FINAL SAFETY ANALYSIS REPORT

CHAPTER 6

ENGINEERED SAFETY FEATURES

6.0 ENGINEERED SAFETY FEATURES

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements as identified in the following sections.

6.1 ENGINEERED SAFETY FEATURES MATERIALS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

6.1.1 Metallic Materials

No departures or supplements.

6.1.1.1 Materials Selection and Fabrication

The U. S. EPR FSAR includes the following COL Item in Section 6.1.1.1:

> A COL applicant that references the U. S. EPR design certification will review the fabrication and welding procedures and other QA methods of ESF component vendors to verify conformance with RGs 1.44 and 1.31.

This COL Item is addressed as follows:

{Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC} will select vendors in accordance with requirements in the Quality Assurance Program Description (QAPD) referenced in FSAR Section 17.5.

The QAPD describes Control of Purchased Material, Equipment and Services. The QAPD establishes measures to provide control of special processes. Special processes that control or verify quality, such as those used in welding, heat treating, and nondestructive examination, must be performed by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements. Ensuring the vendor processes conform to Regulatory Guides 1.31 and 1.44 (NRC, 1978 and NRC, 1973) will be accomplished by this license condition:

{Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC} will include, or require its contractors to include, a review of special processes such as fabrication and welding procedures and other QA methods to verify conformance with Regulatory Guides 1.31 and 1.44 for ESF components as part of the procurement process. The procurement process will be established prior to purchasing ESF components.

This will ensure that conformance with RG 1.31 and 1.44 will be established within the appropriate vendor processes prior to initiation of any fabrication activity that would be subject to NRC construction inspection program.

6.1.1.2 ESF Fluids

No departures or supplements.

6.1.1.3 Component and Systems Cleaning

No departures or supplements.

6.1.1.4 Thermal Insulation

No departures or supplements.

6.1.2 Organic Materials

No departures or supplements.

6.1.2.1 Description of Protective Coatings

No departures or supplements.

6.1.2.2 Safety Evaluation

No departures or supplements.

6.1.2.3 Quality Assurance

No departures or supplements.

6.1.2.3.1 Special Processes

No departures or supplements.

6.1.2.3.2 Service Level I Coatings

The U. S. EPR FSAR includes the following COL Item in Section 6.1.2.3.2:

> If components cannot be procured with DBA-qualified coatings applied by the component manufacturer, a COL applicant that references the U. S. EPR design certification must do one of the following:
>
> - Procure the component as uncoated and apply a DBA-qualified coating system in accordance with 10 CFR 50, Appendix B, Criterion IX.
> - Confirm that the DBA-unqualified coating is removed and that the component is recoated with DBA-qualified coatings in accordance with 10 CFR 50, Appendix B, Criterion IX.
> - Add the quantity of DBA-unqualified coatings to a list that documents those DBA-unqualified coatings already existing within containment.

This COL Item is addressed as follows:

If components cannot be procured with DBA-qualified coatings applied by the component manufacturer, {Calvert Cliffs 3 Nuclear Project, LLC, and UniStar Nuclear Operating Services, LLC} shall do one of the following:

- Procure the component as uncoated and apply a DBA-qualified coating system in accordance with 10 CFR 50, Appendix B, Criterion IX. The DBA-qualified (i.e., Service Level 1) coating will be applied in accordance with the applicable standards stated in Regulatory Guide 1.54, Rev. 1 (NRC, 2000), except as modified by U.S. EPR FSAR Section 6.1.2.4.
- Confirm that the DBA-unqualified coating is removed and that the component is recoated with DBA-qualified coatings in accordance with 10 CFR 50, Appendix B, Criterion IX. The DBA-qualified (i.e., Service Level 1) coating will be applied in accordance with the applicable standards stated in Regulatory Guide 1.54, Rev. 1 (NRC, 2000), except as modified by U.S. EPR FSAR Section 6.1.2.4.
- Add the quantity of DBA-unqualified coatings to a list that documents those DBA-unqualified coatings already existing within containment.

The protective coatings program will be implemented prior to the application of coatings on plant surfaces or equipment or the procurement of components and equipment with vendor

applied coatings. The protective coatings program is implemented within plant administrative procedures. The administrative procedures are described in Section 13.5.1.

6.1.2.3.3 Service Level II Coatings

No departures or supplements.

6.1.2.3.4 Service Level III Coatings

No departures or supplements.

6.1.2.3.5 Protective Coating and Organic Materials Program

No departures or supplements.

6.1.2.4 Exceptions to Regulatory Guide 1.54, Revision 1

No departures or supplements.

6.1.3 References

{**NRC, 1978.** Control of Ferrite Content in Stainless Steel Weld Metal, Regulatory Guide 1.31, Revision 3, U.S. Nuclear Regulatory Commission, April 1978.

NRC, 2000. Service Level I, II, and III Protective Coatings Applied To Nuclear Power Plants, Regulatory Guide 1.54, Revision 1, U.S. Nuclear Regulatory Commission, July 2000.

NRC, 1973. Control of the Use of Sensitized Stainless Steel, Regulatory Guide 1.44, U.S. Nuclear Regulatory Commission, May 1973.}

6.2 CONTAINMENT SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

6.2.1 Containment Functional Design

No departures or supplements.

6.2.2 Containment Heat Removal Systems

No departures or supplements.

6.2.3 Secondary Containment Functional Design

No departures or supplements.

6.2.4 Containment Isolation System

No departures or supplements.

6.2.5 Combustible Gas Control in Containment

No departures or supplements.

6.2.6 Containment Leakage Testing

The U.S. EPR FSAR includes the following COL Item in Section 6.2.6:

> A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the CLRT program described under 10 CFR 50, Appendix J.

This COL Item is addressed as follows:

Table 13.4-1 provides milestones for containment leak rate testing implementation in accordance with 10 CFR 50, Appendix J (CFR, 2008).

6.2.7 Fracture Prevention of Containment Pressure Vessel

No departures or supplements.

6.2.8 References

{**CFR, 2008.** Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, Title10, Code of Federal Regulations, Part 50, Appendix J, U.S. Nuclear Regulatory Commission, 2008.}

6.3 EMERGENCY CORE COOLING SYSTEM

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

6.3.1 Design Bases

No departures or supplements.

6.3.2 System Design

6.3.2.1 Schematic Piping and Instrumentation Diagrams

No departures or supplements.

6.3.2.2 Equipment and Component Descriptions

6.3.2.2.1 System Overview

No departures or supplements.

6.3.2.2.2 System Components

The U.S. EPR FSAR contains the following COL Item in Section 6.3.2.2.2:

> A COL applicant that references the U.S. EPR design certification will describe the containment cleanliness program which limits debris within containment.

This COL Item is addressed as follows:

The containment cleanliness program is consistent with the guidance provided in NEI 04-07 (NEI, 2004), as endorsed and modified by Regulatory Guide 1.39, Rev. 2 (NRC, 1977), Regulatory Guide 1.82, Rev. 3 (NRC, 2003), Regulatory Guide 1.206, June 2007 (NRC, 2007a), and NUREG-0800, March 2007 (NRC, 2007b). The principal functions of the program are described below.

Latent debris is controlled by limiting the number of potential debris sources prior to reactor containment closeout before plant operation. This effort includes control of intended debris sources and unintended debris sources. General surveys consisting of visual examination of containment shall be performed every refueling outage. Surveys with detailed calculations of latent debris shall be performed every other outage. Additional surveys shall be conducted after invasive or extended maintenance activities.

The containment cleanliness program is performed in conjunction with containment close-out procedures. The outage and planning supervisor is responsible for implementing the containment cleanliness program.

Visual inspection of containment for loose debris is performed to reduce intended and unintended debris sources. Visual inspection includes all levels of the containment; including the trash racks, the weirs, and the retaining baskets located below each heavy floor opening. The inspection shall include the Safety Injection System (SIS) and the Severe Accident Heat Removal System (SAHRS) strainers located above each respective sump. The containment cleanliness program shall be implemented through procedures to limit intended and unintended latent debris inside containment.

Examples of intended debris include equipment tags that are not permanent, stickers or placards (adhered with adhesive), and tape. The use of non-permanent tags and stickers shall

be controlled by procedure in order to identify potential loading from these sources. The use of tape shall also be monitored and removed once its use has been met. Tape that remains in-place shall be identified as another debris loading source. Storage of outage materials such as temporary scaffolding and tools inside containment during power operation shall be monitored. Loose insulation on piping and equipment inside containment shall be considered as a transport potential. Debris transport is considered in identifying the amount of debris from these sources that reaches the sump.

Unintended debris sources include dust and other particulates that result from in-containment maintenance activities or deterioration of in-containment materials. These sources shall be inspected and an estimate of loading developed based on the inspection results. Statistical sample mass collection is the method used for quantifying latent debris inventories. This method of statistical sample mass collection will be established following guidance provided in NEI 04-07, Volume 2 (NEI, 2004). Sampling results will be evaluated after work in containment is finished and in conjunction with plant walkdowns. This inspection and characterization includes vertical surfaces as well as horizontal surfaces. Inaccessible and accessible areas are considered. Based on inspections, any failures of qualified coatings or degraded conditions will be evaluated following guidance specified in NRC RIS 2005-20, Revision 1 (NRC, 2008). If degraded conditions call for replacement or removal, abatement procedures will be established to avoid generating latent debris in the containment.

The major debris source will be from those SSCs in the zone of influence.

6.3.2.3 Applicable Codes and Classifications

No departures or supplements.

6.3.2.4 Material Specifications and Compatibility

No departures or supplements.

6.3.2.5 System Reliability

No departures or supplements.

6.3.2.6 Protection Provisions

No departures or supplements.

6.3.2.7 Provisions for Performance Testing and Inspection

No departures or supplements.

6.3.2.8 Manual Actions

No departures or supplements.

6.3.3 Performance Evaluation

No departures or supplements.

6.3.4 Tests and Inspections

No departures or supplements.

6.3.5 Instrumentation Requirements

No departures or supplements.

6.3.6 References

{NEI, 2004. Pressurized Water Reactor Sump Performance Evaluation Methodology, NEI 04-07, Nuclear Energy Institute, December 2004.

NRC, 1977. Housekeeping Requirements for Water-Cooled Nuclear Power Plants, Regulatory Guide 1.39, Rev. 2, U.S. Nuclear Regulatory Commission, September, 1977.

NRC, 2003. Water Sources for Long Term Recirculation Cooling Following a Loss-of-Coolant Accident, Regulatory Guide 1.82, Rev. 3, U.S. Nuclear Regulatory Commission, November, 2003.

NRC, 2007a. Combined License Applications for Nuclear Power Plants, Regulatory Guide 1.206, U.S. Nuclear Regulatory Commission, June 2007.

NRC, 2007b. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, NUREG-0800, U.S. Nuclear Regulatory Commission, March, 2007.

NRC, 2008. Revision to NRC Inspection Manual Part 9900 Technical Guidance, "Operability Determinations & Functionality Assessments for Resolution of Degraded or Nonconforming Conditions Adverse to Quality or Safety," RIS 2005-20, Revision 1, U.S. Nuclear Regulatory Commission, April, 2008.}

6.4 HABITABILITY SYSTEMS

{This section of the U.S. EPR FSAR is incorporated by reference with the following supplements and departures.

For CCNPP Unit 3, the detection of toxic gases and subsequent isolation of the Control Room Envelope (CRE) is not required and is not a part of the site-specific design. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceeded the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.1 Design Basis

{This section of the U.S. EPR FSAR is incorporated by reference with the following departures:

For CCNPP Unit 3, protection from hazardous chemical releases within the CRE is not required and is not part of the design basis. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceed the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.2 System Design

6.4.2.1 Definition of Control Room Envelope

{This section of the U.S. EPR FSAR is incorporated by reference with the following departures:

For CCNPP Unit 3, protection from toxic gases within the CRE is not required and not part of the site-specific system design. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceed the limits established in Regulatory Guide 1.78 (NRC, 2001). As a result, no specific provisions are required to protect the operators from an event involving a release of a toxic gas.}

6.4.2.2 Ventilation System Design

{This section of the U.S. EPR FSAR is incorporated by reference with the following departures:

For CCNPP Unit 3, detection of toxic gases and subsequent isolation of the CRE is not required and is not part of the site-specific system design. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceed the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.2.3 Leaktightness

{No departures or supplements.}

6.4.2.4 Interaction with Other Zones and Pressure-Containing Equipment

{This section of the U.S. EPR FSAR is incorporated by reference with the following departures:

For CCNPP Unit 3, detection of toxic gases and subsequent isolation of the CRE is not required and is not part of the site-specific system design. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceed the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.2.5 Shielding Design

{No departures or supplements.}

6.4.3 System Operational Procedures

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements {and departures}.

The U.S. EPR FSAR includes the following COL Item in Section 6.4.3:

> A COL applicant that references the U.S. EPR design certification will provide written emergency planning and procedures in the event of a radiological or hazardous chemical release within or near the plant, and will provide training of control room personnel.

This COL Item is addressed as follows:

{Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC} shall provide written emergency planning and procedures for use in the event of a radiological or hazardous chemical release within or near the plant, and will provide training of control room personnel, prior to receipt of fuel onsite at {CCNPP Unit 3} .

{For CCNPP Unit 3, detection of toxic gases and subsequent isolation of the CRE is not required and is not part of the site-specific system operation. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceed the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving the release of a toxic gas As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.4 Design Evaluations

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements {and departures}.

The U.S. EPR FSAR includes the following COL Item in Section 6.4.4:

> A COL applicant that references the U.S. EPR design certification will confirm that the radiation exposure of MCR occupants resulting from a DBA at a nearby unit on a multi-unit site is bounded by the radiation exposure from the postulated design basis accidents analyzed for the U.S. EPR; or confirm that the limits of GDC 19 are met.

This COL Item is addressed as follows:

{The main control room (MCR) dose to CCNPP Units 1 and 2 from a CCNPP Unit 3 LOCA is less than 2.0 rem total effective dose equivalent (TEDE). This dose is below the regulatory dose

acceptance criterion of 5 rem TEDE. The CCNPP Unit 3 MCR dose from a LOCA in CCNPP Unit 1 or 2 will be less than CCNPP Units 1 and 2 dose from a CCNPP Unit 3 LOCA, which also meets the regulatory dose acceptance criterion of 5 rem TEDE.

The CCNPP Unit 3 MCR is equipped with safety-related radiation monitors in the HVAC intake ducts and would isolate in a timely manner. The CCNPP Unit 3 MCR HVAC emergency filtration system design basis accident configuration is described in U.S. EPR FSAR 15.0.3.}

The U.S. EPR FSAR includes the following COL Item in Section 6.4.4:

> A COL applicant that references the U.S. EPR design certification will evaluate the results of the toxic chemical accidents from Section 2.2.3 and address their impact on control room habitability in accordance with RG 1.78.

This COL Item is addressed as follows:

{For CCNPP Unit 3, detection of toxic gases and subsequent isolation of the CRE is not required and is not part of the site-specific design. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceeded the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving the release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.5 Testing and Inspection

{No departures or supplements.}

6.4.6 Instrumentation Requirements

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements {and departures}.

The U.S. EPR FSAR includes the following and COL Item in Section 6.4.6:

> A COL applicant that references the U.S. EPR design certification will identify the type(s) of Seismic Category I Class IE toxic gas sensors (i.e. the toxic chemical(s) of concern) necessary for control room operator protection.

This COL Item is addressed as follows:

{For CCNPP Unit 3, toxic gas sensors are not required and are not part of the site-specific instrumentation design. The evaluation of the CCNPP Unit 3 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceed the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving the release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at CCNPP Unit 3.}

6.4.7 References

{**NRC, 2001**. Evaluating the Habitability of a Nuclear Power Plant Control Room during a Postulated Hazardous Chemical Release, Regulatory Guide 1.78, Revision 1, U.S. Nuclear Regulatory Commission, December 2001.}

6.5 FISSION PRODUCT REMOVAL AND CONTROL SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference.

6.6 INSERVICE INSPECTION OF CLASS 2 AND 3 COMPONENTS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

The U.S. EPR FSAR includes the following COL Item in Section 6.6:

> A COL applicant that references the U.S. EPR design certification will identify the implementation milestones for the site-specific ASME Section XI preservice and inservice inspection program for Class 2 and Class 3 components, consistent with the requirements of 10 CFR 50.55a(g). The program will identify the applicable edition and addenda of the ASME Code Section XI, and will identify additional relief requests and alternatives to Code requirements.

This COL Item is addressed as follows:

The site-specific preservice inspection and inservice inspection programs for Class 2 and Class 3 components meet the requirements of 10 CFR 50.55a(g), and comply with ASME Boiler and Pressure Vessel Code, Section XI, 2004 Edition (ASME, 2004). This code is consistent with that established in U.S. EPR FSAR Section 6.6. No relief requests or alternatives are required. The implementation milestones for the site-specific ASME Section XI preservice and inservice inspection programs for Class 2 and Class 3 components are identified in Table 13.4-1.

The initial inservice inspection program shall incorporate the latest edition and addenda of the ASME Boiler and Pressure Vessel Code approved in 10 CFR 50.55a(b) on the date 12 months before initial fuel load. Inservice examination of components and system pressure tests conducted during successive 120-month inspection intervals must comply with the requirements of the latest edition and addenda of the Code incorporated by reference in 10 CFR 50.55a(b) 12 months before the start of the 120-month inspection interval (or the optional ASME Code cases listed in Regulatory Guide 1.147, that are incorporated by reference in 10 CFR 50.55a(b), subject to the limitations and modifications listed in 10 CFR 50.55a(b)).

Should relief requests be required, they will be developed through the regulatory process and submitted to the NRC for approval in accordance with 10 CFR 50.55a(g)(5). The relief requests shall include appropriate justifications and proposed alternative inspection methods.

6.6.1 Components Subject to Examination

{No departures or supplements.}

6.6.2 Accessibility

No departures or supplements.

6.6.3 Examination Techniques and Procedures

No departures or supplements.

6.6.4 Inspection Intervals

{No departures or supplements.}

6.6.5 Examination Categories and Requirements

No departures or supplements.

6.6.6 Evaluation of Examination Results

No departures or supplements.

6.6.7 System Pressure Tests

No departures or supplements.

6.6.8 Augmented ISI to Protect Against Postulated Piping Failures

{There is no high-energy site-specific piping associated with the UHS Makeup Water System.}

6.6.9 References

{ASME, 2004. ASME Boiler and Pressure Vessel Code, Section XI, 2004 Edition, American Society of Mechanical Engineers, Inc., 2004.}

6.7 MAIN STEAMLINE ISOLATION VALVE LEAKAGE CONTROL SYSTEM (BWRS)

This section of the U.S. EPR FSAR is incorporated by reference.

6.8 EXTRA BORATING SYSTEM

This section of the U.S. EPR FSAR is incorporated by reference.