no outstanding information is expected to be addressed in the COL FSAR related to this section.

In addition, the staff concluded that the information pertaining to Fermi 3 COL FSAR, Section 3.13 is within the scope of the design certification and adequately incorporates by reference Section 3.9.3.9 of the ESBWR DCD, which addresses SRP Section 3.13, "Threaded Fasteners – ASME Code Class 1, 2, and 3." The information is thus acceptable and meets the NRC regulations.