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No figures were included in this chapter.

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No tables were included in this chapter.

7 INSTRUMENTATION AND CONTROLS

This chapter provides information on the systems and components which sense various reactor parameters and transmit signals to the control systems during normal operations and to the reactor trip and engineered safety features systems during abnormal and accident conditions.

7.1 Instrumentation and Controls - Introduction

7.1.1 Introduction

The instrumentation and control (I&C) systems for Calvert Cliffs Unit 3 are discussed in Section 7.1 of the U.S. EPR Final Safety Analysis Report (FSAR). Specifically, the U.S. EPR FSAR Tier 2, Section 7.1, provides an overview of the I&C systems that provide control of plant processes to protect against unsafe and improper reactor operations during steady-state and transient power operations. The U.S. EPR I&C systems also provide the initiating signals to mitigate the consequences of accident conditions. U.S. EPR FSAR Tier 2, Section 7.1, addresses the requirements and criteria that the I&C systems meet.

7.1.2 Summary of Application

In the Calvert Cliffs Unit 3 combined license (COL) FSAR Section 7.1, "Introduction," the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.1, without departures. COL FSAR Section 7.1 does not contain any COL information items or supplementary information related to the U.S. EPR FSAR Tier 2, Section 7.1.

7.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.1 design certification application.

7.1.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.1, to the guidance in Standard Review Plan (SRP) Section 7.1 and Regulatory Guide (RG) 1.206, Section C.III.1, Chapter 7, Section C.I.7.1, "Instrumentation and Controls." The staff concludes that the COL applicant appropriately incorporates by reference, U.S. EPR FSAR Tier 2, Section 7.1. U.S. EPR FSAR Tier 2, Section 7.1, is being reviewed by the staff under Docket No. 52-020. The staff notes that the Safety Evaluation Report (SER) on the U.S. EPR is not yet complete. The staff issued RAI 222, Question 01-5 to track the ongoing review of the U.S. EPR design certification application. **RAI 222, Question 01-5 is being tracked as an open item.** The staff will update Section 7.1 of this report to reflect the final disposition of the design certification application

7.1.5 Post Combined License Activities

No post combined license activities were identified during the staff's review.

7.1.6 Conclusion

As a result of Open Item RAI 222, Question 01-5, the staff was unable to finalize the conclusions relating to compliance with 10 CFR 50.55a, in accordance with the NRC requirements.

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.2 Reactor Trip System

7.2.1 Introduction

This section describes the instrument channels, trip actuators and trip logic circuitry that initiate rapid insertion of control rods to shut down the reactor.

7.2.2 Summary of Application

In COL FSAR Section 7.2, "Reactor Trip System," the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.2, without departures. COL FSAR Section 7.2 does not contain any COL information items or supplementary information related to U.S. EPR FSAR Tier 2, Section 7.2.

7.2.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.2, design certification application.

7.2.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.2, to the guidance in SRP Section 7.2 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.2, "Reactor Trip System." The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.2. U.S. EPR FSAR Tier 2, Section 7.2, is being reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.2 of this report to reflect the final disposition of the design certification application.

7.2.5 Post Combined License Activities

No post combined license activities were identified during the staff's review.

7.2.6 Conclusion

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.3 Engineered Safety Features Systems

7.3.1 Introduction

This section describes Engineered Safety Features (ESF) I&C and supporting systems used to sense accident situations and initiate ESF responses.

7.3.2 Summary of Application

In COL FSAR Section 7.3, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.3, without departures. COL FSAR Section 7.3 does not contain any COL information items or supplementary information related to the U.S. EPR FSAR Tier 2, Section 7.3.

7.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.3, design certification application.

7.3.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.3, to the guidance in SRP Section 7.3 and RG 1.206 Section C.III.1, Chapter 7, C.I.7.3, "Engineered Safety Features Systems." The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.3. U.S. EPR FSAR Tier 2, Section 7.3, is being reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.3 of this report to reflect the final disposition of the design certification application.

7.3.5 Post-Combined License Activities

No post-combined license activities were identified during the staff's review.

7.3.6 Conclusion

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL

information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.4 Systems Required for Safe Shutdown

7.4.1 Introduction

This section describes aspects of I&C and supporting systems designed to achieve and maintain a safe and orderly reactor shutdown.

7.4.2 Summary of Application

In COL FSAR Section 7.4, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.4, without departures. COL FSAR Section 7.4 does not contain any COL information items or supplementary information related to the U.S. EPR FSAR Tier 2, Section 7.4.

7.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.4, design certification application.

7.4.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.4, to the guidance in SRP Section 7.4 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.4, "Systems Required for Safe Shutdown." The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.4. U.S. EPR FSAR Tier 2. Section 7.4 is being reviewed by the staff under Docket No. 52-020. The staff notes that the Safety Evaluation Report (SER) on the U.S. EPR is not yet complete. The staff will update Section 7.4 of this report to reflect the final disposition of the design certification application.

7.4.5 Post Combined License Activities

No post combined license activities were identified during the staff's review.

7.4.6 Conclusion

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.5 Information Systems Important to Safety

7.5.1 Introduction

This section describes safety-related display systems that provide information for the safe operation of the plant during normal operation, anticipated operational occurrences, and accidents.

7.5.2 Summary of Application

In COL FSAR Section 7.5, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.5, with supplemental information. Supplemental Information was provided in COL FSAR Sections 7.5, and 7.5.2.2.1.

7.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.5, design certification application.

7.5.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.5, to the guidance in SRP Section 7.5 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.5, "Information Systems Important to Safety." The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.5. U.S. EPR FSAR Tier 2, Section 7.5, is being reviewed by the staff under docket number 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.5.4 of this report to reflect the final disposition of the design certification application.

In addition, in COL FSAR Section 7.5, "Information Systems Important to Safety," and COL FSAR, Section 7.5.2.2.1, "Conformance with Regulatory Guide 1.97 and [Branch Technical Position] BTP 7-10," the COL applicant provided the following information.

Supplemental Information

While no applicable supplemental information was identified in COL FSAR Chapter 7, the staff noted that COL FSAR ITAAC contained instrumentation and control design information, for which no information or details were provided in any section of COL FSAR Chapter 7. The staff identified site-specific systems, such as the ultimate heat sink (UHS), makeup water system and the UHS makeup water intake structure ventilation system, for which the staff was not able to identify the safety-related I&C systems controlling these site-specific systems. For example, these systems may be controlled by the safety automation system (SAS), as described in the U.S. EPR FSAR, or they may be controlled by stand-alone I&C systems. If they are controlled by stand-alone I&C systems, the COL FSAR should address how those stand-alone I&C systems meet applicable I&C requirements. Additionally, the staff was not able to identify the automatic and manual functions associated with these site-specific systems. Therefore, in Request for Additional Information (RAI) 325, Question 07.05-01, the staff requested that the COL applicant address the identified I&C issues. **RAI 325, Question 07.05-1 is being tracked as an open item.**

The following supplemental information was provided in COL FSAR Sections 7.5 and 7.5.2.2.1.

COL FSAR Section 7.5, “Information Systems Important to Safety,” provides the following supplemental information:

> Calvert Cliffs Unit 3 COL FSAR Section 7.5 states that the U.S.EPR is incorporated by reference with the following supplements:
>
> {Table 7.5-1 of the U.S. EPR FSAR is supplemented with the following CCNPP Unit 3 site-specific Post-Accident Monitoring Variables.}

COL FSAR Table 7.5-1 identifies the following as site-specific post accident monitoring (PAM) variables:

- ESWS Cooling Tower Basin Level
- Meteorological Monitoring System Wind Speed - 10 meters (32.8 feet)
- Meteorological Monitoring System Wind Speed - 60 meters (196.8 feet)
- Meteorological Monitoring System Wind Direction - 10 meters (32.8 feet)
- Meteorological Monitoring System Wind Direction - 60 meters (196.8 feet)
- Meteorological Monitoring System Vertical Temperature Difference - between 10 and 60 meters

COL FSAR Section 7.5.2.2.1, “Conformance with RG 1.97 and BTP 7-10,” provides the following supplemental information:

> The U.S. EPR FSAR includes the following COL Item in Section 7.5.2.2.1:
>
> > A COL applicant that references the U.S. EPR design certification will update the initial inventory list of accident monitoring variables in Table 7.5-1— initial inventory of Post-Accident Monitoring Variables, with a final list upon completion of the emergency operating and abnormal operating procedures prior to fuel loading.
>
> This COL Item is addressed as follows:
>
> > {Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC} shall update the initial inventory list of accident monitoring variables in Table 7.5-1, with a final list upon completion of the emergency operating and abnormal operating procedures prior to fuel loading.

The staff reviewed conformance of COL FSAR Section 7.5, to the guidance in SRP Section 7.5 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.5, “Information Systems Important to Safety.” The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.5. However, the staff issued an RAI to the U.S. EPR project (52-020) pertaining to U.S. EPR FSAR, Section 7.5, that questioned the necessity for the above COL Item. The staff finds the post-accident monitoring instrumentation in U.S. EPR FSAR Tier 2, Section 7.5, needs to be a complete list with the exception of site-specific instrumentation. Therefore, there does not appear to be a need to update the post-accident monitoring

instrumentation list. U.S. EPR FSAR Tier 2, Section 7.5, is being reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.5 of this report to reflect the final disposition of the design certification application. Regarding COL FSAR, the staff issued the applicant RAI 325, Question **07.05-2**, to track the coordination of applicable changes in the U.S. EPR FSAR regarding post-accident monitoring. **RAI 325, Question 07.05-2 is being tracked as an open item**.

7.5.5 Post Combined License Activities

The COL FSAR indicates that the accident monitoring variables will be confirmed prior to fuel loading, per the COL Item identified in U.S. EPR FSAR Tier 2, Section 7.5.2.2.1. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.5.5 of this report to reflect the final disposition of the design certification application.

7.5.6 Conclusion

As a result of Open Item RAI 325, Questions 07.05-1 and 07.05-2, the staff was unable to finalize the conclusions relating to compliance with 10 CFR 50.55a, in accordance with the NRC requirements.

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.6 Interlock Systems Important for Safety

7.6.1 Introduction

This section describes systems that operate to reduce the probability of occurrence of specific events or to maintain systems in a state that assures their availability in an accident.

7.6.2 Summary of Application

In COL FSAR Section 7.6, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.6, without departures. COL FSAR Section 7.6 does not contain any COL information items or supplementary information related to the U.S. EPR FSAR Tier 2, Section 7.6.

7.6.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.6 of the U.S. EPR FSAR design certification application.

7.6.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.6 to the guidance in SRP Section 7.6 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.6, "Interlock Systems Important to Safety." The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.6. U.S. EPR FSAR Tier 2, Section 7.6, was reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.6.4 of this report to reflect the final disposition of the design certification application

7.6.5 Post Combined License Activities

No post combined license activities were identified during the staff's review.

7.6.6 Conclusion

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.7 Control Systems Not Required for Safety

7.7.1 Introduction

This section describes control systems used to establish and maintain the plant operating conditions within prescribed limits, minimizes the number of situations for which some protective response is initiated, and relieves the operator from routine tasks.

7.7.2 Summary of Application

In COL FSAR Section 7.7, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.7, without departures. COL FSAR Section 7.7 does not contain any COL information items or supplementary information related to the U.S. EPR FSAR Tier 2, Section 7.7.

7.7.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.7, design certification application.

7.7.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.7, to the guidance in SRP Section 7.7 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.7, "Control Systems Not Required for Safety." While the staff finds that the applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.7, For the Calvert Cliffs COL application, the staff issued RAI 326, Question

07.07-1 pertaining to COL FSAR Section 7.7. The staff was not able to identify where the applicant addressed the COL item related to primary power calorimetric uncertainty. In its review of U.S. EPR design certification, the staff indentified the following information, as stated in U.S. EPR FSAR Tier 2, Section 7.7.2.3.5, Interim Revision 3 mark-ups, which was provided supplemental design change information in an AREVA May 25, 2011, response to U.S. EPR RAI 442, Question 07.01-28.

> A COL applicant that references the U.S. EPR design certification will, following selection of the actual plant operating instrumentation and calculation of the instrumentation uncertainties of the operating plant parameters, prior to fuel load, calculate the primary power calorimetric uncertainty. The calculations will be completed using an NRC acceptable method and confirm that the safety analysis primary power calorimetric uncertainty bounds the calculated values.

In RAI 326, Question 07.07-1, the staff requested that the COL applicant provide design information that addresses the above COL Information Item. If the COL Information Item is addressed in another part of the COL FSAR, information should be provided in COL FSAR Section 7.7 that acknowledges the COL Information Item and points to the applicable location where the design information is provided. **RAI 326, Question 07.07-1, is being tracked as an open item** for the Calvert Cliffs COL application**.**

U.S. EPR FSAR Tier 2, Section 7.7, was reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.7.4 of this report to reflect the final disposition of the design certification application.

7.7.5 Post Combined License Activities

No post combined license activities were identified during the staff's review of COL FSAR Section 7.7.

7.7.6 Conclusion

As a result of Open Item RAI 326, Question 07.07-1, the staff was unable to finalize the conclusions relating to compliance with 10 CFR 50.55a, in accordance with the NRC requirements.

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.8 Diverse Instrumentation and Control Systems

7.8.1 Introduction

This section describes systems and equipment provided for the express purpose of protecting against potential common-cause failures of protection systems. These systems include ATWS

mitigation systems, diverse manual controls and displays, and diverse actuation systems provided for meeting the NRC position of diversity and defense-in-depth.

7.8.2 Summary of Application

In COL FSAR Section 7.8, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.8, without departures. COL FSAR Section 7.8 does not contain any COL information items or supplementary information related to the U.S. EPR FSAR Tier 2, Section 7.8.

7.8.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.8, design certification application.

7.8.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.8, to the guidance in SRP Section 7.8 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.8, "Diverse Instrumentation and Control Systems." The staff concludes that the applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.8. U.S. EPR FSAR Tier 2, Section 7.8, is being reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.8.4 of this report to reflect the final disposition of the design certification application.

7.8.5 Post Combined License Activities

No post combined license activities were identified during the staff's review.

7.8.6 Conclusion

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.

7.9 Data Communications Systems

7.9.1 Introduction

This section describes systems and components that transmit, receive, or connect multiple signals over electrical conductors or optical fiber medium on a fixed schedule or rotations (internal computer buses are excluded) in support of the functions of the I&C systems covered in U.S. EPR FSAR Tier 2, Sections 7.2 through 7.8.

7.9.2 Summary of Application

In COL FSAR Section 7.9, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 7.9, without departures. COL FSAR Section 7.9 does not contain any COL information items or supplementary information related to U.S. EPR FSAR Tier 2, Section 7.9.

7.9.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the related U.S. EPR FSAR Tier 2, Section 7.1, design certification application.

7.9.4 Technical Evaluation

The staff reviewed conformance of COL FSAR Section 7.9, to the guidance in SRP Section 7.9 and RG 1.206, Section C.III.1, Chapter 7, C.I.7.9, "Data Communication Systems." The staff concludes that the COL applicant appropriately incorporates by reference U.S. EPR FSAR Tier 2, Section 7.9. U.S. EPR FSAR Tier 2, Section 7.9, was reviewed by the staff under Docket No. 52-020. The staff notes that the SER on the U.S. EPR is not yet complete. The staff will update Section 7.9.4 of this report to reflect the final disposition of the design certification application.

7.9.5 Post Combined License Activities

No post combined license activities were identified during the staff's review.

7.9.6 Conclusion

The staff reviewed the COL application and checked the referenced sections of the U.S. EPR FSAR to ensure that all COL information items, interface items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The staff is reviewing the COL information incorporated by reference from the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the COL information incorporated by reference from the U.S. EPR will be documented in the staff's evaluation of the U.S. EPR design certification application. The staff will update this report to reflect the final disposition of the U.S. EPR design certification application.