REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**316-8305**
SRP Section:	**SRP 17.04**
Application Section:	**17.4**
Date of RAI Issue:	**11/17/2015**

Question No. 17.04-1

SRP Chapter 17.4, Revision 1, Section II, "Acceptance Criteria" states, "… an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations." The staff reviewed APR1400 DCD Section 17.4, "Reliability Assurance Program," and found that the DCD Table 1.9-2 referenced SRP Chapter 17.4, Revision 1, but the information seems to follow the guidance provided in SRP Chapter 17.4, Revision 0. For example, APR1400 DCD Section 17.4 discusses a) essential elements of RAP instead of programmatic controls and processes for RAP in the operations phase, and b) development/integration of operational RAP (O-RAP), which is not included in the SRP guidance. Therefore, in order for the staff to reach an assurance finding on the conformance to SRP Chapter 17.4 regarding program adequacy, please provide details of a RAP program that follows the guidance in SRP Chapter 17.4, Revision 1 or an alternative to the SRP acceptance criteria, and revise the APR1400 DCD Section 17.4 accordingly.

Response – (Rev.1)

A revision to DCD Section 17.4 was provided to the NRC. Subsequently, the NRC staff provided several additional questions and comments on the revision in a conference call on 9/27/2016. The questions and comments from the conference call are addressed in the revised Section 17.4, as shown in Attachment 1.

Impact on DCD

DCD Section 17.4 will be revised.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on Technical/Topical/Environmental Reports.

 RAI 316-8305 - Question 17.04-1_Rev.1

17.2 Quality Assurance during the Operations Phase

establishes and implements

The COL applicant ~~is to establish and implement~~ a QA program that is applicable to site-specific design activities during the plant construction and operation phases.

17.4 Reliability Assurance Program

This section presents the design reliability assurance program (RAP) for the APR1400.

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17.4.1 Introduction

The RAP is implemented according to the Commission's direction provided in the Staff Requirements Memorandum (SRM) dated June 28, 1995, for Item E, the Reliability Assurance Program (RAP), of SECY-95-132, "A Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs" (Reference 1). The RAP applies to the systems, structures, and components (SSCs), both safety-related and non-safety-related that are identified as risk-significant (or significant contributors to plant safety). The SSCs within the scope of the RAP (referred to in this section as within-scope SSCs) are identified by using a combination of probabilistic, deterministic, or other methods of analysis, including information obtained from sources such as the probabilistic risk assessment (PRA), severe accident evaluations, industry operating experience, and expert panels.

The purposes of the RAP are to provide reasonable assurance of the following:

a. The reactor is designed, constructed, and operated consistent with the key assumptions and risk insights for the within-scope SSCs.

b. The within-scope SSCs do not degrade to an unacceptable level of reliability, availability, or condition during plant operations.

c. The frequency of transients that challenge these SSCs is minimized.

d. SSC function is reliable when challenged.

The purposes of the RAP can be achieved by implementing the program in two stages. Stage 1 applies to reliability assurance activities that occur before the initial fuel load. Stage 1 is referred to as the design reliability assurance program (design RAP). Stage 2 applies to the reliability assurance activities in the operations phase of the plant's life cycle. Only Stage 1 is described in this section. Stage 2 is not within the scope of the design certification and is to be addressed during the COL application stage.

 RAI 316-8305 - Question 17.04-1

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The objective of Stage 1 (design RAP) is to provide reasonable assurance that the reactor is designed and constructed consistent with the key assumptions (including reliability and availability assumptions in the PRA, when applicable) and risk insights for the within-scope SSCs. This objective can be achieved through the following:

a. Applying the essential elements of the design RAP (i.e., organization, design control, procedures and instructions, records, corrective actions, and audit plans) during design and construction activities. The essential elements provide reasonable assurance that the key assumptions and risk insights are consistent with the reactor design and construction and that the list of within-scope SSCs is appropriately developed, maintained, and communicated to the appropriate organizations.

b. Implementing the appropriate quality assurance (QA) controls related to design and construction (e.g., design, procurement, fabrication, construction, inspection, testing activities) to provide control over activities affecting the quality of the within-scope SSCs. QA controls for safety-related SSCs are established through QA requirements in 10 CFR Part 50, Appendix B (Reference 2), "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." The provisions in Part V, "Non-safety-related SSC Quality Controls," of SRP Section 17.5 (Reference 3) address graded QA controls for non-safety-related, within-scope SSCs.

The PRA evaluates the APR1400 design response to a spectrum of initiating events to provide reasonable assurance that plant damage has a low probability of occurring and that risk to the public is minimized. The risk-significant SSCs including both safety-related and non-safety related SSCs for the APR1400 design are identified and made available to the design organization.

The APR1400 RAP process is implemented in three phases. During Phase 1, the design certification phase, system information is collected and a system model is developed. The designer, Korea Hydro & Nuclear Power Co., Ltd. (KHNP), is responsible for Phase 1. The system information and model are used as input to a design phase PRA and review of external events.

RAI 316-8305 - Question 17.04-1

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The goal of Phase 1 is to provide reasonable assurance that the reactor design meets the purposes specified above through the design, procurement, fabrication, construction, and preoperational testing activities and programs. The results of these activities are provided to an expert panel that identifies risk-significant SSCs using deterministic, probabilistic, and other methods.

During Phase 2, the site-specific phase, the RAP process is applied to the plant site-specific information and the site-specific SSCs and APR1400 design SSCs are combined into one list.

During Phase 3, the last phase of the RAP, the procurement, fabrication, construction, and preoperational testing are implemented. The site-specific list of SSCs is provided as input to the RAP during the operations phase, which addresses plant operation and maintenance activities. The objective during this phase is to provide reasonable assurance that the reliability of the SSCs within the scope of the RAP is maintained during plant operations. Phases 2 and 3 are the responsibility of the COL applicant. The COL applicant is to specify the policy and implement procedures to address the plant operation and maintenance activities associated with the risk-significant SSCs identified during Phase 1 of the RAP.

The non-safety-related RAP SSCs are subjected to the appropriate QA controls, which are described in Section 17.5.

17.4.2 Scope

The APR1400 RAP identifies risk-significant SSCs and provides key assumptions and risk insights for aspects of plant operation, maintenance, and performance monitoring to provide reasonable assurance of safe, reliable plant operation or to mitigate plant transients or other events that could present a risk to the public. Risk-significant SSCs are identified using the PRA, deterministic method, or other methods of analysis, including industry experience, and the input of the expert panel.

17.4.3 Quality Controls

a. Organization

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~~KHNP is responsible for Phase 1 of the design RAP, as follows:~~

~~The Project Manager of the APR1400 project is responsible for establishing and implementing the APR1400 RAP. The Project Manager or designated representative is responsible for providing reasonable assurance that all affected organizations are aware of the RAP, and its purposes and requirements.~~

~~The Manager of Plant Safety is responsible for providing reasonable assurance of overall plant safety in the design, including the use of the PRA results and risk insights in the RAP implementation.~~

~~The Manager of QA is responsible for providing reasonable assurance that the QA program is implemented properly, which includes design control, procedures and instructions, records, corrective actions, and audits pertaining to the RAP.~~

~~The Managers of Design Engineering are responsible for implementing the RAP and providing reasonable assurance that the APR1400 design is consistent with the identified risk-significant RAP SSCs and the associated key assumptions and risk insights from the PRA.~~

~~The risk management organization is responsible for requesting the related design engineering sections to review key assumptions in the PRA and to incorporate the comments to provide reasonable assurance that the key assumptions are realistic and achievable. The risk management organization is also responsible for providing the related inputs to the RAP in the design process by participating in the design change process. The risk management organization is also responsible for being involved in the design review.~~

~~b. Design control~~

~~The list of risk-significant SSCs for the RAP and the associated key assumptions and risk insights from the PRA are maintained by the risk management organization. The list and changes are approved by an expert panel, and the panel provides the information to design engineering and QA staff working on the APR1400 project.~~

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The risk management organization provides reasonable assurance that the design engineering organizations are provided with the list of risk-significant RAP SSCs and the associated key assumptions and risk insights from the PRA, which are addressed in Section 19.1. The design engineering organization reviews the list of risk-significant RAP SSCs and associated key assumptions and risk insights from the PRA. The design engineering organization compares this information to the design activities and provides feedback to the risk management organization to achieve reasonable assurance that the risk-significant RAP SSCs and the key assumptions and risk insights from the PRA are reasonably incorporated into the design, construction, and operational activities.

c. Procedures and instructions

The Project Manager of the APR1400 project or designated representative prepares the procedures and instructions used to implement the RAP. The Project Manager of the APR1400 project is responsible for the development, verification, and implementation of the RAP and for providing reasonable assurance that all affected organizations are aware of the RAP.

d. Records

The RAP-related records that are maintained include the following:

1) List of risk-significant SSCs

2) Expert panel meeting minutes/summaries

3) Other QA program records in accordance with the QA Program for the APR1400 (Reference 4)

e. Corrective action

The activities associated with the RAP that are determined to be in error, deficient, or nonconforming are processed through the corrective action program (CAP), which supports the quality assurance procedure.

 RAI 316-8305 - Question 17.04-1

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f. Audit

Audit plans include a consideration of sampling the implementation of the RAP and its procedures to evaluate effectiveness. Audits consider several key aspects of the RAP including the identification of risk-significant RAP SSCs and whether the key assumptions and risk insights from PRA are reasonably incorporated in the design, construction and operational activities.

17.4.4 Integration into Existing Operational Programs

The APR1400 RAP serves as a source for other administrative and operational programs. Certain risk-significant SSCs identified in the RAP may be included in existing operational programs such as Technical Specifications surveillance requirements and provide reasonable assurance that the reliability values assumed in the PRA are maintained throughout the plant life.

During the operations phase, the RAP implements measures that yield continual improvements in the PRA through the plant's existing programs for maintenance or QA. Implementation of the Maintenance Rule requirements in 10 CFR 50.65 (Reference 5) is an example of how the plant could address the enhanced treatment of certain SSCs in the RAP during the operations phase. Per SECY 95-132, the COL applicant is to meet the objectives of the RAP during the operations phase using existing programs such as the Maintenance Rule, inservice testing, and QA. The COL applicant is to address non-safety risk-significant SSCs in the RAP.

17.4.5 Operating Experience

Consideration and use of operating experience is vital to the objective of the RAP. Operating experience is considered along with various PRA analytical and importance measures when developing a comprehensive risk analysis. The expert panel considers SSC operating history and industry operating experience when assessing SSC risk significance. For example, operating experience indicates that the reliability of motor-driven and turbine-driven pumps may be different.

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A review of operating experience may reveal conditions in which previous failures of SSCs in similar design applications have led to functional failures of SSCs. The review of operating experience is not limited to hardware failure but also extends to situations in which human performance led to functional failures of SSCs with a similar system design. For example, the APR1400 design improved SSC reliability by eliminating required operator actions to switch from injection to recirculation, which is typical in conventional PWRs.

17.4.6 Design RAP

As described in Subsection 17.4.1, Phase 1 of the design RAP includes the initial identification of SSCs to be included in the program, implementation of the aspects applicable to design efforts, and the definition of the scope, requirements, and implementation options to be included in the later phases.

17.4.6.1 SSC Identification

During the APR1400 design phase, risk-significant SSCs are identified for inclusion in the design RAP. A list of risk-significant SSCs is developed and controlled as design input for consideration during the design phase. The list of risk-significant SSCs is initially based on the results of the PRA and the expert panel. For further information on the PRA, refer to Section 19.1. In addition to PRA input, information from U.S. industry operating experience is considered in the identification of risk-significant SSCs. The list of risk-significant SSCs identified during the design phase is updated when the plant-specific PRA is developed.

a. Risk-significant SSC identification

1) Importance analysis based on the PRA results

The PRA is used to identify risk-significant SSCs based on risk achievement worth (RAW) and Fussell-Vesely (FV) importance. Risk-significant SSCs are identified using importance criteria of FV importance greater than 0.005 and a RAW greater than 2. In the APR1400 RAP, these criteria have been applied to both single-failure basic events and common cause failure (CCF)

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basic events. A RAW value of 20 was conservatively selected to reflect the fact that the common cause RAW measures the failure of two or more trains, including the higher likelihood of failure of the second train from common causes, as described in NEI 00-04 (Reference 6). Risk-significant SSCs identified by a RAW greater than 2 for single-failure basic events sufficiently cover the Risk-significant SSCs identified by a RAW greater than 20 for common cause basic events. Component-based FVs are also estimated and used to identify risk-significant SSCs. The RAW and FV criteria are applied to the results of each risk hazard model separately, not to the combined results. For seismic margin analysis (SMA), risk-significant SSCs are identified according to the approach provided by NEI 00-04.

2) Engineering judgment based on PRA key assumptions and results is used for:

a) SSCs for which RAW/FV values have not been quantified

b) SSCs whose RAW/FV results do not exceed the importance criteria

Risk significance is identified by engineering judgment from the following points of view:

a) Contribution to required mitigation functions during an accident

b) Similarity of the impact of failure with other risk-significant SSCs

c) Impact on risk-significant human actions or signals

For severe accident-management SSCs, SSCs that are required to satisfy the requirements of 10 CFR are evaluated, and key SSCs are identified as risk-significant SSCs (e.g., cavity flooding system isolation valves).

3) Expert panel discussions and results

A third source in the RAP process for identifying risk-significant SSCs is the use of an expert panel consisting of representatives from design engineering,

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PRA, and other qualified individuals in operations and maintenance who are independent of the PRA group. The expert panel also reviews the categorization of SSCs determined to be non-risk significant based on quantified PRA results (e.g., technical adequacy of the basis used in the categorization, review of defense-in-depth implications, review of safety margin implications). As part of the RAP process, the PRA analytical results, operating experience, and an expert panel process are combined to develop a comprehensive list of risk-significant SSCs.

b. Dominant failure mode identification

For SSCs modeled in the PRA models, the failure modes of SSCs that can impact accident mitigative functions are represented by basic events in fault tree models. The dominant failure modes of SSCs can be determined from PRA models. For SSCs that are not modeled in PRA, dominant failure modes are based on SSCs that have a similar impact on the accident mitigation. The expert panel considers dominant failure modes in order to reflect industry operating experience.

17.4.6.2 Expert Panel

An expert panel is responsible for the final selection of the SSCs included in the RAP. The expert panel consists of a minimum of four people and includes at least one person with experience in design engineering, PRA, operations and maintenance, and QA. Industry operating experience and the expert panel are part of the deterministic approach and other processes. Engineering judgment is used in considering the addition of SSCs to the RAP. Qualifications of the voting members of the expert panel are defined in the Expert Panel Implementing Procedure for APR1400 Reliability Assurance Program and are as follows:

a. Minimum of 6 years of experience in the nuclear industry

b. Minimum of 4 years of experience in a relevant discipline such as engineering or operations

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17.4.6.3 Phase 1 RAP Implementation

Implementation of Phase 1 of the RAP is the responsibility of KHNP as it applies to the reactor design process. The SSCs included in this phase are listed in Table 17.4-1. The boundary for the SSCs listed in the table is defined as follows:

a. The RAP SSC boundaries are evaluated consistent with the SSCs in the corresponding sections of the DCD.

b. The RAP SSC boundary is specific to the component and/or structure under consideration and does not include any supporting or backup SSCs.

c. The RAP SSC boundary modeled in the PRA is consistent with the SSC boundary definition used in the APR1400 PRA (refer to Section 19.1), which is consistent with the available generic failure data.

Phase 1 RAP activities provide reasonable assurance that the key assumptions and risk insights from PRA, as identified in Section 19.1, are appropriately reflected in Table 17.4-1.

17.4.7 ITAAC for the Design RAP

Tier 1 inspections, tests, analyses, and acceptance criteria (ITAAC) are proposed to verify that the design phase RAP provides reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for risk-significant SSCs. The list of risk-significant SSCs for ITAAC is prepared by introducing the plant's site-specific information to the list shown in Table 17.4-1 in Phase 2 of the RAP. The ITAAC are established to provide reasonable assurance that the APR1400 design has been subjected to the applicable reliability assurance activities for all risk-significant within-scope RAP SSCs when the COL is issued.

17.4.8 Combined License Information

COL 17.4(1) The COL applicant is to develop and implement Phases 2 and 3 of the design RAP, including QA requirements. In Phase 2, the plant's site-specific information is to be subjected to the design RAP process, and the

RAI 316-8305 - Question 17.04-1

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site-specific risk-significant SSCs are combined with the APR1400 design risk-significant SSCs into one list for the plant. Phase 2 is to be performed during the COL application phase and updated/maintained during the COL license holder phase. In Phase 3, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the RAP provide reasonable assurance that key assumptions, such as equipment reliability, are realistic and achievable. The QA requirements are implemented during the procurement, fabrication, construction, and pre-operation testing of the SSCs within the scope of the RAP. Phase 3 is to be performed during the COL license holder phase and prior to initial fuel loading. The COL applicant is to propose a method for incorporating the objectives of the reliability assurance program into other programs for design or operational errors that degrade non-safety-related, risk-significant SSCs.

COL 17.4(2) The COL applicant is to develop and implement the RAP in the operations phase in which RAP activities are integrated into the existing operational program (e.g., Maintenance Rule, surveillance testing, inservice inspection, inservice testing, QA). The RAP in the operations phase also includes the process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP. A description of the proposed method for developing /integrating the operational RAP into operating plant programs (e.g., Maintenance Rule, quality assurance) is to be performed during the COL application phase. The development/integration of the O-RAP is performed during the COL license holder phase and prior to initial fuel loading. All SSCs identified as risk-significant within the scope of the design RAP are categorized as high-safety-significant (HSS) within the scope of the initial Maintenance Rule. Integration of reliability assurance activities into existing operational programs also addresses the establishment of:

a. Reliability performance goals for risk-significant SSCs consistent with the existing maintenance and quality assurance processes on the basis of information from the design RAP (for example, implementation of the Maintenance Rule following the guidance contained in NRC RG 1.160 is one acceptable method for establishing performance goals if

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SSCs are categorized as HSS within the scope of the Maintenance Rule program).

b. Performance and condition monitoring requirements to provide reasonable assurance that risk-significant SSCs do not degrade to an unacceptable level during plant operations.

17.4.9 References

1. SECY 95-132, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Design," U.S. Nuclear Regulatory Commission, May 1995.

2. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," U.S. Nuclear Regulatory Commission.

3. NUREG-0800, Standard Review Plan, Section 17.5, "Quality Assurance Program Description – Design Certification, Early Site Permit and New License Applicants," Rev. 0, U.S. Nuclear Regulatory Commission, March 2007.

4. APR1400-K-Q-TR-11005-NP, "KHNP Quality Assurance Program Description (QAPD) for the APR1400 Design Certification," Rev. 4, KHNP, March 2014.

5. 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," U.S. Nuclear Regulatory Commission.

6. NEI 00-04, "10 CFR 50.69, SSC Categorization Guideline," Rev. 0, Nuclear Energy Institute, 2005.

7. NUREG-0800, Standard Review Plan, Section 17.4, "Reliability Assurance Program," Rev. 1, U.S. Nuclear Regulatory Commission, May 2014.

8. 10 CFR 52.47(b)(1), "Contents of applications; additional technical information," 2015.

9. 10 CFR 52.80(a), "Contents of applications; additional technical information," 2015.

17.4.1 Introduction

APR1400

The RAP is implemented according to the Commission's direction provided in the Staff Requirements Memorandum (SRM) dated June 28, 1995, for Item E, the Reliability Assurance Program (RAP), of SECY-95-132, "A Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs" (Reference 1). The RAP applies to the systems, structures, and components (SSCs), both safety-related and non-safety-related that are identified as risk-significant (or significant contributors to plant safety). The SSCs within the scope of the RAP, referred to in this chapter as within-scope SSCs, are identified by a combination of probabilistic, deterministic, or other methods of analysis, including information obtained from sources such as the probabilistic risk assessment (PRA), severe accident evaluations, industry operating experience and expert panels.

The RAP provides reasonable assurance of the following:

a. A plant is designed, constructed, and operated in a manner that is consistent with the risk insights and key assumptions (e.g., SSC design, reliability, and availability) from the probabilistic, deterministic, and other methods of analysis used to identify and ~~prioritize~~ risk.

quantify

b. The RAP SSCs do not degrade to an unacceptable level of reliability, availability, or condition during plant operation.

c. The frequency of transients that challenge these SSCs is minimized.

d. These SSCs will function reliably when challenged.

The RAP is implemented in two stages. The first stage, the design reliability assurance program (D-RAP), encompasses reliability assurance activities that occur before initial fuel load. The second stage comprises the reliability assurance activities conducted during the operations phase of the plant's license. This DCD only describes the first stage.

The second stage~~, the operations RAP (O-RAP),~~ is not within the scope of the design certification and will be addressed during the COL application stage.

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RAI 316-8305 - Question 17.04-1_Rev.1

The D-RAP ensures that the plant is designed and constructed in a manner that is consistent with the risk insights and key assumptions (e.g., SSC design, reliability, and availability) from the probabilistic, deterministic, and other methods of analysis used to identify and quantify risk. Therefore, the key features of the D-RAP include the following:

a. Programmatic controls that ensure the risk insights and key assumptions are consistent with the plant design and construction. These programmatic controls address organization responsibilities, design control activities, procedures and instructions, records, corrective action and assessment plans, and that the list of D-RAP SSCs is appropriately developed, maintained, and communicated to the appropriate organizations.

b. Quality assurance (QA) programs related to design and construction activities (e.g., design, procurement, fabrication, construction, inspection, and testing activities) to safety-related SSCs are established through Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." The QA requirements are specified in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." SRP Section 17.5, Part V, "Non-safety-Related SSC Quality Controls," addresses QA controls for RAP SSCs that are not safety-related.

17.4.2 RAP Implementation

Phase 1 of the design RAP includes the initial identification of SSCs in the program, implementation of the aspects applicable to design efforts, and the definition of the scope, requirements, and implementation options included in the later phases.

~~The D-RAP is implemented as follows, in compliance with Reference 7:~~

The D-RAP is implemented as follows.

17.4.2.1 Development

The ~~RAP~~ APR1400 D-RAP identifies risk-significant SSCs and provides key assumptions and risk insights for aspects of plant operation, maintenance, and performance monitoring to provide reasonable assurance of safe, reliable plant operation or to mitigate plant transients or other events that could present a risk to the public. Risk-significant SSCs are identified using

the PRA, deterministic evaluation or other methods of analysis, including industry experience, and the input of the expert panel.

The APR1400 ~~D~~-RAP process is implemented in three phases.

a. Phase 1 (Design Certification) During this phase, system information is collected and a system model is developed. The designer, Korea Hydro & Nuclear Power Co., Ltd. (KHNP), is responsible for Phase 1. The system information and model are used as input to a design phase PRA and review of external events. / Phase 1 provides reasonable assurance that the reactor design meets the purposes specified above through the ~~design, procurement, fabrication, construction, and preoperational testing activities and programs.~~ design phase. The results of these activities are provided to an expert panel that identifies risk-significant SSCs using deterministic, probabilistic, and other methods.

b. Phase 2 (Site Specific) During this phase, the RAP process is applied to the plant site-specific ~~information and the~~ information. The list of site-specific SSCs and APR1400 ~~design SSCs are combined into one list.~~ is developed at this time.

c. Phase 3 (Final pre-operation) During the last phase of the RAP, the procurement, fabrication, construction, and preoperational testing are implemented. The site-specific list of SSCs is provided as input to the RAP during the operations phase, which addresses plant operation and maintenance activities. This phase provides reasonable assurance that the reliability of the SSCs within the scope of the RAP is maintained during plant operations.

Phases 2 and 3 are the responsibility of the COL applicant. Additional details are provided in Section 17.4.3.

17.4.2.2 Programmatic Controls

a. Organization

KHNP has established the following positions to ensure effective design and configuration control throughout the DC process:

The Project Manager of the APR1400 project is responsible for establishing and implementing the ~~RAP~~ APR1400 D-RAP. The Project Manager or designated representative is responsible for providing reasonable assurance that all affected organizations are aware of the D-RAP, its purposes and requirements.

The ~~Manager of Plant Safety~~ PRA Engineer is responsible for providing reasonable assurance of overall plant safety in the design, including the use of the PRA results and risk insights in the D-RAP implementation.

The ~~Manager of QA~~ QA Engineer is responsible for providing reasonable assurance that the QA program is implemented properly, which includes design control, procedures and instructions, records, corrective actions and audits pertaining to the D-RAP.

The ~~Managers of Design Engineering~~ Design Engineers are responsible for implementing the ~~RAP~~ D-RAP and providing reasonable assurance that the APR1400 design is consistent with the identified risk-significant SSCs and the associated key assumptions and risk insights from the PRA.

The risk management organization is responsible for requesting design engineering to review key assumptions in the PRA and to incorporate the comments to provide reasonable assurance that the key assumptions are realistic and achievable. The risk management organization is also responsible for providing the related inputs to ~~RAP~~ D-RAP in the design process by participating in the design change process. The risk management organization is also responsible for being involved in the design review. Changes are therefore identified for potential D-RAP impact.

Configuration control is established by the risk management organization, which maintains the list of risk-significant SSCs for the ~~RAP~~ D-RAP and the associated key assumptions and risk insights from the PRA. The list and changes are approved by an expert panel, and the panel provides the information to design engineering and QA staff working on the APR1400 project.

The risk management organization provides reasonable assurance that the design engineering organizations are provided with the list of risk-significant ~~RAP~~ D-RAP SSCs

and the associated key assumptions and risk insights from the PRA, which are addressed in DCD Section 19.1. The design engineering organization reviews the list of risk-significant RAP SSCs and associated key assumptions and risk insights from the PRA. The design engineering organization compares this information to the design activities and provides feedback to the risk management organization to achieve reasonable assurance that the risk-significant SSCs and the key assumptions and risk insights from the PRA are reasonably incorporated into the design, construction, and operational activities. This action ensures an acceptable level of quality control.

The APR1400 Project Manager or designated representative prepares the procedures and instructions used to implement the ~~RAP~~ D-RAP. The Project Manager or representative is responsible for the development, verification, and implementation and for providing reasonable assurance that all affected organizations are aware of the ~~RAP~~ D-RAP.

b. Records

~~RAP~~ D-RAP-related records include the following:

1) List of risk-significant SSCs

2) Expert panel meeting minutes/summaries

Other QA program records are maintained in accordance with the QA Program for the APR1400 (Reference 4).

c. Corrective Action

The activities associated with the ~~RAP~~ D-RAP that are determined to be in error, deficient, or nonconforming are processed through the corrective action program (CAP), which supports the quality assurance procedure.

d. Audits

RAI 316-8305 - Question 17.04-1_Rev.1

Audit plans include a consideration of sampling the implementation of the D-RAP and its procedures to evaluate effectiveness. Audits consider several key aspects of the D-RAP including the identification of risk-significant SSCs and whether the key assumptions and risk insights from PRA are reasonably incorporated ~~in the design, construction and operational activities.~~ during design activities.

17.4.2.3 SSC Identification

During the APR1400 design phase, risk-significant SSCs are identified for inclusion in the ~~RAP~~ D-RAP. A list of risk-significant SSCs is developed and controlled as design input for consideration during the design phase. The list of risk-significant SSCs is initially based on the results of the PRA and the expert panel. For further information on the PRA, refer to Section 19.1. In addition to PRA input, information from U.S. industry operating experience is considered in the identification of risk-significant SSCs. The list of risk-significant SSCs identified during the design phase is updated after the plant-specific PRA results are developed.

The PRA evaluates the APR1400 design response to a spectrum of initiating events to provide reasonable assurance that plant damage has a low frequency and that risk to the public is minimized. The risk-significant SSCs including both safety-related and non-safety related SSCs for the APR1400 design are identified for the design organization.

The PRA is used to identify risk-significant SSCs, based on risk achievement worth (RAW) and Fussell-Vesely (FV) importance. Risk-significant SSCs are identified with importance criteria of FV greater than 0.005 and RAW greater than 2. In the APR1400 D-RAP, these criteria have been applied to both single-failure basic events and common cause failure (CCF) basic events. A RAW value of 20 was conservatively selected to reflect the fact that the common cause RAW measures the failure of two or more trains, including the higher likelihood of failure of the second train from common causes, as described in NEI 00-04 (Reference 6). Risk-significant SSCs identified by a RAW greater than 2 for single-failure basic events sufficiently cover the risk-significant SSCs identified by a RAW greater than 20 for common cause basic events. Component-based FVs are also estimated and used to identify risk-significant SSCs. The RAW and FV criteria are applied to the results of each risk hazard model separately, not to the combined results. For the seismic margin analysis (SMA), risk-significant SSCs are identified according to the approach provided by NEI 00-04.

RAI 316-8305 - Question 17.04-1_Rev.1

Engineering judgment based on the PRA key assumptions and results is used for:

1) SSCs for which RAW/FV values have not been quantified,

2) SSCs whose RAW/FV results do not exceed the importance criteria

Risk significance is identified by engineering judgment from the following points of view:

1) Contribution to required mitigation functions during the accident

2) Similarity of the impact of failure with other risk-significant SSCs

3) Impact on risk-significant human actions or signals

4) Potential contribution of un-modeled components

5) Potential impact of conservative modeling

For severe accident management SSCs, SSCs that are required to meet the requirements of 10 CFR are evaluated, and key SSCs are identified as risk-significant SSCs (e.g. cavity flooding system isolation valves).

A third source in the ~~RAP~~ D-RAP process for identifying risk-significant SSCs is the use of an expert panel consisting of representatives from design engineering, PRA, and other qualified individuals in operations and maintenance who are independent of the PRA group. The expert panel also reviews the categorization of SSCs determined to be non-risk significant based on quantified PRA results (e.g., technical adequacy of the basis used in the categorization, review of defense-in-depth implications, review of safety margin implications). As part of the ~~RAP~~ D-RAP process, the PRA analytical results, operating experience, and an expert panel process are combined to develop a comprehensive list of risk-significant SSCs.

For SSCs modeled in the PRA models, the failure modes of SSCs that can impact accident mitigative functions are represented by basic events in fault tree models. The dominant failure modes are determined from PRA models. For SSCs that are not modeled in PRA,

RAI 316-8305 - Question 17.04-1

dominant failure modes are based on SSCs that have a similar impact on the accident mitigation. The expert panel considers dominant failure modes in order to reflect industry operating experience.

The expert panel is responsible for the final selection of the SSCs included in the ~~RAP~~ D-RAP. The expert panel consists of a minimum of four people and includes at least one person with experience in design engineering, PRA, operations and maintenance, and QA. Industry operating experience and the expert panel are part of the deterministic approach and other processes. Engineering judgment is used in considering the addition of SSCs to the ~~RAP~~ D-RAP. Qualifications of the voting members of the expert panel are defined in the Expert Panel Implementing Procedure for APR1400 Reliability Assurance Program and are as follows:

1) Minimum of 6 years of experience in the nuclear industry. This requirement ensures that each member's experience reflects the unique requirements of their discipline in support of nuclear plant operations.

2) Minimum of 4 years of experience in a relevant discipline such as engineering or operations. This requirement ensures that each member's experience is appropriate for their specific panel duties.

The SSCs included in the design phase are listed in Table 17.4-1. The boundaries for the ~~RAP~~ D-RAP SSCs listed in the table are defined as follows:

1) The SSC boundaries are verified as consistent with the SSCs in the corresponding sections of the DCD.

2) Each SSC boundary is specific to the component and/or structure under consideration and does not include any supporting or backup SSCs.

3) The SSC boundary modeled in the PRA is consistent with the SSC boundary definition used in the APR1400 PRA (refer to Section 19.1), which is consistent with the available generic failure data.

Phase 1 ~~RAP~~ D-RAP activities provide reasonable assurance that the key assumptions and risk insights from PRA, as identified in Section 19.1, are appropriately reflected in Table 17.4-1.

RAI 316-8305 - Question 17.04-1

RAI 316-8305 - Question 17.04-1_Rev.1

A (9/12)

17.4.2.4 QA Controls

D-RAP

The non-safety-related ~~RAP~~ SSCs are subjected to appropriate QA controls as described in ~~Section 17.5~~.

Reference 4

17.4.2.5 ITAAC Development

Tier 1 inspections, tests, analyses and acceptance criteria (ITAAC) for the COL D-RAP are proposed to provide reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for risk-significant SSCs. The list of risk-significant SSCs for ITAAC is prepared by introducing the plant's site-specific information to the list shown in Table 17.4-1 in Phase 2 of the ~~RAP~~. The ITAAC is established to provide reasonable assurance that the APR1400 design has been subjected to the applicable reliability assurance activities for all risk-significant within-scope SSCs when the COL is issued.

D-RAP

Replace with B

~~17.4.3 Operations Phase~~

~~17.4.3.1 Objective~~

~~Once operation commences, the RAP ensures that the reliability and availability of SSCs are maintained commensurate with their risk significance. This phase is implemented through regulatory requirements for SSCs, including (1) the maintenance rule program established per 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," (2) the QA program for safety-related SSCs established per Appendix B to 10 CFR Part 50, (3) QA controls for non-safety-related SSCs established in accordance with Part V of SRP Section 17.5, and (4) the inservice inspection, inservice testing, surveillance testing, and maintenance programs. Prior to initial fuel load, the COL licensee identifies dominant failure modes and integrates the RAP into operational programs. During the operations phase of the plant, performance and condition monitoring are implemented to provide reasonable assurance that these SSCs do not degrade to an unacceptable level of reliability, availability, or condition.~~

RAI 316-8305 - Question 17.04-1

RAI 316-8305 - Question 17.04-1_Rev.1

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17.4.3.2 Integration

The APR1400 RAP serves as a source for other administrative and operational programs. Certain risk-significant SSCs identified in the RAP may be included in existing operational programs such as Technical Specifications surveillance requirements and provide reasonable assurance that the reliability values assumed in the PRA are maintained throughout the plant life.

During the operations phase, the RAP implements measures that yield continual improvements in the PRA through the plant's existing programs for maintenance or QA. Implementation of the Maintenance Rule requirements in 10 CFR 50.65 (Reference 5) is an example of how the plant could address the enhanced treatment of certain SSCs during the operations phase. COL applicant responsibilities are listed in DCD Section 17.4.4.

17.4.3.3 Operating Experience

Consideration and use of operating experience is vital to the objective of the RAP. Operating experience is considered along with various PRA analytical and importance measures when developing a comprehensive risk analysis. The expert panel considers SSC operating history and industry operating experience when assessing SSC risk significance. For example, operating experience indicates that the reliability of motor-driven and turbine-driven pumps may be different.

A review of operating experience may reveal conditions in which previous failures of SSCs in similar design applications have led to functional failures of SSCs. The review of operating experience is not limited to hardware failure but also extends to situations in which human performance led to functional failures of SSCs with a similar system design. For example, the APR1400 design improves SSC reliability by eliminating required operator actions to switch from injection to recirculation, which is an improvement relative to conventional PWRs.

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17.4.4 17.4.5 Combined License Information

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The COL applicant responsibilities during the license application phase, and prior to the initial fuel load, are delineated in Reference 7. These responsibilities are not addressed in

RAI 316-8305 - Question 17.04-1

RAI 316-8305 - Question 17.04-1_Rev.1

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detail during the APR1400 design phase. The following paragraphs briefly summarize these D-RAP responsibilities on a preliminary basis.

COL 17.4(1) The COL applicant is to develop and implement Phases 2 and 3 of the design RAP, including QA requirements. In Phase 2, the plant's site-specific information is subjected to the D-RAP process, and the site-specific risk-significant SSCs are combined with the Phase 1 (design) risk-significant SSCs into one list for the plant. Phase 2 is performed during the COL application phase and updated/maintained during the COL license holder phase. In Phase 3, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the D-RAP provide reasonable assurance that key assumptions, such as equipment reliability, are realistic and achievable. The QA requirements are implemented at this time. Phase 3 is performed during the COL license holder phase and prior to initial fuel loading.

COL 17.4(2) The COL applicant is to propose a method for incorporating the objectives of the reliability assurance program into other programs for design or operational errors that degrade non-safety-related, risk-significant SSCs.

COL 17.4(3) The COL applicant to develop and implement the RAP in the operations phase in which RAP activities are integrated into the existing operational program (e.g., Maintenance Rule, surveillance testing, inservice inspection, inservice testing, QA). The RAP in the operations phase also includes the process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP. A description of the proposed method for developing and integrating the operational RAP into operating plant programs (e.g., Maintenance Rule, quality assurance) is to be performed during the COL application phase. The development/integration of the O-RAP is performed during the COL license holder phase and prior to initial fuel loading. All SSCs identified as risk-significant within the scope of the design RAP are categorized as high-safety-significant (HSS) within the scope of the initial Maintenance Rule. Integration of reliability assurance activities into existing operational programs also addresses the establishment of:

RAI 316-8305 - Question 17.04-1

RAI 316-8305 - Question 17.04-1_Rev.1

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a. ~~Reliability performance goals for risk-significant SSCs consistent with the existing maintenance and quality assurance processes on the basis of information from the D-RAP. For example, implementation of the Maintenance Rule per Regulatory Guide 1.160 is one acceptable method for establishing performance goals if SSCs are categorized as HSS within the scope of the Maintenance Rule program.~~

b. ~~Performance and condition monitoring requirements to provide reasonable assurance that risk-significant SSCs do not degrade to an unacceptable level during plant operations.~~

RAI 316-8305 - Question 17.04-1_Rev.1

B (1/2)

17.4.3 COL Applicant Responsibilities

The COL applicant responsibilities during the license application phase, and prior to the initial fuel load, are delineated in Reference 7. These responsibilities are not addressed in detail during the APR1400 design phase. The following paragraphs briefly summarize these D-RAP responsibilities on a preliminary basis.

a. Phases 2 and 3 The COL applicant develops and implements Phases 2 and 3 of the design RAP, including QA requirements.

   1) In Phase 2, the plant's site-specific information is subjected to the D-RAP process, and the site-specific risk-significant SSCs are combined with the Phase 1 (design) risk-significant SSCs into one list for the plant. Phase 2 is performed during the COL application phase and updated/maintained afterward.

   2) In Phase 3, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the D-RAP provide reasonable assurance that key assumptions, such as equipment reliability, are realistic and achievable. The QA requirements are implemented at this time. Phase 3 is performed prior to initial fuel loading.

b. Program Interface The COL applicant proposes a method for incorporating the objectives of the reliability assurance program into other programs for design or operational errors that degrade non-safety-related, risk-significant SSCs.

c. Program Integration The COL applicant integrates the D-RAP in the operations phase into existing operational programs (e.g., Maintenance Rule, surveillance testing, inservice inspection, inservice testing, QA) per SECY 95-132 for the operations stage. This stage also includes the process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope. A description of the proposed method for developing /integrating the operational RAP into operating plant programs (e.g., Maintenance Rule, quality assurance) is provided during the COL application phase. The development/integration of the RAP is performed prior to initial fuel

RAI 316-8305 - Question 17.04-1_Rev.1

B (2/2)

loading. All SSCs identified as risk-significant within the scope of the D-RAP are categorized as high-safety-significant (HSS) within the scope of the initial Maintenance Rule. The integration of reliability assurance activities into existing operational programs also establishes:

1) Reliability performance goals for risk-significant SSCs consistent with the existing maintenance and quality assurance processes on the basis of information from the D-RAP. For example, implementation of the Maintenance Rule per Regulatory Guide 1.160 is one acceptable method for establishing performance goals if SSCs are categorized as HSS within the scope of the Maintenance Rule program.

2) Performance and condition monitoring requirements to provide reasonable assurance that risk-significant SSCs do not degrade to an unacceptable level during plant operations.

3) Appropriate treatment for non-safety, but risk-significant, SSCs.

d. <u>COL Acceptance Criteria</u> The COL Applicant demonstrates compliance with the requirements of Reference 7, Acceptance Criteria, Section B, Combined License Application.

RAI 316-8305 - Question 17.04-1_Rev.1

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17.4.4 Implementation of Reliability Assurance Program

The implementation of reliability assurance program for the Design Certification application is summarized as follows:

A.1, Description of Design Reliability Assurance Program The APR1400 D-RAP identifies risk-significant SSCs and provides key assumptions and risk insights for aspects of plant operation, maintenance, and performance monitoring to provide reasonable assurance of safe, reliable plant operation or to mitigate plant transients or other events that could present a risk to the public. Risk-significant SSCs are identified using the PRA, deterministic evaluation or other methods of analysis, including industry experience, and the input of the expert panel.

The APR1400 D-RAP process is implemented in three phases.

a. Phase 1 (Design Certification) During this phase, system information is collected and a system model is developed. The designer, Korea Hydro & Nuclear Power Co., Ltd. (KHNP), is responsible for Phase 1. The system information and model are used as input to a design phase PRA and review of external events.

   Phase 1 provides reasonable assurance that the reactor design meets the purposes specified above through the design phase. The results of these activities are provided to an expert panel that identifies risk-significant SSCs using deterministic, probabilistic, and other methods.

b. Phase 2 (Site Specific) During this phase, the RAP process is applied to the plant site-specific information. The list of site-specific SSCs is developed.

c. Phase 3 (Final pre-operation) During the last phase of the RAP, the procurement, fabrication, construction, and preoperational testing are implemented. The site-specific list of SSCs is provided as input to the RAP during the operations phase, which addresses plant operation and maintenance activities. This phase provides reasonable assurance that the reliability of the SSCs within the scope of the RAP is maintained during plant operations.

C (2/5)

Phases 2 and 3 are the responsibility of the COL applicant.

A.2, Programmatic Controls of Design Reliability Assurance Program

A.2.1, Organizations KHNP has established the following positions to ensure effective design and configuration control throughout the DC process:

The Project Manager of the APR1400 project is responsible for establishing and implementing the APR1400 D-RAP. The Project Manager or designated representative is responsible for providing reasonable assurance that all affected organizations are aware of the D-RAP, its purposes and requirements.

The PRA Engineer is responsible for providing reasonable assurance of overall plant safety in the design, including the use of the PRA results and risk insights in the D-RAP implementation.

The QA Engineer is responsible for providing reasonable assurance that the QA program is implemented properly, which includes design control, procedures and instructions, records, corrective actions and audits pertaining to the D-RAP.

The Design Engineers are responsible for implementing the D-RAP.

The risk management organization is responsible for requesting design engineering to review key assumptions in the PRA and to incorporate the comments to provide reasonable assurance that the key assumptions are realistic and achievable. The risk management organization is also responsible for providing the related inputs to D-RAP in the design process by participating in the design change process. The risk management organization is also responsible for being involved in the design review. Changes are therefore identified for potential D-RAP impact.

Configuration control is established by the risk management organization, which maintains the list of risk-significant SSCs for the D-RAP and the associated key assumptions and risk insights from the PRA. The list and changes are approved by an expert panel, and the panel provides the information to design engineering and QA staff working on the APR1400 project.

RAI 316-8305 - Question 17.04-1_Rev.1

C (3/5)

The risk management organization provides reasonable assurance that the design engineering organizations are provided with the list of risk-significant D-RAP SSCs and the associated key assumptions and risk insights from the PRA, which are addressed in DCD Section 19.1. The design engineering organization reviews the list of risk-significant RAP SSCs and associated key assumptions and risk insights from the PRA. The design engineering organization compares this information to the design activities and provides feedback to the risk management organization to achieve reasonable assurance that the risk-significant SSCs and the key assumptions and risk insights from the PRA are reasonably incorporated into the design, construction, and operational activities. This action ensures an acceptable level of quality control.

The APR1400 Project Manager or designated representative prepares the procedures and instructions used to implement the D-RAP. The Project Manager or representative is responsible for the development, verification, and implementation and for providing reasonable assurance that all affected organizations are aware of the D-RAP.

<u>A.2.2, Design Control</u> The QA Engineer is responsible for providing reasonable assurance that the QA program is implemented properly, which includes design control pertaining to the D-RAP.

<u>A.2.3, Procedure Control</u> The Project Manager or designated representative prepares the procedures and instructions used to implement the D-RAP. The QA Engineer is responsible for providing reasonable assurance that the QA program is implemented properly, which includes procedures pertaining to the D-RAP.

<u>A.2.4, Corrective Action</u> The activities associated with the D-RAP that are determined to be in error, deficient, or nonconforming are processed through the corrective action program (CAP), which supports the quality assurance procedure.

<u>A.2.5, Records</u> D-RAP-related records include a list of risk-significant SSCs and the expert panel meeting minutes/summaries. Other QA program records are maintained in accordance with the QA Program for the APR1400 (Reference 4).

RAI 316-8305 - Question 17.04-1_Rev.1

C (4/5)

A.2.6, Audits Audit plans include a consideration of sampling the implementation of the D-RAP and its procedures to evaluate effectiveness. Audits consider several key aspects of the D-RAP including the identification of risk-significant SSCs and whether the key assumptions and risk insights from PRA are reasonably incorporated in the design, construction and operational activities.

A.3, SSC Identification Methodology The APR1400 D-RAP identifies risk-significant SSCs and provides key assumptions and risk insights for aspects of plant operation, maintenance, and performance monitoring to provide reasonable assurance of safe, reliable plant operation or to mitigate plant transients or other events that could present a risk to the public. Risk-significant SSCs are identified using the PRA, deterministic evaluation or other methods of analysis, including industry experience, and the input of the expert panel.

A.4, Expert Panel The expert panel is responsible for the final selection of the SSCs included in the D-RAP. The expert panel consists of a minimum of six people and includes at least one person with experience in design engineering, PRA, operations and maintenance, and QA. Industry operating experience and the expert panel are part of the deterministic approach and other processes. Engineering judgment is used in considering the addition of SSCs to the D-RAP. Qualifications of the voting members of the expert panel are defined in the Expert Panel Implementing Procedure for APR1400 Reliability Assurance Program and are as follows:

a. Minimum of 6 years of experience in the nuclear industry.

b. Minimum of 4 years of experience in a relevant discipline such as engineering or operations.

A.5, SSCs within Scope Components within the D-RAP scope, and their classification basis, are listed in Table 17.4-1. The boundaries for the D-RAP SSCs listed in the table are defined as follows:

a. The SSC boundaries are verified as consistent with the SSCs in the corresponding sections of the DCD.

RAI 316-8305 - Question 17.04-1_Rev.1

C (5/5)

b. Each SSC boundary is specific to the component and/or structure under consideration and does not include any supporting or backup SSCs.

The SSC boundary modeled in the PRA is consistent with the SSC boundary definition used in the APR1400 PRA (refer to Section 19.1), which is consistent with the available generic failure data.

A.6, Dominant Failure Modes For SSCs modeled in the PRA models, the failure modes of SSCs that can impact accident mitigative functions are represented by basic events in fault tree models. The dominant failure modes are determined from PRA models. For SSCs that are not modeled in PRA, dominant failure modes are based on SSCs that have a similar impact on the accident mitigation. The expert panel considers dominant failure modes in order to reflect industry operating experience.

A.7, Quality Assurance Associated with Design Activities For non-safety-related RAP SSCs, the QA program for the APR1400 design certification is described in Section 17.5.

A.8, ITAAC for Design Reliability Assurance Program Tier 1 inspections, tests, analyses and acceptance criteria (ITAAC) for the COL D-RAP are proposed to provide reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for risk-significant SSCs. The list of risk-significant SSCs for ITAAC is prepared by introducing the plant's site-specific information to the list shown in Table 17.4-1 in Phase 2 of the D-RAP. The ITAAC is established to provide reasonable assurance that the APR1400 design has been subjected to the applicable reliability assurance activities for all risk-significant within-scope SSCs when the COL is issued.

A.9, Combined License Applicant Action Items The COL applicant action items are described in Section 17.4.5.

RAI 316-8305 - Question 17.04-1_Rev.1

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17.4.5 Combined License Information

COL 17.4(1) The APR1400 application will update the description of the D-RAP to include relevant site- and plant-specific information (e.g., design, program, procedural, and organizational information). This includes identifying the SSCs within the scope of the plant-specific RAP (i.e., the RAP SSCs identified in the DC, updated using COL site- and plant-specific information) and establishing the programmatic controls of D-RAP to be applied during the COL design and construction activities prior to initial fuel load.

COL 17.4(2) The APR1400 application will specify appropriate QA controls for the non-safety-related RAP SSCs in accordance with the provisions in Part V, "Non-safety-Related SSC Quality Controls," of SRP Section 17.5. This includes providing corrective actions for potential design and pre-operational errors that could degrade non-safety-related RAP SSCs.

COL 17.4(3) The APR1400 application will propose a process for integrating the RAP into operational programs (e.g., maintenance rule program, QA program, inservice inspection, inservice testing, surveillance testing, and maintenance programs). The process should also address the (1) establishment of reliability, availability, or condition performance goals for the RAP SSCs, (2) establishment of performance and condition monitoring requirements to provide reasonable assurance that RAP SSCs do not degrade to an unacceptable level of reliability, availability, or condition during plant operations, (3) for non-safety-related RAP SSCs, establishment of QA controls for activities during the operations phase in accordance with the provisions in Part V of SRP Section 17.5, and (4) consideration of dominant failure modes of RAP SSCs in meeting the objectives of the RAP during plant operation.

Table 17.4-1 (1 of 28)

Risk-Significant Within-Scope RAP SSCs

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
1	AF	TP01A	Auxiliary Feedwater Turbine-Driven Pump 1A	Level 1, Level 2, Flood, Fire, Seismic	Fails to Start Fails to Run
2	AF	TP01B	Auxiliary Feedwater Turbine-Driven Pump 1B	Level 1, Level 2, Flood, Fire, Seismic	Fails to Start Fails to Run
3	AF	MDP02A	Auxiliary Feedwater Motor-Driven Pump 2A	Level 1, Fire, Seismic	Fails to Start Fails to Run
4	AF	MDP02B	Auxiliary Feedwater Motor-Driven Pump 2B	Level 1, Fire, Seismic	Fails to Start Fails to Run
5	AF	CV1003A	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
6	AF	CV1003B	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
7	AF	CV1004A	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
8	AF	CV1004B	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
9	AF	CV1007A	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
10	AF	CV1007B	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
11	AF	CV1008A	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
12	AF	CV1008B	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
13	AF	CV1012A	Auxiliary Feedwater Motor-Driven Pump 2A Mini-flow Line Check Valve	Level 1, Level 2, Fire	Fails to Open
14	AF	CV1012B	Auxiliary Feedwater Motor-Driven Pump 2B Mini-flow Line Check Valve	Level 1, Level 2, Fire	Fails to Open
15	AF	CV1014A	Auxiliary Feedwater Turbine-Driven Pump 1A Mini-flow Line Check Valve	Level 1, Fire	Fails to Open

Table 17.4-1 (2 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
16	AF	CV1014B	Auxiliary Feedwater Turbine-Driven Pump 1B Mini-flow Line Check Valve	Level 1, Fire	Fails to Open
17	AF	MV043	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Isolation Valve	Level 1, Level 2, Fire	Fails to Open Fails to Closed
18	AF	MV044	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Isolation Valve	Level 1, Level 2, Fire	Fails to Open Fails to Closed
19	AF	MV045	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Isolation Valve	Level 1, Level 2	Fails to Open Fails to Closed
20	AF	MV046	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Isolation Valve	Level 1, Level 2	Fails to Open Fails to Closed
21	AF	SOV0035	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Modulation Valve	Level 2, Fire	Fails to Control Spuriously Closed
22	AF	SOV0036	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Modulation Valve	Level 2, Fire	Fails to Control Spuriously Closed
23	AF	SOV0037	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Modulation Valve	Level 1	Fails to Control Spuriously Closed
24	AF	SOV0038	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Modulation Valve	Level 1	Fails to Control Spuriously Closed
25	AF	78-15D-AF-X	Auxiliary Feedwater System Piping in Room 078-A15D	Flood	Break
26	AT	AOV009	Auxiliary Feedwater Turbine-Driven Pump 1A Turbine Steam Supply Isolation Valve	Level 1, Level 2	Fails to Open
27	AT	AOV010	Auxiliary Feedwater Turbine-Driven Pump 1B Turbine Steam Supply Isolation Valve	Level 1, Level 2	Fails to Open
28	AT	CV1020A	Auxiliary Feedwater Turbine-Driven Pump 1A Turbine Steam Supply Check Valve	Level 1, Level 2	Fails to Open
29	AT	CV1020B	Auxiliary Feedwater Turbine-Driven Pump 1B Turbine Steam Supply Check Valve	Level 1, Level 2	Fails to Open

Table 17.4-1 (3 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
30	AX	AFWST	Auxiliary Feedwater Storage Tank	Expert Panel	Rupture
31	AX	CV1600	Demineralized Water Line Check Valve	Level 1, Level 2	Fails to Open
32	CA	CV1023	Condenser Vacuum System - Containment Isolation Valve	LPSD Fire Level 2	Fails to Open
33	CC	MP01A	Component Cooling Water Pump 1A	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run
34	CC	MP01B	Component Cooling Water Pump 1B	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run
35	CC	MP02A	Component Cooling Water Pump 2A	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run
36	CC	MP02B	Component Cooling Water Pump 2B	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run
37	CC	HE01A	Component Cooling Water Heat Exchanger 1A	Level 1, Level 2, Fire, Seismic	Fails while operating
38	CC	HE01B	Component Cooling Water Heat Exchanger 1B	Level 1, Level 2, Fire, Seismic	Fails while operating
39	CC	HE02A	Component Cooling Water Heat Exchanger 2A	Level 1, Level 2, Fire, Seismic	Fails while operating
40	CC	HE02B	Component Cooling Water Heat Exchanger 2B	Level 1, Level 2, Fire, Seismic	Fails while operating
41	CC	HE03A	Component Cooling Water Heat Exchanger 3A	Level 1, Level 2, Fire, Seismic	Fails while operating
42	CC	HE03B	Component Cooling Water Heat Exchanger 3B	Level 1, Level 2, Fire, Seismic	Fails while operating
43	CC	CV1001	Component Cooling Water Pump 1A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
44	CC	CV1002	Component Cooling Water Pump 1B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
45	CC	CV1003	Component Cooling Water Pump 2A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
46	CC	CV1004	Component Cooling Water Pump 2B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
47	CC	MV021	Component Cooling Water Heat Exchanger ~~3A~~ 1A Discharge Valve	Expert Panel	Fails to Remain Open

Table 17.4-1 (4 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]	Failure Mode
48	CC	MV022	Component Cooling Water Heat Exchanger ~~3B~~ 1B Discharge Valve	Expert Panel	Fails to Remain Open
49	CC	MV023	Component Cooling Water Heat Exchanger ~~3A~~ 2A Discharge Valve	Expert Panel	Fails to Remain Open
50	CC	MV024	Component Cooling Water Heat Exchanger ~~3B~~ 2B Discharge Valve	Expert Panel	Fails to Remain Open
51	CC	MV025	Component Cooling Water Heat Exchanger 3A Discharge Valve	Expert Panel	Fails to Open
52	CC	MV026	Component Cooling Water Heat Exchanger 3B Discharge Valve	Expert Panel	Fails to Open
53	CC	MV027	Component Cooling Water Heat Exchanger Bypass Valve	Expert Panel	Fails to Open
54	CC	MV028	Component Cooling Water Heat Exchanger Bypass Valve	Expert Panel	Fails to Open
55	CC	MV097	Containment Spray Heat Exchanger 1A Component Cooling Water Inlet Valve	Level 1, Level 2	Fails to Open
56	CC	MV098	Containment Spray Heat Exchanger 1B Component Cooling Water Inlet Valve	Level 1, Level 2	Fails to Open
57	CC	MV131	Essential Chiller 2A Component Cooling Water Outlet Valve	Level 1, Fire	Fails to Open
58	CC	MV132	Essential Chiller 2B Component Cooling Water Outlet Valve	Level 1, Fire	Fails to Open
59	CC	MV143	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
60	CC	MV144	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
61	CC	MV145	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
62	CC	MV146	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
63	CC	MV147	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
64	CC	MV148	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close

Table 17.4-1 (5 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]	Failure Mode
65	CC	MV149	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
66	CC	MV150	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire	Fails to Close
67	CC	MV181	Emergency Diesel Generator 1C Component Cooling Water Inlet Valve	Level 1, Level 2, Fire	Fails to Open
68	CC	MV182	Emergency Diesel Generator 1D Component Cooling Water Inlet Valve	Level 1, Level 2, Fire	Fails to Open
69	CC	MV191	Emergency Diesel Generator 1A Component Cooling Water Inlet Valve	Level 1, Level 2, Fire	Fails to Open
70	CC	MV192	Emergency Diesel Generator 1B Component Cooling Water Inlet Valve	Level 1, Level 2, Fire	Fails to Open
71	CC	MV351	Shutdown Cooling Heat Exchanger 1A Component Cooling Water Inlet Valve	LPSD	Fails to Open
72	CC	MV352	Shutdown Cooling Heat Exchanger 1B Component Cooling Water Inlet Valve	LPSD	Fails to Open
73	CC	MV383	Essential Chiller 1A Component Cooling Water Outlet Valve	Expert Panel	Fails to Open
74	CC	MV384	Essential Chiller 1B Component Cooling Water Outlet Valve	Expert Panel	Fails to Open
75	CC	TK01A	Component Cooling Water Surge Tank 1A	Level 1, Level 2, Flood, Fire	Rupture
76	CC	TK01B	Component Cooling Water Surge Tank 1B	Level 1, Level 2, Flood, Fire	Rupture
77	CD	TK01	Condensate Deaerator Storage Tank A	Level 1	Rupture
78	CD	TK02	Condensate Deaerator Storage Tank B	Level 1	Rupture
79	CS	PP01A	Containment Spray Pump 1A	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run

Table 17.4-1 (6 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
80	CS	PP01B	Containment Spray Pump 1B	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run
81	CS	HE01A	Containment Spray Heat Exchanger 1A	Level 1, Level 2, Seismic	Fails while operating
82	CS	HE01B	Containment Spray Heat Exchanger 1B	Level 1, Level 2, Seismic	Fails while operating
83	CS	HE02A	Containment Spray Mini-flow Line Heat Exchanger 2A	Seismic	Fails while operating
84	CS	HE02B	Containment Spray Mini-flow Line Heat Exchanger 2B	Seismic	Fails while operating
85	CS	CV1001	Containment Spray Pump 1A Discharge Check Valve	Level 1	Fails to Open
86	CS	CV1002	Containment Spray Pump 1B Discharge Check Valve	Level 1	Fails to Open
87	CS	CV1007	Containment Spray Heat Exchanger 1A Discharge Check Valve	Level 1, Level 2	Fails to Open
88	CS	CV1008	Containment Spray Heat Exchanger 1B Discharge Check Valve	Level 1, Level 2	Fails to Open
89	CS	MV001	Containment Spray Heat Exchanger 1A Discharge Isolation Valve	Level 1, Level 2	Fails to Open
90	CS	MV002	Containment Spray Heat Exchanger 1B Discharge Isolation Valve	Level 1, Level 2	Fails to Open
91	CS	MV003	Containment Spray Heat Exchanger 1A Discharge Isolation Valve	Level 1, Level 2	Fails to Open
92	CS	MV004	Containment Spray Heat Exchanger 1B Discharge Isolation Valve	Level 1, Level 2	Fails to Open
93	CV	PP03	Auxiliary Charging Pump	Level 1, Level 2, Seismic	Fails to Start Fails to Run
94	CV	CV334	Auxiliary Charging Pump Discharge Check Valve	Level 1	Fails to Open
95	CV	CV189	In-Containment Refueling Water Storage Tank Return Line Check Valve	Level 1, Level 2	Fails to Open

Table 17.4-1 (7 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]
96	CV	MV509	In-Containment Refueling Water Storage Tank Return Line Isolation Valve (Normally Closed)	Level 1, Level 2
97	CV	MV553	In-Containment Refueling Water Storage Tank Return Line Isolation Valve (Normally Open)	Level 1, Level 2
98	CV	VV126	In-Containment Refueling Water Storage Tank Refill Line Manual Isolation Valve	Level 1, Level 2
99	CV	VV649	In-Containment Refueling Water Storage Tank Refill Line Manual Isolation Valve	Level 1, Level 2
100	CV	TK02	Boric Acid Storage Tank	Level 1
101	CV	AV505, AV523, AV561	Chemical and Volume Control System - Containment Isolation Valve	LPSD Fire Level 2
102	CV	AV506, AV522, AV560	Chemical and Volume Control System - Containment Isolation Valve	Expert Panel
103	DA	AACTG	Alternate Alternating Current Gas Turbine Generator	SBO, Level 1, Level 2, Seismic
104	DA	PP01	Alternate Alternating Current Fuel Oil Transfer Pump	SBO, Fire
105	DA	PP02	Alternate Alternating Current Fuel Oil Transfer Pump	SBO, Fire
106	DA	CV1005	Alternate Alternating Current Fuel Oil Transfer Pump Discharge Check Valve	SBO, Expert Panel
107	DA	CV1007	Alternate Alternating Current Fuel Oil Transfer Pump Discharge Check Valve	SBO, Expert Panel
108	DA	TK01	Alternate Alternating Current Fuel Oil Storage Tank	SBO, Expert Panel
109	DA	TK02	Alternate Alternating Current Fuel Oil Day Tank	SBO, Expert Panel

Failure Mode
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Rupture
Fails to Close
Fails to Close
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Open
Fails to Open
Rupture
Rupture

Table 17.4-1 (8 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]	Failure Mode
110	DC	BC01A	Class 1E 125 V Direct Current Battery Charger 1A	Level 1, Level 2, Seismic	Fails to Operate
111	DC	BC01B	Class 1E 125 V Direct Current Battery Charger 1B	Level 1, Level 2, Seismic	Fails to Operate
112	DC	BC01C	Class 1E 125 V Direct Current Battery Charger 1C	Level 1, Level 2, Seismic	Fails to Operate
113	DC	BC01D	Class 1E 125 V Direct Current Battery Charger 1D	Level 1, Level 2, Seismic	Fails to Operate
114	DC	BC02A	Class 1E 125 V Direct Current Standby Battery Charger 2A	Level 1, Seismic	Fails to Operate
115	DC	BC02B	Class 1E 125 V Direct Current Standby Battery Charger 2B	Level 1, Seismic	Fails to Operate
116	DC	BC02C	Class 1E 125 V Direct Current Standby Battery Charger 2C	Level 1, Seismic	Fails to Operate
117	DC	BC02D	Class 1E 125 V Direct Current Standby Battery Charger 2D	Level 1, Seismic	Fails to Operate
118	DC	BT01A	Class 1E 125 V Direct Current Battery 1A	Level 1, Level 2, Fire, Seismic	Fails to Provide Output
119	DC	BT01B	Class 1E 125 V Direct Current Battery 1B	Level 1, Level 2, Fire, Seismic	Fails to Provide Output
120	DC	BT01C	Class 1E 125 V Direct Current Battery 1C	Level 1, Level 2, Fire, Seismic	Fails to Provide Output
121	DC	BT01D	Class 1E 125 V Direct Current Battery 1D	Level 1, Level 2, Fire, Seismic	Fails to Provide Output
122	DC	MC01A	Class 1E 125 V Direct Current Bus 1A	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
123	DC	MC01B	Class 1E 125 V Direct Current Bus 1B	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
124	DC	MC01C	Class 1E 125 V Direct Current Bus 1C	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
125	DC	MC01D	Class 1E 125 V Direct Current Bus 1D	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
126	DC	MC01M	Non-Class 1E 250 V Direct Current Bus 1M	Level 1, Level 2	Fails to Operate
127	DC	MC01N	Non-Class 1E 250 V Direct Current Bus 1N	Level 1, Level 2	Fails to Operate

Table 17.4-1 (9 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
128	DE	AV006	Radioactive Drain System - Containment Isolation Valve	Level 2	Fails to Close
129	DE	MV005	Radioactive Drain System - Containment Isolation Valve	LPSD Fire Level 2	Fails to Close
130	DG	EDG A	Emergency Diesel Generator A	Level 1, Level 2, LPSD, Fire, Seismic	Fails to Start Fails to Run
131	DG	EDG B	Emergency Diesel Generator B	Level 1, Level 2, LPSD, Fire, Seismic	Fails to Start Fails to Run
132	DG	EDG C	Emergency Diesel Generator C	Level 1, Level 2, LPSD, Fire, Seismic	Fails to Start Fails to Run
133	DG	EDG D	Emergency Diesel Generator D	Level 1, Level 2, LPSD, Fire, Seismic	Fails to Start Fails to Run
134	DO	PP01A	Diesel Fuel Oil Transfer Pump 1A	Level 1, Level 2, Seismic	Fails to Start Fails to Run
135	DO	PP01B	Diesel Fuel Oil Transfer Pump 1B	Level 1, Level 2, Seismic	Fails to Start Fails to Run
136	DO	PP01C	Diesel Fuel Oil Transfer Pump 1C	Level 1, Level 2, Seismic	Fails to Start
137	DO	PP01D	Diesel Fuel Oil Transfer Pump 1D	Level 1, Level 2, Seismic	Fails to Run
138	DO	PP02A	Diesel Fuel Oil Transfer Pump 2A	Level 1, Level 2, Seismic	Fails to Start
139	DO	PP02B	Diesel Fuel Oil Transfer Pump 2B	Level 1, Level 2, Seismic	Fails to Run
140	DO	PP02C	Diesel Fuel Oil Transfer Pump 2C	Level 1, Level 2, Seismic	Fails to Start
141	DO	PP02D	Diesel Fuel Oil Transfer Pump 2D	Level 1, Level 2, Seismic	Fails to Run
142	DO	CV1005A	Diesel Fuel Oil Transfer Pump 1A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
143	DO	CV1005B	Diesel Fuel Oil Transfer Pump 1B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
144	DO	CV1005C	Diesel Fuel Oil Transfer Pump 1C Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open

Table 17.4-1 (10 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]	Failure Mode
145	DO	CV1005D	Diesel Fuel Oil Transfer Pump 1D Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
146	DO	CV1007A	Diesel Fuel Oil Transfer Pump 2A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
147	DO	CV1007B	Diesel Fuel Oil Transfer Pump 2B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
148	DO	CV1007C	Diesel Fuel Oil Transfer Pump 2C Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
149	DO	CV1007D	Diesel Fuel Oil Transfer Pump 2D Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
150	DO	LS3025A	Diesel Fuel Oil Day Tank Level Switch	Fire	Fails to Operate
151	DO	LS3025B	Diesel Fuel Oil Day Tank Level Switch	Fire	Fails to Operate
152	DO	LS3025C	Diesel Fuel Oil Day Tank Level Switch	Fire	Fails to Operate
153	DO	LS3025D	Diesel Fuel Oil Day Tank Level Switch	Fire	Fails to Operate
154	DO	TK01A	Diesel Fuel Oil Storage Tank A	Level 1, Level 2, Fire, Seismic	Rupture
155	DO	TK01B	Diesel Fuel Oil Storage Tank B	Level 1, Level 2, Fire, Seismic	Rupture
156	DO	TK01C	Diesel Fuel Oil Storage Tank C	Level 1, Level 2, Fire, Seismic	Rupture
157	DO	TK01D	Diesel Fuel Oil Storage Tank D	Level 1, Level 2, Fire, Seismic	Rupture
158	DP	HS071A	Diverse Protection System Manual Trip Push Button	ATWS, Expert Panel	Fails to Operate
159	DP	HS071B	Diverse Protection System Manual Trip Push Button	ATWS, Expert Panel	Fails to Operate
160	DP	PLC1	Diverse Protection System Signal Processor	ATWS, Expert Panel	Fails to Operate
161	DP	PLC2	Diverse Protection System Signal Processor	ATWS, Expert Panel	Fails to Operate

Table 17.4-1 (11 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
162	FP	055-05-FP-X	4 in and 6 in Fire Protection System piping in stairwell 055-A05D	Flood	Break
163	FP	78-01D-FP-M	4 to 8 in Fire Protection System piping in room 078-A01D	Flood	Break
164	FP	78-10C-FP-M	4 to 8 in Fire Protection System piping in room 078-A10C	Flood	Break
165	FP	78-19A-FP-M	2.5 to 8 in Fire Protection System piping in room 078-A19A	Flood	Break
166	FP	78-19A-FP-X	2.5 to 8 in Fire Protection System piping in room 078-A19A	Flood	Break
167	FP	78-19B-FP-X	1 to 8 in Fire Protection System piping in room 078-A19B	Flood	Break
168	FP	78-31A-FP-M	4 in and 8 in Fire Protection System piping in room 078-A31A	Flood	Break
169	FP	78-31A-FP-X	4 in and 8 in Fire Protection System piping in room 078-A31A	Flood	Break
170	FP	78-44B-FP-X	2 to 8 in Fire Protection System piping in room 078-A44B	Flood	Break
171	FP	100-10B-FP-X	3 in and 8 in Fire Protection System piping in room 078-A10B	Flood	Break
172	FP	100-20A-FP-X	2.5 in to 12 in Fire Protection System piping in room 100-A20A	Flood	Break
173	FP	100-22A-FP-X	4 in and 6 in Fire Protection System piping in room 100-A22A	Flood	Break
174	FP	100-37B-FP-X	2.5 in to 4 in Fire Protection System piping in room 100-A37B	Flood	Break
175	FP	120-11B-FP-X	8 in Fire Protection System piping in room 120-A11B	Flood	Break
176	FP	137-09C-FP-X	4 to 8 in Fire Protection System piping in room 137-A09C	Flood	Break
177	FP	137-13B-FP-M	1 in and 1.5 in Fire Protection System piping in room 137-A13B	Flood	Break
178	FP	137-29B-FP-X	4 to 8 in Fire Protection System piping in room 137-A29B	Flood	Break

Table 17.4-1 (12 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]	Failure Mode
179	FW	CV1026	Startup Feedwater Pump Discharge Check Valve	Level 1	Fails to Open
180	FW	MP07	Startup Feedwater Pump	Level 1, Level 2	Fails to Start Fails to Run
181	FW	MV093	Startup Feedwater Pump Discharge Isolation Valve	Level 1	Fails to Open
182	FW	ZV058	Startup Feedwater Pump Discharge Stop Check Valve	Level 1	Fails to Open
183	GW	SV002	Gaseous Radwaste System - Containment Isolation Valve	Level 2	Fails to Close
184	GW	-	Key SSCs in Gaseous Waste Management System	Expert Panel	Fails to Operate
185	HG	PAR	Passive Autocatalytic Recombiners	Level 2	Fails to Operate
186	HG	Igniter	Hydrogen Igniters	Expert Panel	Fails to Operate
187	IP	IN01A	Class 1E 120 V Alternating Current Inverter 1A	Level 1, Level 2, Fire, Seismic	Fails to Operate
188	IP	IN01B	Class 1E 120 V Alternating Current Inverter 1B	Level 1, Level 2, Fire, Seismic	Fails to Operate
189	IP	IN01C	Class 1E 120 V Alternating Current Inverter 1C	Level 1, Level 2, Fire, Seismic	Fails to Operate
190	IP	IN01D	Class 1E 120 V Alternating Current Inverter 1D	Level 1, Level 2, Fire, Seismic	Fails to Operate
191	IW	CFS Valves - MV001/002 /003/004	Cavity Flooding System Isolation Valves	Level 2	Fails to Open
192	MS	MSIV- EV011, EV012, EV013, EV014	Main Steam Isolation Valves	Level 1, Level 2	Fails to Close
193	MS	MSSV- 1301/1303/1305/1307/1309/ 1302/1304/1306/1308/1310/ 1311/1313/1315/1317/1319/ 1312/1314/1316/1318/1320	Main Steam Safety Valves	Level 1, Level 2	Fails to Open

RAI 316-8305 - Question 17.04-1

Table 17.4-1 (13 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]
194	MS	AOV109/110	Auxiliary Feedwater Pump Turbine Steam Supply Valves	Level 1, Level 2
195	NB	SW01M	Non-1E 4.16 kV Switchgear	Level 1, Level 2
196	NB	SW02N	Non-1E 4.16 kV Switchgear	Level 1, Level 2
197	NB	SW03N-F2	Non-1E 4.16 kV Switchgear Circuit Breaker	Level 1, Level 2
198	NB	SW03N-G2	Non-1E 4.16 kV Switchgear Circuit Breaker	Level 1, Level 2
199	NG	LC05N	Non-1E 480 V Load Center	Level 1, Level 2
200	NG	LC10M	Non-1E 480 V Load Center	Level 1, Level 2
201	NG	TR05N	Non-1E 480 V Load Center Transformer	Level 1, Level 2
202	NG	TR10M	Non-1E 480 V Load Center Transformer	Level 1, Level 2
203	NH	MC03M	Non-1E 480 V Motor Control Center	Level 1, Level 2
204	NH	MC20N	Non-1E 480 V Motor Control Center	Level 1, Level 2
205	NP	SW02N	Non-1E 13.8 kV Switchgear Bus	Level 1
206	NP	TR02M	Standby Auxiliary Transformer	Fire
207	NP	TR02N	Standby Auxiliary Transformer	Fire
208	PF	SW01A	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
209	PF	SW01B	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
210	PF	SW01C	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
211	PF	SW01D	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
212	PF	SW01A-H2	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire

Failure Mode
Fails to Open
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Open

Table 17.4-1 (14 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]	Failure Mode
213	PF	SW01B-H2	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire	Fails to Open
214	PF	SW01C-C2	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire	Fails to Open
215	PF	SW01D-G2	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire	Fails to Open
216	PF	SW01A-A2	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire	Fails to Close Fails to Open
217	PF	SW01B-A2	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire	Fails to Close Fails to Open
218	PF	SW01C-A2	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire	Fails to Close Fails to Open
219	PF	SW01D-J2	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire	Fails to Close Fails to Open
220	PF	SW01A-G2	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2	Fails to Close
221	PF	SW01B-B2	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2	Fails to Close
222	PF	SW01C-E2	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2	Fails to Close
223	PF	SW01D-D2	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2	Fails to Close
224	PG	LC01A	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
225	PG	LC01B	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate

Table 17.4-1 (15 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]	Failure Mode
226	PG	LC01C	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
227	PG	LC01D	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
228	PG	LC02	Class 1E 480 V Load Center	Level 1, Seismic	Fails to Operate
229	PG	LC02A	Class 1E 480 V Load Center	Fire	Fails to Operate
230	PG	LC02B	Class 1E 480 V Load Center	Fire	Fails to Operate
231	PG	LC02C	Class 1E 480 V Load Center	Fire	Fails to Operate
232	PG	LC02D	Class 1E 480 V Load Center	Fire	Fails to Operate
233	PG	TR01A	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
234	PG	TR01B	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
235	PG	TR01C	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
236	PG	TR01D	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic	Fails to Operate
237	PG	TR02A	Class 1E 480 V Load Center Transformer	Fire	Fails to Operate
238	PG	TR02B	Class 1E 480 V Load Center Transformer	Fire	Fails to Operate
239	PG	TR02C	Class 1E 480 V Load Center Transformer	Fire	Fails to Operate
240	PG	TR02D	Class 1E 480 V Load Center Transformer	Fire	Fails to Operate
241	PH	MC01A	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic	Fails to Operate
242	PH	MC01B	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic	Fails to Operate
243	PH	MC01C	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic	Fails to Operate
244	PH	MC01D	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic	Fails to Operate
245	PH	MC02A	Class 1E 480 V Motor Control Center	Fire, Seismic	Fails to Operate

Table 17.4-1 (16 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]
246	PH	MC02B	Class 1E 480 V Motor Control Center	Fire, Seismic
247	PH	MC02C	Class 1E 480 V Motor Control Center	Fire, Seismic
248	PH	MC02D	Class 1E 480 V Motor Control Center	Fire, Seismic
249	PH	MC03A	Class 1E 480V Motor Control Center	Fire, Seismic
250	PH	MC03B	Class 1E 480 V Motor Control Center	Fire, Seismic
251	PH	MC03C	Class 1E 480 V Motor Control Center	Fire, Seismic
252	PH	MC03D	Class 1E 480 V Motor Control Center	Fire, Seismic
253	PH	MC04C	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
254	PH	MC04D	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
255	PH	MC05A	Class 1E 480 V Motor Control Center	Fire, Seismic
256	PH	MC05B	Class 1E 480 V Motor Control Center	Fire, Seismic
257	PS	AV031,AV032, AV033,AV034	Process Sampling System - Containment Isolation Valve	LPSD Fire Level 2
258	RC	MV130/131, MV132/133, MV134/135, MV136/137	POSRV Pilot Valves	Seismic
259	RC	POSRVs V200, V201, V202, V203	Pressurizer Pilot Operated Safety Relief Valves	Level 1, Level 2, Seismic
260	RC	PT102A/B/C/D	Pressurizer Low Pressure Transmitters	Fire
261	RG	SOV410/412	Pressurizer Gas Vent Line Isolation Valves	Expert Panel
262	RG	SOV411/413	Pressurizer Gas Vent Line Isolation Valves	Expert Panel

Failure Mode
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Close
Fails to Open
Fails to Open
Fails to Operate
Fails to Close
Fails to Close

Table 17.4-1 (17 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]
263	RG	SOV415/417	Reactor Vessel Gas Vent Line Isolation Valves	Expert Panel
264	RG	SOV414/416	Reactor Vessel Gas Vent Line Isolation Valves	Expert Panel
265	RG	SOV418	Reactor Vessel Gas Vent Line Reactor Drain Tank Discharge Isolation Valve	Expert Panel
266	RG	SOV419/420	Reactor Vessel Gas Vent Line In-Containment Refueling Water Storage Tank Discharge Isolation Valves	Expert Panel
267	RP	TCB-A1/B1/C1/D1	Reactor Trip Circuit Breakers A1/B1/C1/D1	Level 1, ATWS
268	RP	TCB-A2/B2/C2/D2	Reactor Trip Circuit Breakers A2/B2/C2/D2	Level 1, ATWS
269	SI	CV100	Safety Injection Pump 2A/2C In-Containment Refueling Water Storage Tank Return Line Check Valve	Level 1, Level 2, Fire
270	SI	CV101	Safety Injection Pump 2B/2D In-Containment Refueling Water Storage Tank Return Line Check Valve	Level 1, Level 2, Fire
271	SI	CV113	Safety Injection Pump 2D Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
272	SI	CV123	Safety Injection Pump 2B Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
273	SI	CV133	Safety Injection Pump 2C Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
274	SI	CV143	Safety Injection Pump 2A Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
275	SI	CV157	Containment Spray Pump 1A In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Level 2, Fire

Failure Mode
Fails to Close
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open

Table 17.4-1 (18 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]	Failure Mode
276	SI	CV158	Containment Spray Pump 1B In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Level 2, Fire	Fails to Open
277	SI	CV159	Shutdown Cooling Pump 1A In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Fire	Fails to Open
278	SI	CV160	Shutdown Cooling Pump 1B In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Fire	Fails to Open
279	SI	CV168	Shutdown Cooling Heat Exchanger 1B Discharge Line Check Valve	Expert Panel	Fails to Open
280	SI	CV178	Shutdown Cooling Heat Exchanger 1A Discharge Line Check Valve	Expert Panel	Fails to Open
281	SI	CV217	Safety Injection Line Check Valve - DVI Nozzle 1B	Level 1, Level 2, LPSD, Fire	Fails to Open
282	SI	CV227	Safety Injection Line Check Valve - DVI Nozzle 2B	Level 1, Level 2, LPSD, Fire	Fails to Open
283	SI	CV237	Safety Injection Line Check Valve - DVI Nozzle 2A	Level 1, Level 2, LPSD, Fire	Fails to Open
284	SI	CV247	Safety Injection Line Check Valve - DVI Nozzle 1A	Level 1, Level 2, LPSD, Fire	Fails to Open
285	SI	CV404	Safety Injection Pump 2A Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
286	SI	CV405	Safety Injection Pump 2B Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
287	SI	CV446	Safety Injection Pump 2D Discharge Check Valve	Level 1, Level 2, Fire	Fails to Open
288	SI	CV424	Safety Injection Pump 2A Mini-flow Line Check Valve	Level 1, Level 2, Fire	Fails to Open
289	SI	CV426	Safety Injection Pump 2B Mini-flow Line Check Valve	Level 1, Level 2, Fire	Fails to Open
290	SI	CV448	Safety Injection Pump 2D Mini-flow Line Check Valve	Level 1, Level 2, Fire	Fails to Open

Table 17.4-1 (19 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)
291	SI	CV451	Safety Injection Pump 2C Mini-flow Line Check Valve	Level 1, Level 2, Fire
292	SI	CV540	Safety Injection Pump 2D Discharge Check Valve	Level 1, LPSD, Fire
293	SI	CV541	Safety Injection Pump 2B Discharge Check Valve	Level 1, LPSD, Fire
294	SI	CV542	Safety Injection Pump 2C Discharge Check Valve	Level 1, LPSD, Fire
295	SI	CV543	Safety Injection Pump 2A Discharge Check Valve	Level 1, LPSD, Fire
296	SI	CV568	Shutdown Cooling Pump 1A Discharge Check Valve	Level 1, Fire
297	SI	CV569	Shutdown Cooling Pump 1B Discharge Check Valve	Level 1, Fire
298	SI	PP01A	Shutdown Cooling Pump 1A	Level 1, Level 2, LPSD, Fire, Seismic
299	SI	PP01B	Shutdown Cooling Pump 1B	Level 1, Level 2, LPSD, Fire, Seismic
300	SI	HE01A	Shutdown Cooling Heat Exchanger 1	LPSD, Seismic
301	SI	HE01B	Shutdown Cooling Heat Exchanger 2	LPSD, Seismic
302	SI	HE02A	Shutdown Cooling Mini-flow Line Heat Exchanger 1	Seismic
303	SI	HE02B	Shutdown Cooling Mini-flow Line Heat Exchanger 2	Seismic
304	SI	PP02A	Safety Injection Pump 2A	Level 1, Level 2, LPSD, Fire, Seismic
305	SI	PP02B	Safety Injection Pump 2B	Level 1, Level 2, LPSD, Fire, Seismic
306	SI	PP02C	Safety Injection Pump 2C	Level 1, Level 2, LPSD, Fire, Seismic
307	SI	PP02D	Safety Injection Pump 2D	Level 1, Level 2, LPSD, Fire, Seismic
308	SI	MV616	Safety Injection Pump 2D Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
309	SI	MV626	Safety Injection Pump 2B Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire

Failure Mode
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Operate
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Open
Fails to Open

Table 17.4-1 (20 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)
310	SI	MV636	Safety Injection Pump 2C Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
311	SI	MV646	Safety Injection Pump 2A Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
312	SI	MV302	Safety Injection Pump 2A/2C Mini-flow Line Isolation Valve	Fire
313	SI	MV303	Safety Injection Pump 2B/2D Mini-flow Line Isolation Valve	Fire
314	SI	MV395	Safety Injection Pump 2A/2C Mini-flow Line Isolation Valve	Fire
315	SI	MV308	In-Containment Refueling Water Storage Tank Suction Line Isolation Valve	LPSD Level 2
316	SI	MV309	In-Containment Refueling Water Storage Tank Suction Line Isolation Valve	LPSD Level 2
317	SX	PP01A	Essential Service Water Pump 1A	Level 1, Level 2, Fire, Seismic
318	SX	PP01B	Essential Service Water Pump 1B	Level 1, Level 2, Fire, Seismic
319	SX	PP02A	Essential Service Water Pump 2A	Level 1, Level 2, Fire, Seismic
320	SX	PP02B	Essential Service Water Pump 2B	Level 1, Level 2, Fire, Seismic
321	SX	CV1001	Essential Service Water Pump 1A Discharge Check Valve	Level 1, Level 2, Fire
322	SX	CV1002	Essential Service Water Pump 1B Discharge Check Valve	Level 1, Level 2, Fire
323	SX	CV1003	Essential Service Water Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
324	SX	CV1004	Essential Service Water Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
325	SX	FT01A, FT01B, FT02A, FT02B, FT03A, FT03B	Essential Service Water Debris Filters	Level 1, Level 2, Fire, LPSD Fire, LPSD Fire Level 2

Failure Mode
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Operate

Table 17.4-1 (21 of 28)

Index	System [(1)]	SSC ID	SSC Description	Within-Scope Basis [(2)]
326	SX	MV071	Ultimate Heat Sink Cooling Tower 1A Discharge Line Control Valve	Level 1, Level 2
327	SX	MV072	Ultimate Heat Sink Cooling Tower 1A Discharge Line Bypass Valve	Level 1, Level 2
328	SX	MV073	Ultimate Heat Sink Cooling Tower 1B Discharge Line Control Valve	Level 1, Level 2
329	SX	MV074	Ultimate Heat Sink Cooling Tower 1B Discharge Line Bypass Valve	Level 1, Level 2
330	SX	AH01A	Ultimate Heat Sink Cooling Tower Fan 1A	Level 1, Level 2, Fire
331	SX	AH01B	Ultimate Heat Sink Cooling Tower Fan 1B	Level 1, Level 2, Fire
332	SX	AH02A	Ultimate Heat Sink Cooling Tower Fan 2A	Level 1, Level 2, Fire
333	SX	AH02B	Ultimate Heat Sink Cooling Tower Fan 2B	Level 1, Level 2, Fire
334	VD	HV12A	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant A	Level 1, Level 2, LPSD, Fire, Seismic
335	VD	HV12B	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant B	Level 1, Level 2, LPSD, Fire, Seismic
336	VD	HV12C	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant C	Level 1, Level 2, LPSD, Fire, Seismic
337	VD	HV12D	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant D	Level 1, Level 2, LPSD, Fire, Seismic
338	VD	HV13A	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant A	Level 1, Level 2, LPSD, Fire, Seismic
339	VD	HV13B	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant B	Level 1, Level 2, LPSD, Fire, Seismic
340	VD	HV13C	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant C	Level 1, Level 2, LPSD, Fire, Seismic

Failure Mode
Fails to Open
Fails to Open
Fails to Open
Fails to Open
Fails to Run
Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run

Table 17.4-1 (22 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]
341	VD	HV13D	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant D	Level 1, Level 2, LPSD, Fire, Seismic
342	VK	Y1301A	Auxiliary Building Controlled Area I Emergency Core Cooling System Equipment Room Air Cleaning Unit Exhaust Damper	Seismic
343	VK	Y1301B	Auxiliary Building Controlled Area II Emergency Core Cooling System Equipment Room Air Cleaning Unit Exhaust Damper	Seismic
344	VO	HV31A	Essential Chiller 1A Room Cubicle Cooler	Level 1, Level 2
345	VO	HV31B	Essential Chiller 1B Room Cubicle Cooler	Level 1, Level 2
346	VO	HV32A	Essential Chiller 2A Room Cubicle Cooler	Level 1, Level 2
347	VO	HV32B	Essential Chiller 2B Room Cubicle Cooler	Level 1, Level 2
348	VO	HV33A	Auxiliary Feedwater Motor-Driven Pump 2A Room Cubicle Cooler	Level 1, Level 2, Fire
349	VO	HV33B	Auxiliary Feedwater Motor-Driven Pump 2B Room Cubicle Cooler	Level 1, Level 2, Fire
350	VO	TE085A	Auxiliary Feedwater Motor-Driven Pump 2A Room Temperature Transmitter	Level 1, Level 2, Fire
351	VO	TE086B	Auxiliary Feedwater Motor-Driven Pump 2B Room Temperature Transmitter	Level 1, Level 2, Fire
352	VQ	2014/2016 /2024	Reactor Containment Building Purge System – Leak Rate Test Line Valves	Level 2, LPSD Fire Level 2
353	WM	VV1201A	Raw Water Pump Supply Isolation Manual Valve	Level 1, Level 2
354	WM	VV1205	Raw Water Pump Discharge Isolation Manual Valve	Level 1, Level 2
355	WM	VV1220	Raw Water Pump Discharge Isolation Manual Valve	Level 1, Level 2

Failure Mode
Fails to Start Fails to Run
Fails to Open
Fails to Open
Fails to Run
Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Start Fails to Run
Fails to Operate
Fails to Operate
Fails to Close
Fails to Open
Fails to Open
Fails to Open

Table 17.4-1 (23 of 28)

Index	System [1]	SSC ID	SSC Description	Within-Scope Basis [2]	Failure Mode
356	WM	VV1700	Raw Water Pump Discharge Isolation Manual Valve	Level 1, Level 2	Fails to Open
357	WO	PP01A	Essential Chilled Water Pump 1A	Level 1, Level 2, Fire, Seismic	Fails to Run
358	WO	PP01B	Essential Chilled Water Pump 1B	Level 1, Level 2, Fire, Seismic	Fails to Run
359	WO	PP02A	Essential Chilled Water Pump 2A	Level 1, Level 2, Fire, Seismic	Fails to Start Fails Run
360	WO	PP02B	Essential Chilled Water Pump 2B	Level 1, Level 2, Fire, Seismic	Fails to Start Fails to Run
361	WO	CV1010A	Essential Chilled Water Pump 1A Discharge Check Valve	Level 1, Fire	Fails to Open Fails to Close
362	WO	CV1010B	Essential Chilled Water Pump 1B Discharge Check Valve	Level 1, Fire	Fails to Open Fails to Close
363	WO	CV1014A	Essential Chilled Water Pump 2A Discharge Check Valve	Level 1, Fire	Fails to Open Fails to Close
364	WO	CV1014B	Essential Chilled Water Pump 2B Discharge Check Valve	Level 1, Fire	Fails to Open Fails to Close
365	WO	CH01A	Essential Chilled Water Chiller 1A (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire	Fails to Start Fails to Run
366	WO	CH01B	Essential Chilled Water Chiller 1B (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire	Fails to Start Fails to Run
367	WO	CH02A	Essential Chilled Water Chiller 2A (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire	Fails to Start Fails to Run
368	WO	CH02B	Essential Chilled Water Chiller 2B (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire	Fails to Start Fails to Run
369	WO	TK01A	Essential Chilled Water Compression Tank 1A	Level 1, Level 2, Flood, Fire	Rupture
370	WO	TK01B	Essential Chilled Water Compression Tank 1B	Level 1, Level 2, Flood, Fire	Rupture
371	WO	TK02A	Essential Chilled Water Air Separator Tank 2A	Level 1, Level 2, Flood, Fire	Rupture

Table 17.4-1 (24 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
372	WO	TK02B	Essential Chilled Water Air Separator Tank 2B	Level 1, Level 2, Flood, Fire	Rupture
373	FP	-	Fire Protection Pumps and Associated SSCs	Fire Protection, Expert Panel	Fails to Start Fails to Run
374	Light Load Handling System	-	Key SSCs in Light Load Handling System	Expert Panel	Fails to Operate
375	Liquid Waste Management System	-	Key SSCs in Liquid Waste Management System	Expert Panel	Fails to Operate
376	Control Room HVAC System	-	Main Control Room Air Handling Units and Air Cleaning Unit	Expert Panel	Fails to Operate
377	Emergency Containment Spray Backup System	-	Key SSCs in Emergency Containment Spray Backup System	LPSD Level 2, LPSD Fire Level 2	Fail to Operate
378	VG	ESW Pump Room Cooling	Key SSCs in Essential Service Water Pump Room Cooling Function	Level 1, Fire, Seismic, LPSD Fire Level 2	Fails to Operate
379	VU	AAC Building Cooling	Key SSCs in Alternate Alternating Current Building Cooling Function	SBO, Expert Panel, LPSD Fire, LPSD Fire Level 2	Fails to Operate
380	EF-Group Controller	PA03A, PA03B, PA03C, PA03D, PA06C, PA06D	Group Controller (Engineered Safety Function Actuation System)	LPSD Fire, LPSD Fire Level 2	Fails to Operate

Table 17.4-1 (25 of 28)

Index	System (1)	SSC ID	SSC Description	Within-Scope Basis (2)	Failure Mode
381	PE-Loop Controller	LX01A, LX02B, LX03A, LX03B, LX03C, LX03D, LX04A, LX04B, LX05A, LX05B	Loop Controller (Engineered Safety Feature - Component Control System)	LPSD Fire, LPSD Fire Level 2	Fails to Operate
382	PE-Loop Controller	LX06A, LX06B, LX09B, LX10A, LX10B	Loop Controller (Engineered Safety Feature - Component Control System)	LPSD Fire Level 2	Fails to Operate
383	-	-	Containment Building	Expert Panel	Fails to Integrity
384	-	-	Containment Equipment Hatch	Level 2	Fails to Isolate
385	-	-	Remote Shutdown Console	Expert Panel	Fails to Operate

REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**316-8305**
SRP Section:	**SRP 17.04**
Application Section:	**17.4**
Date of RAI Issue:	**11/17/2015**

Question No. 17.04-2

SRP Chapter 17.4, Revision 1, Section II, “Acceptance Criteria” states in part, “…The DC application should include the following COL action items ....” The staff reviewed APR1400 DCD Section 17.4, “Reliability Assurance Program,” and found that the section did not include all the COL action items listed in the SRP 17.4 acceptance criteria. Therefore, in order for the staff to reach an assurance finding on the conformance to SRP Chapter 17.4 regarding COL action items, please provide COL action items that follow the guidance in SRP Chapter 17.4, Revision 1 or an alternative to the SRP acceptance criteria, and revise the APR1400 DCD Section 17.4 accordingly.

Response – (Rev.1)

The specific COL action items during the design phase lists is included in Section 17.4.5.

Impact on DCD

DCD Section 17.4 is revised as shown in the response to RAI 17.04-1.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical/Topical/Environmental Reports.