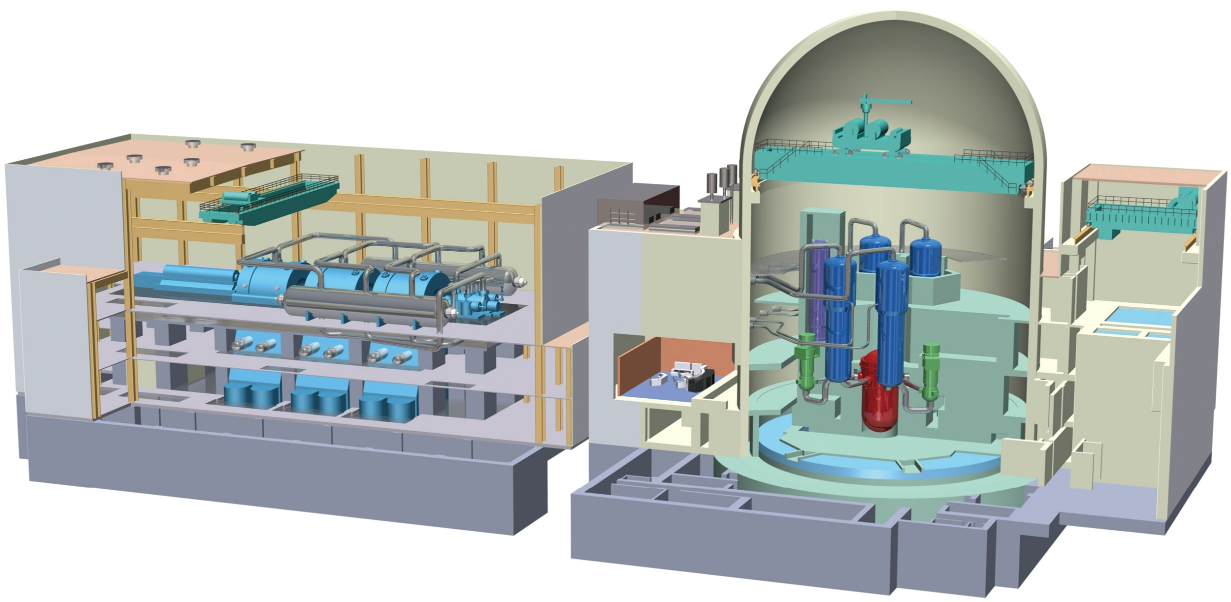
DESIGN CONTROL DOCUMENT FOR THE US-APWR

Chapter 17
Quality Assurance and Reliability Assurance

MUAP- DC017

REVISION 0

DECEMBER 2007



MITSUBISHI HEAVY INDUSTRIES, LTD.

Mitsubishi Heavy Industries, Ltd.

16-5, Konan 2-chome, Minato-ku

Tokyo 108-8215 Japan

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TABLES

ACRONYMS AND ABBREVIATIONS

ac	alternating current
CCF	common cause failure
CCW	component cooling water
CCWS	component cooling water system
CDF	core damage frequency
CFR	Code of Federal Regulations
COL	Combined License
COLA	Combined License Application
DAS	diverse actuation system
dc	direct current
DCD	Design Control Document
D-RAP	design reliability assurance program
DVI	direct vessel injection
ECCS	emergency core cooling system
EFWP	emergency feedwater pit
ESF	engineered safety features
ESWS	essential service water system
FV	Fussell Vesely
FVW	Fussell Vesely worth
HSIS	human-system interface system
HVAC	heating, ventilation, and air conditioning
I&C	instrumentation and control
ITAAC	inspection, test, analysis, and acceptance criteria
kV	kilovolt
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
MHI	Mitsubishi Heavy Industries, Ltd.
MV	megavolt
NESH	Nuclear Energy Systems Headquarters
NRC	U.S. Nuclear Regulatory Commission
O-RAP	operational reliability assurance program
PAM	postaccident monitoring
PCMS	plant control and monitoring system
PRA	probabilistic risk assessment
QA	quality assurance
QAP	quality assurance program

ACRONYMS AND ABBREVIATIONS (Continued)

QAPD	quality assurance program description
RAP	reliability assurance program
RAW	risk achievement worth
RCP	reactor coolant pump
RCS	reactor coolant system
RG	Regulatory Guide
RHR	residual heat removal
RRW	risk reduction worth
RTNSS	regulatory treatment of non-safety-related systems
RWSP	refueling water storage pit
SBO	station blackout
SDV	safety depressurization valve
SG	steam generator
SGTR	steam generator tube rupture
SIS	safety injection system
SRP	Standard Review Plan
SSC	structure, system, and component
US-APWR	United States - Advanced Pressurized Water Reactor
VCT	volume control tank

17.0 QUALITY ASSURANCE AND RELIABILITY ASSURANCE

The General Manager of NESH is responsible for the Design Certification Activities of US-APWR. The major design activities are performed by the Nuclear Energy Systems Engineering Center engineers. QA Program controls governing the activities are specified in QAPD (PQD-HD-19005 Rev.1).

Subcontractors of the Nuclear Energy Systems Engineering Center performing design activities in support of the US-APWR are also required to follow QAPD (PQD-HD-19005 Rev.1) (Ref 17.5.5-4).

17.1 Quality Assurance During the Design Certification Phase

For quality assurance during the design certification phase, see Section 17.5.

17.2 Quality AssuraNce During the Construction and Operations Phase

The Combined License (COL) Applicant is responsible for development of the Construction and Operational Phase Quality Assurance Program.

17.3 Quality Assurance Program Description

For the quality assurance program description during the design certification phase, see Section 17.5.

17.4 Design Reliability Assurance Program

This section presents the US-APWR design reliability assurance program (D-RAP).

17.4.1 New Section 17.4 in the Standard Review Plan

As noted in Item E of SECY 95-132 (Ref. 17.4-1), an applicant for design certification should establish the scope, purpose, objective, and essential elements of an effective D-RAP and would implement those portions of the D-RAP that apply to design certification. A COL Applicant is responsible for augmenting and completing the remainder of the D-RAP to include any site-specific design information and identify the risk-significant SSCs. Once the site-specific D-RAP has been established and the risk-significant SSCs identified, the procurement, fabrication, construction, and preoperational testing can be implemented in accordance with the COL holder's D-RAP or other programs and would be verified using the inspections, test, analyses and acceptance criteria (ITAAC) process.

17.4.2 Introduction

The purposes of the US-APWR RAP are to provide reasonable assurance that: 1) the US-APWR is designed, constructed, and operated in a manner that is consistent with the assumptions and risk insights for the SSCs, 2) the SSCs do not degrade to an unacceptable level during plant operations, 3) the frequency of transients that challenge SSCs is minimized, and 4) the SSCs function reliably when challenged. An additional goal is to facilitate communication between the probabilistic risk assessment (PRA), the design, and the ultimate COL activity.

The PRA evaluates the US-APWR design response to a spectrum of initiating events to ensure that plant damage has a very low probability and that risk to the public is minimized. Risk significant SSCs for the US-APWR design control document (DCD) are identified and made available to the design organization.

The US-APWR D-RAP process is implemented in several phases. Phase I, the Design Certification phase, collects system information and develops a system model. This system information and model is used as input to the design phase PRA, an operating experience review, and a review for external events. The results of each of these activities are provided to an expert panel (EP) which identifies risk significant items using probabilistic, deterministic, and other methods for inclusion in the program. Phase II, the site-specific phase, introduces the plant's site-specific information to the D-RAP process. During Phase II, the site-specific SSCs are combined with the US-APWR design SSCs into a list for the specific plant. Phase III, the last phase of the D-RAP, implements the procurement, fabrication, construction, and preoperational testing in accordance with the site-specific D-RAP. The site-specific list of SSCs is also provided as an input to the operational phase of RAP (O-RAP) which addresses the specific plant operation and maintenance activities. The designer, MHI, is responsible for Phase I of the D-RAP. Phases II and III of the D-RAP and the O-RAP are the responsibility of the COL Applicant. The COL Applicant will specify the policy and implement procedures to address the specific plant operation and maintenance activities associated with the risk-significant SSCs identified by the D-RAP.

17.4.3 Scope

The US-APWR D-RAP identifies risk-significant SSCs and provides risk insights and reliability assumptions for aspects of plant operation, maintenance, and performance monitoring to be addressed to ensure safe, reliable plant operation or mitigate plant transients or other events that could present a risk to the public. The risk-significant SSCs are identified using PRA, deterministic, or other methods of analysis, including industry experience, and expert panels.

17.4.4 Quality Controls

a. Organization

General Manager, US-APWR project: The General Manager, US-APWR project is overall responsible for the establishment of and implementation of the US-APWR D-RAP. In this regard, the GM or his designated representative is responsible to assure all affected organizations are aware of the D-RAP, its purpose, and the requirements herein.

General Manager, Reactor and Plant Safety: The General Manager, Reactor and Plant Safety, is responsible for the use of the PRA results and risk insights for the Expert Panel, and for the conduct and coordination of the Expert Panel. The Reactor and Plant Safety organization includes the risk and reliability organization.

General Manager, QA: The General Manager, QA is responsible to assure proper implementation of QA program elements. This includes design control, procedures and instructions, records, corrective actions and audits pertaining to the D-RAP.

General Managers, Design Engineering: The General Managers, Design Engineering, are responsible to implement this D-RAP and specifically to assure that the US-APWR is designed consistent with the reliability assumptions and insights of the PRA for risk-significant SSCs.

The risk and reliability organization is responsible to ask the related design engineering sections to review key assumptions and to feed back their comments to ensure key assumptions are realistic and achievable.

The risk and reliability organization is responsible to provide the RAP related inputs in the design process by participating in the design change process.

The risk and reliability organization is also responsible to involve in the design review.

b. Design Control

The list of risk-significant SSCs for the D-RAP and its key assumptions shall be maintained by the risk and reliability organization. The list and changes thereof shall be approved by the Expert Panel and be provided to design engineering and QA staff working on the US-APWR project.

The risk and reliability organization shall ensure that the design engineers are provided the list of risk-significant SSCs for the D-RAP and its key assumption. The Design engineers shall take into account the list of the risk-significant SSCs for the D-RAP and its key assumptions in their design activities and give some feedback to the risk and reliability organization in order to ensure that the key assumptions are realistic and achievable, if necessary.

c. Procedures and Instructions

General Manager, US-APWR project or his designated representative has prepared the procedures and instructions used in implementation of the D-RAP. General Manager, US-APWR project is responsible for development and verification of implementation of the D-RAP, and for assuring all affected MHI organizations are aware of the D-RAP.

d. Records

Records related to the D-RAP which are required to be maintained include the following:

- List of Risk-Significant SSCs
- Expert Panel meeting minutes/summaries
- Other quality assurance program records in accordance with the US-APWR QAPD for design certification.

e. Corrective action

Deficiencies identified where design documents address SSC reliability assumptions which are not compatible with the reliability assumptions of the PRA, or are not achievable or are unrealistic shall be entered into the corrective action program (CAP) system and addressed appropriately. The CAP utilized to support the QAPD can be used to implement the corrective actions related to the RAP.

f. Audit

Audit plans shall include for consideration, sampling the effectiveness of implementation of RAP implementation procedure. Audits shall consider several key aspects of the RAP including the identification of risk-significant SSCs, whether design and procurement information is consistent with the risk insights from the PRA, and whether assumed equipment reliability is determined to be practicable or achievable.

17.4.5 Integration into Existing Operational Programs

The US-APWR D-RAP is a source to other administrative and operational programs. Certain risk-significant SSCs identified in the D-RAP are included in existing operational programs such as the technical specifications surveillance requirements and provide assurance that the reliability values assumed in the PRA will be maintained throughout the plant life. The O-RAP implements the measures that yield the significant improvements in the PRA through the plant's existing programs for maintenance or QA. Implementation of the Maintenance Rule requirements contained in 10CFR50.65 (Ref.

17.4-2) is an example of how the plant could address the enhanced treatment of certain SSCs in the O-RAP. Per SECY 95-132, the COL Applicant may meet most of the objectives of the O-RAP via existing programs such as maintenance rule, in-service testing, and QA. The COL Applicant must address non-safety risk significant SSCs.

17.4.6 Operating Experience

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

The review of operating experience investigates situations where previous failures of components in similar design applications have led to functional failures of SSCs. The review of operating experiences is not limited to hardware failure but also extends to situations where human performance led to functional failures of SSCs of a similar system design. As an example, the US-APWR design improves reliability and eliminates required operator actions to switch over from injection to recirculation typical in conventional PWRs.

17.4.7 Phase I of the D-RAP

As discussed in Section 17.4.2, Phase I of the D-RAP includes the initial identification of SSCs to be included in the program, implementation of the aspects applicable to design efforts, and definition of the scope, requirements, and implementation options to be included in the later phases.

17.4.7.1 SSCs Identification

During the US-APWR design phase, risk significant SSCs are identified for inclusion in the scope of the D-RAP. A list of risk significant SSCs is developed and controlled as a 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 discussion on PRA, refer to Chapter 19, Section 19.1, of this DCD. The PRA is used to identify risk significant SSCs based on risk achievement worth (RAW) and Fussell-Vesely Worth (FVW). For further information, see Chapter 19, Section 19.1.7.4 of this DCD. The list of risk significant SSCs identified during the design phase is updated when the plant-specific PRA is developed. In addition to the PRA input, information from operating experience of Japanese design plants, as well as US industry experience is considered for identification of risk significant SSCs. A third source in the D-RAP process for identifying risk significant SSCs is the use of an EP consisting of representatives from Design Engineering, PRA, as well as other highly qualified individuals with operations, and maintenance experience who are independent of the PRA Section. As part of the D-RAP process, the PRA analytical results, operating experience, and an EP process are combined to develop a comprehensive list of risk significant SSCs.

17.4.7.2 Expert Panel

An EP, consisting of highly qualified representatives of Reliability and PRA Engineering, as well as representatives independent of the PRA process from Design and Plant Engineering is responsible for the final selection of the SSCs included in the D-RAP. Industry operating experience when it can be applied to assessing risk significance, and engineering judgment are employed in considering the addition of SSCs to the D-RAP. Each voting member of the RAP Expert Panel should have proper level education and experience, or receives a written justification from the Expert Panel Chairman:

17.4.7.3 Phase I D-RAP Implementation and SSCs included

The implementation of the Phase I D-RAP is the responsibility of MHI as it applies to the reactor design process. The SSCs included in this phase are listed in Table 17.4-1.

Table 17.4-1 Risk significant SSCs (sheet 1 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
	Accumulator injection system	
Discharge line secondary isolation check valve train A through D [VLV-102A (B,C,D)]	RAW/CCF	The accumulator provides safety injection function for refill and re-flooding of the reactor vessel following a loss of coolant accident (LOCA). Also provides negative reactivity to shutdown the reactor. Single failure of any SSCs listed here has potential to cause failure of its dedicated train to inject coolant to RCS.
Boundary check valve train A through D (Discharge line) [VLV-103A (B,C,D)]	RAW/CCF	
Discharge line isolation motor operated valve train A through D [VLV-101A (B,C,D)]	RAW	
Discharge line orifice train A through D [R006A (B,C,D)]	RAW	
Piping of discharge line train A through D	RAW	
A～D-Accumulator [SIS-CTK-001A (B,C,D)]	EJ	

Table 17.4-1 Risk significant SSCs (sheet 2 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Chemical and volume control system (CVCS)		
Charging line air operated valves [AOV-146], [FCV-138], [AOV-159]	RAW/LPSD	The CVCS maintains appropriate volume and quality of reactor coolant for the primary reactor coolant system, adjusts boron concentration for the chemical shim control, and supplies seal water to the reactor coolant pump seals, and disposes borated water discharged from the primary reactor coolant system. RCP seal water injection provided by the CVCS is an essential function to prevent RCP seal LOCA under loss of CCW conditions. When loss of CCW occurs, either the fire suppression system or the non-essential chilled water system is connected to the charging pump cooling line. Thus, the RC P seal water injection is maintained under loss of CCW conditions. Since CVCS is not completely separated in trains, large external leak from SSCs that result in loss of inventory is assumed to result in degradation or failure of the system. Accordingly, SSCs that has the potential of large leak are risk significant.
RCP seal cooling injection line air operated valves [FCV-140], [AOV-165]	RAW	
Auxiliary spray injection line air operated valve [AOV-155]	RAW/LPSD	
A,B-Charging pump [CVS-RPP-001A (B)]	RAW/CCF/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 3 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
Volume control tank discharge line check valve [VLV-125]	RAW/LPSD	SSCs that have potential to cause common cause failure s among multiple trains are also important. Such common cause failure results in loss of redundant SSCs. During low power and shutdown operation, CVCS provides RCS make up function. On low VCT level, suction is switched from the VCT to the refueling water auxiliary tank, which is supplied by the refueling water storage pit. Low-pressure letdown line isolation valves are automatically closed and the CVCS is isolated from the RHRS with receiving the RCS loop low-level signal to prevent loss of RCS inventory at mid-loop operation. When these valves are not closed, loss of a RCS inventory is prevented by manually closing the air-operated valve at the downstream of these valves.
Volume control tank discharge line motor operated valves [LCV-121B], [LCV-121C]	RAW/LPSD	
RWS refueling water auxiliary tank discharge line check valve [VLV-595]	RAW/LPSD	
RWS refueling water auxiliary tank discharge line manual valve [VLV-591]	RAW/LPSD	
Charging pump minimum flow line check valves [VLV-129A (B)]	RAW/LPSD	
Charging pump discharge line check valves [VLV-131A (B)]	RAW/LPSD	
Charging line containment isolation check valve [VLV-153]	RAW/LPSD	
Charging line isolation check valve [VLV-160]	RAW/LPSD	
Charging line boundary isolation check valve [VLV-161]	RAW/LPSD	
RCP seal water injection line boundary isolation check valves [VLV-182A (B,C,D)]	RAW	
RCP seal water injection line third isolation check valves [VLV-179A (B,C,D)]	RAW	

Table 17.4-1 Risk significant SSCs (sheet 4 of 29)

System, Structure or Component (SSC)	Rationale[(1)]	Insights and Assumptions
RCP seal water injection line third isolation check valves [VLV-179A (B,C,D)]	RAW	
Charging line containment isolation motor operated valve [MOV-152]	RAW/LPSD	
Charging line containment isolation motor operated valve [MOV-151]	RAW/LPSD	
RCP seal water injection line containment isolation motor operated valves [MOV-178A (B,C,D)]	RAW	
Charging line orifice [FE138]	RAW/LPSD	
Charging flow control orifice	RAW/LPSD	
RCP seal water injection line orifices [FE160A (B,C,D)]	RAW	
Regenerative heat exchanger [CHX-001]	RAW/LPSD	
Charging pump minimum flow line manual valves [VLV-130A (B)]	RAW/LPSD	
Charging pump discharge line manual valves [VLV-132A (B)]	RAW/LPSD	
Charging pump discharge line cross tie-line manual valve [VLV-133]	RAW/LPSD	
Charging pump suction line manual valves [VLV-126A (B)]	RAW/LPSD	
Charging line manual valves [VLV-145], [VLV-147]	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 5 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Charging line by-pass line manual valve [VLV-144]	RAW/LPSD	
RCP seal water injection line manual valves [VLV-164], [VLV-166], [VLV-168], [VLV-170B], [VLV-171B], [VLV173]	RAW	
RCP seal water injection by-pass line manual valve [VLV-163]	RAW	
RCP seal water injection line manual valves [VLV-180A (B,C,D)]	RAW	
RCP seal water injection line needle valves [VLV-177A (B,C,D)]	RAW	
Low-pressure letdown line air operated valve [HCV-102]	LPSD	

Table 17.4-1 Risk significant SSCs (sheet 6 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
Component cooling water system (CCWS)		
CCW pump discharge line check valves [VLV-016A (B,C,D))	RAW/CCF/LPSD	The component cooling water system (CCWS) transfer heat from plant safety-related components to the essential service water system (ESWS). This system supports various safety and non-safety mitigation systems. Accordingly, reliability of CCWS EFW system has significant impact on risk.
A~D-Component cooling water pump [NCS-RPP-001A (B,C,D)]	FV/RAW/CCF /LPSD	CCWS has four trains, each having a component cooling water pump and a component cooling water heat exchanger. Two trains compose a subsystem, which shares a supply / return header and a surge tank. SSCs that have either of the following characteristics are risk significant.
A~D-Component cooling water heat exchanger [NCS-RHX-001A (B,C,D)]	RAW/CCF/LPSD	
CCW pump discharge cross tie-line motor operated valves [MOV-020A (B,C,D)]	RAW/CCF/LPSD	- SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains.
CCW pump suction line cross tie-line motor operated valves [MOV-007A (B,C,D)]	RAW/CCF/LPSD	SSCsthat have potential to cause large external leak are risk significant. Since the two trains that compose a subsystem are not physically isolated, large external leak from SSCs that result in loss of inventory is assumed to result in degradation or failure of two trains
SSCs that compose CCW boundary	RAW/EJ/LPSD	
CS/RHR heat exchanger discharge line motor operated valves [MOV-145A (B,C,D)]	FV/RAW/CCF /LPSD	
Charging injection Pump Cooling Line Check Valves	RAW/CCF/LPSD	These valves are used (opened) to provide alternative CCW from the fire suppression system or the non-essential chilled water system to the charging pump cooling line under loss of CCW events. These are important SSCs at loss of CCW events to prevent RCP seal LOCA.
Charging injection pump cooling discharge line motor operated valves	RAW/CCF/LPSD	
CCWS - fire suppression system boundary motor operated valves	RAW/CCF/LPSD	
CCWS - RWSP line boundary check valves [VLV-065A (B)]	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 7 of 29)

System, Structure or Component (SSC)	Rationale[(1)]	Insights and Assumptions
CCWS - RWSP line boundary manual valves [VLV-066A (B)]	RAW/LPSD	
Containment system		
Containment vessel	EJ	The containment vessel is designed to completely enclose the reactor and reactor coolant system and to ensure that essentially no leakage of radioactive materials to the environment would result even if a major failure of the reactor coolant system were to occur.
Hydrogen ignition system	EJ	Hydrogen ignition system are provided for protection against possible detonation following a core damage accident to meet the requirement of 10CFR50.34(f) and 10CFR50.44(c).
Containment isolation system		
Instrument air system check valve [VLV-003]	RAW(L2)	In the case of core damage accident, the containment isolation valves are important to prevent radionuclide releases to the environment.

Table 17.4-1 Risk significant SSCs (sheet 8 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Emergency feedwater system (EFWS)		
EFW pit discharge line check valves [VLV-008A (B)]	RAW/CCF/LPSD	The emergency feedwater system (EFWS) supplies feedwater to the steam generators in order to remove reactor decay heat and RCS residual. This system is required after all initiating events exceeding large and medium LOCA. Accordingly, reliability of EFW system has significant impact on risk. Two trains share one emergency feedwater pit, which has 50% capacity to perform cold shutdown. Large leak from SSCs or failure that result in degradation of water supply from EFW pit will lead to lack of EFW. In this case manual action to supply feedwater from Secondary Demineralizer Water Tank is required. SSCs that have either of the following characteristics are risk significant. - SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains. - SSCs that have potential to cause large leak or failure that result in degradation of water supply from EFW pit will lead are risk important. If such failure occurs, manual action to supply feedwater from secondary demineralizer water tank will be required.
A,D-emergency feedwater pump actuation valve [EFS-MOV-103A (D)]	RAW/LPSD	
B,C-Emergency feedwater pump [EFS-RPP-001B (C)]	RAW/CCF/LPSD	
A,D-Emergency feedwater pump [EFS-RPP-001A (D)]	FV/RAW/CCF/LPSD	
Feedwater line check valves [VLV-018A (B,C,D)]	RAW/CCF/LPSD	
EFW pump discharge line check valves [VLV-012A (B,C,D)]	RAW/CCF/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 9 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
Minimum/Full flow line check valves [VLV-020A (B,C,D)], [VLV-022A (B,C,D)]	RAW/LPSD	
Minimum/Full flow line manual valves [VLV-021A (B,C,D)], [VLV-023A (B,C,D)]	RAW/LPSD	
A~D-emergency feedwater control valve [EFS-MOV-017A (B,C,D))	RAW/LPSD	
A~D-emergency feedwater isolation valve [EFS-MOV-019A (B,C,D)]	RAW	
EFW pit discharge line piping	RAW/LPSD	
T/D pump steam supply line piping	RAW/LPSD	
Minimum/Full flow line	RAW/LPSD	
A,B-Emergency feedwater pit [EFS-RPT-001A(B)]	RAW/LPSD	
Minimum/Full flow line manual valves [VLV-026A (B)]	RAW/LPSD	
EFW pump suction line manual valves [VLV-009A (B,C,D)]	RAW/LPSD	
EFW pump discharge line manual valves [VLV-013A (B,C,D)]	RAW/LPSD	
EFW pit discharge line manual valves [VLV-007A (B)]	RAW/LPSD	
Secondary demineralizer water tank discharge line manual valves [VLV-006A (B)]	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 10 of 29)

System, Structure or Component (SSC)	Rationale[(1)]	Insights and Assumptions
Emergency power source (EPS)		
480V AC motor control center (mcc) buses	RAW/LPSD	The EPS consists of four separate trains. Each safety train consists of one 6.9kV AC medium voltage bus and 480V AC low voltage buses (Load Centers, Motor Control Centers). Each AC medium voltage bus connects to class 1E gas turbine generator. This system supports various safety mitigation systems and therefore, reliability of the EPS system has significant impact on risk.
480V AC load center buses		
6.9kV buses	RAW/EJ/LPSD	
125V DC buses train A and D	RAW/LPSD	Since the EPS consists of four separate trains, single failure in trains not significantly impact risk. However, failure of multiple trains is have significant impact on risk. Accordingly, SSCs that have potential to cause common cause failures among multiple trains are risk significant.
125V DC buses train B and C	RAW(L2)	
120V bus train A	RAW(L2)	
Swing MCC incomer circuit breakers	RAW/CCF/LPSD	
Batteries	RAW/CCF/LPSD	
6.9kV AC bus incomer circuit breakers	FV/RAW/CCF/LPSD	
Gas turbine discharge circuit breakers	RAW/CCF/LPSD	
Circuit breaker between 6.9kV bus and 6.9kV/480V safety power transformer	RAW/CCF/LPSD	
MCC bus incomer circuit breaker	RAW/CCF/LPSD	
Circuit breakers between 125V DC bus and Inverter	RAW/CCF/LPSD	
Class 1E gas turbine generators	FV/RAW/CCF /LPSD	
Gas turbines generator sequencers	RAW/CCF/LPSD	
Inverters	RAW/CCF/LPSD	
Main transformer	RAW(L2)	
6.9kV/480V safety power transformers	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 11 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Alternative AC power sources (Permanent bus)		
Non-class 1E gas turbine generators	FV/RAW/CCF /LPSD	Two non-safety buses called "Permanent bus", which is connected to Alternative AC (AAC), which consists of non-class 1E gas turbine generators respectively. Each non-class 1E gas turbine generators is manually connected to two safety medium voltage buses via selector circuit under the occurrence of loss of safety AC power. The AAC is a countermeasure against station blackout events. SSCs that have potential to cause failures that degrade the availability to supply AAC power to safety medium voltage are risk significant. Systems for the mitigation of core damage accident are connected to permanent bus.
480V permanent buses	RAW(L2)	
6.9kV permanent buses	RAW(L2)	
Circuit breaker between 6.9kV bus and 6.9kV/480V power transformer	RAW(L2)	
Batteries	RAW/CFF/LPSD	
Gas turbine generator discharge circuit breakers	RAW/CCF/LPSD	
AAC selector circuit breakers	RAW/CCF/LPSD	
Circuit breakers between 125V DC bus and Inverter	RAW/CCF/LPSD	
Inverters	RAW/CCF/LPSD	
Gas turbine generator sequencers	RAW/CCF/LPSD	
6.9kV/480V power transformers	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 12 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Non-essential chilled water system		
Non-essential chilled water system - CCWS boundary motor operated valves	RAW/LPSD	In the case of loss of component cooling water events, non-essential chilled water system or fire suppression system provides alternative component cooling water to charging pumps in order maintain RCP seal water injection. These SSCs are risk significant because large external leak from these valves result in loss of alternative component cooling water from both non-essential chilled water system and fire suppression system. On the other hand, failure of other SSCs of this system affects only the non-essential chilled water system itself.

Table 17.4-1 Risk significant SSCs (sheet 13 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Fire suppression systems (FSS)		
FSS pump discharge motor operated valve	FV(L2)/RAW(L2)	In the case of core damage accident, Fire Suppression Systems (FSS) injects water from Raw Water Tank into the reactor cavit y via the direct injection line by the fire water pumps.
FSS pump discharge flow meter	RAW(L2)	
Reactor cavity injection line orifice	RAW(L2)	The containment spray system and/or safety injection system perform the reactor cavity flooding through the drain line at loop compartment to prevent core-concrete interaction when the reactor vessel is failed. The Fire suppression system performs as alternative function for the reactor cavity flooding. In the case of loss of component cooling water events, fire suppression system or non-essential chilled water system provides alternative component cooling water to charging pumps in order maintain RCP seal water injection.
FSS piping (from tank to tie line piping)	RAW(L2)	
Raw water tank	RAW(L2)	
FSS pump discharge manual valve	RAW(L2)	
FSS - CCWS Boundary motor operated valves	RAW/LPSD	Large external leak from these valves result in loss of alternative component cooling water from both non-essential chilled water system and fire suppression system. On the other hand, external leak from other SSCs degrade the fire suppression system but the non-essential chilled water system is still available for alternative component cooling. Therefore these valves are risk significant SSCs in preventing core damage.

Table 17.4-1 Risk significant SSCs (sheet 14 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
High head safety injection system		
Safety injection pump discharge check valves [VLV-004A (B,C,D)]	FV/RAW/CCF/LPSD	In the case of LOCA, high head safety injection system injects coolant from refueling water storage pit (RWSP) into the reactor vessel via the Direct Vessel Injection (DVI) line by the safety injection pumps. This system is also essential for bleed and feed operation.
Containment isolation check valves [VLV-010A (B,C,D)]	RAW/CCF/LPSD	Since this system consists of four independent trains, failure of one train does not have significant impact on risk. However, failures of SSCs that impact multiple trains are risk significant.
Injection line secondary isolation check valves [VLV-012A (B,C,D)]	RAW/CCF/LPSD	SSCs that have either of the following characteristics are risk significant. - SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains. - SSCs that have potential to cause loss of RWSP inventory out side the containment due to large external leaks. Loss of RPWS inventory impacts not only all four trains of high head safety injection system but also other systems that use RPWS as water source.
Injection line boundary check valves [VLV-013A (B,C,D)]	RAW/CCF/LPSD	
A～D-Safety injection pump [SIS-RPP-001A (B,C,D)]	FV/RAW/CCF/LPSD	
Containment isolation motor operated valves [MOV-009A (B,C,D)]	RAW	
Containment isolation motor operated valves [MOV-001A (B,C,D)]	RAW/LPSD	
Piping	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 15 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Heating, ventilation, and air conditioning (HVAC) system		
A,D-Emergency feedwater pump room fans	RAW/CCF/LPSD	EFW M/D pump room fans maintain room temperature when pumps are running. EFW M/D pumps are assumed to be unavailable within the mission time without room cooling due to high room temperature. HVAC systems of other rooms are considered not to be risk significant for the following reasons. - HVAC of emergency gas turbine room Gas turbine units itself has function to intake outer air to remove heat out to atmosphere. Accordingly, HVAC is considered not essential to maintain gas turbine function. - HVAC of ESF room (RHR/CSS pump, SI pump) According to room temperature analysis, room temperature will not exceeds limit of the system during the mission time regardless of availability of HVAC. - HVAC of class1E electric power room (Class 1E I&C, switch gear, battery, battery charger) This system is running during normal operation and continues to run after initiating events. Reliability of normally operating HVAC systems are considered to be high and failure of this system is unlikely to occur during the mission time.
A,D-Emergency feedwater pump room fans	RAW/CCF/LPSD	- HVAC of EFW T/D pump room Since T/D driven EFW pump room can operate under high room temperature conditions, they are assumed to be available regardless of room cooling during the mission time.

Table 17.4-1 Risk significant SSCs (sheet 16 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Containment fan cooler system		
Containment fan cooler [VCS-CAH-001A (B,C,D)]	EP	Temperature control of Containment Vessel atmosphere is judged important by experts from a point of view of keeping function of safety components in Containment Vessel.
Main control room HVAC system		
Main control room air handling unit [VRS-RAH-101A (B,C,D)]	EP	Temperature control of main control room atmosphere is judged important by experts from the viewpoint of operator habitability during an accident.

Table 17.4-1 Risk significant SSCs (sheet 17 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Instrumentation and control (I&C) system		
Permanent bus low voltage signal software	RAW/CCF	This software provides start signal to non-class 1E gas turbine generator. Under SBO, This software must operate in order to backup of the safety bus by AAC power source.
Component cooling water system train isolation signal software	RAW/CCF	SSCs that have potential to cause common cause failure of signals are risk significant since such failure may result in loss of total system function. EFW T/D pump start signals are risk significant since such failure results in loss of one of two available EFW pumps under, SBO and loss of EFW room cooling conditions. Reliability of signals other than “S signal” is assumed to have same reliability with “P signal”.
SG isolation signal software	RAW/CCF	
Engineered safety features actuation signal software (P,S)	RAW/CCF	
SG(EFW) isolation signals	RAW/CCF	
Main steam line isolation signal software	RAW/CCF	
Black out signal software	RAW/CCF	
CCW start signals	RAW(L2)	
Containment pressure sensors	RAW(L2)/CCF(L2)	
A,D-Emergency feed water pump start signal	RAW	
EFW pump start signal software	RAW/CCF	
Diverse actuation system	EJ	The unreliability of this system is assumed to be 0.01.

Table 17.4-1 Risk significant SSCs (sheet 18 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Waste management system (WMS)		
Refueling water storage (RWS) system – WMS line boundary check valve [VLV-037]	RAW	Large External leak of the boundary check valve results in loss of inventory from the RWS system. Systems that relies on the RWS as water source is affected by this failure mode.
Main feedwater system (MFWS)		
Main feedwater system	RAW	The Main feedwater system is credited as a function to secondary side cooling during general transients, which does not involve loss of main feedwater.

Table 17.4-1 Risk significant SSCs (sheet 19 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Main steam supply system (MSS)		
A~D-Main steam isolation valve [NMS-AOV-515A (B,C,D)]	RAW/CCF	Main steam isolation valve isolates the ruptured Steam Generator (SG) at the Steam Generator Tube Rupture (SGTR). In case of secondary line break, main steam isolation is required to prevent unlimited steam release. Main steam line piping is required to be intact to isolate the ruptured SG at SGTR events.
A~D-Main steam bypass isolation valve [NMS-HCV-3615,3625,3635,3645]	RAW(L2)	
Main steam line piping	RAW	
A1~A2-Main steam safety valve B1~B2-Main steam safety valve C1~C2-Main steam safety valve D1~D2-Main steam safety valve [NMS-VLV-509A (B,C,D)] [NMS-VLV-510A (B,C,D)]	RAW(L2)	
A,B,C,D,E,F,G,H,J,K,L,M,N,P,Q-Turbine bypass valve [NMS-TCV-500A(B,C,D,E,F,G,H,J,K,L,M,N, P,Q)]	RAW(L2)	

Table 17.4-1 Risk significant SSCs (sheet 20 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
Pressurizer pressure control system part of emergency core cooling system (ECCS)		
A,B-Safety depressurization valve [RCS-MOV-117A (B)]	RAW/CCF	Safety Depressurization Valves (SDVs) are required to open during bleed and feed operation. Pressurizer safety valves releases RCS pressure in case of high RCS pressure. Failure of safety valves to re-close results in loss of primary coolant.
A～D-Pressurizer safety valve [RCS-VLV-120], [RCS-VLV-121], [RCS-VLV-122], [RCS-VLV-123]	RAW	
Depressurization system for severe accident		
Depressurization valves [RCS-MOV-118], [RCS-MOV-119]	FV(L2)	In the case of core damage accident, depressurization of the reactor coolant system is required to prevent high pressure melt ejection and direct containment heating.

Table 17.4-1 Risk significant SSCs (sheet 21 of 29)

System, Structure or Component (SSC)	Rationale[(1)]	Insights and Assumptions
Containment spray / residual heat removal (CS/RHR) system		
Heat exchanger bypass valves [FCV-604], [FCV-636]	RAW/LPSD	The Containment Spray / Residual Heat Removal (CS/RHR) System consists of four independent trains. The CS/RHR System has the following four functions.
RHR line heat exchanger discharge air operated valves [FCV-603], [FCV-633]	RAW/LPSD	a. Containment Spray b. Alternative Core Cooling c. RHR Operation during full power and LPSD operation.
Pump suction line check valves [VLV-004A (B,C,D)]	RAW/CCF/LPSD	
RHR line containment isolation check valves [VLV-022A (B,C,D)]	RAW/CCF/LPSD	Since CS/RHR system consists of four independent trains, failure of one train does not have significant impact on risk. However, failures of SSCs that impact multiple trains are risk significant.
RHR line containment isolation motor operated valves [MOV-021A (B,C,D)]	RAW/CCF/LPSD	SSCs that have either of the following characteristics are risk significant.
		- SSCs that have potential to cause common cause failures among multiple trains. Common cause failure of such system will result in loss of multiple trains. - SSCs that have potential to cause loss of RWSP inventory out side the containment due to large external leaks. Loss of RPWS inventory impacts not only all four trains of CS/RHR system but also other systems that use RPWS as water source.
A~D-Containment spray/residual heat removal pump [RHS-RPP-001A (B,C,D)]	RAW/CCF/LPSD	
A~D-Containment spray/residual heat removal heat exchanger [RHS-RHX-001A (B,C,D)]	RAW/CCF/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 22 of 29)

System, Structure or Component (SSC)	Rationale[(1)]	Insights and Assumptions
RHR line boundary check valves [VLV-028A (B,C,D)]	RAW/LPSD	
RWSP discharge line isolation valves	RAW	
CS line containment isolation motor operated valves [MOV-004A (B,C,D)]	RAW	
Piping	RAW	
CS line heat exchanger discharge manual valves [VLV-002A (B,B,D)]	RAW	
Minimum flow line manual valves [VLV-13A (B,C,D)]	RAW	
CS/RHR - spent fuel pit boundary manual valves (discharge line) [VLV-031A (D))]	RAW	
From FSS to CSS tie line check valve [VLV-012]	RAW(L2)	These valves are required to open to perform firewater injection from FSS to the spray header.
From FSS to CSS tie line motor operated valve [CSS-MOV-011]	FV(L2)/RAW(L2)	
CS/RHR - spent fuel pit boundary manual valves (suction line) [VLV-034A (D)]	RAW/LPSD	These valves are required to open to perform gravitational injection from the spent fuel pit to the RCS when RCS is atmospheric pressure at LPSD operation.
CS/RHR - spent fuel pit boundary manual valves (suction line) [VLV-33A(D)]	LPSD	

Table 17.4-1 Risk significant SSCs (sheet 23 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
CS/RHR pump hot leg suction isolation valves [MOV-001A(B,C,D)] [MOV-002A(B,C,D)]	LPSD	Failure of these valves result in loss of RHR during LPSD.
RCS cold leg injection line motor operated valves [MOV-026A(B,C,D)]	LPSD	
RCS cold leg injection line check valves [VLV-027A(B,C,D)] [VLV-028A(B,C,D)]	LPSD	

Table 17.4-1 Risk significant SSCs (sheet 24 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Refueling water storage system (RWS)		
Refueling water storage pit (RWSP) sump strainers	FV/RAW/CCF	The RWSP is the source of borated water for containment spray and safety injection. During LPSD operation, RWSS has the following functions.
Refueling water storage pit [RWS-CPT-001]	RAW	
Refueling water recirculation pump suction line manual valves [VLV-006A (B)]	RAW/LPSD	a. Refill refueling water auxiliary tank (RWAT) for RCS injection via charging pumps. b. Refill SFP for gravitational injection to RCS. SSCs that have either of the following characteristics are risk significant. - SSCs that have potential to cause common cause failures among multiple trains. Sump strainers have potential of sump screen, which may occur in multiple trains.
Refueling water recirculation pump discharge line check valves [VLV-012A (B)]	RAW/LPSD	- SSCs that have potential to cause resulting loss of RWSP inventory out side the containment due to large external leaks are risk significant, since such failure impacts al l systems that use RWSP as water source. SSCs that have potential to cause failure to supply RWSP water to RWAT or SFP during LPSD operation are also considered risk significant.
Refueling water recirculation pump discharge line manual valves [VLV-013A (B)]	RAW/LPSD	
RWSP discharge line containment isolation motor operated valves [MOV-002] [MOV-004]	RAW/LPSD	
A,B-Refueling water recirculation pump [RWS-RPP-001A (B)]	RAW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 25 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
RWSP discharge line manual valve [VLV-001]	RAW/LPSD	
Refueling water recirculation pump suction cross tie line manual valve [VLV-005]	RAW/LPSD	
Refueling water recirculation pump discharge cross tie line manual valve [VLV-014]	RAW/LPSD	
Refueling water auxiliary tank inlet line manual valve [VLV-052]	RAW/LPSD	
Refueling water auxiliary tank discharge line manual valve [VLV-101]	RAW/LPSD	
Refueling water auxiliary tank suction line manual valve [VLV-021], [VLV-051]	LPSD	
RWSP suction line containment isolation air operated valve [AOV-022]	LPSD	

Table 17.4-1 Risk significant SSCs (sheet 26 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Reactor protection system (RPS)		
Reactor trip breakers	RAW/CCF	These systems are necessary to provide negative reactivity for plant trip.
Control rod (rod injection)	FV/RAW/CCF	
Chilled water system (VWS)		
Chiller units train B and C	FV/RAW/CCW/LPSD	The safety related water system supplies chilled water to safety related HVAC systems. SSCs that have potential to cause common cause failures among trains B and C are risk significant since such failures results in loss room cooling in M/D EWF pump area. SSCs that compose train A and D are not risk significant because the PRA assumes only the M/D EFW pumps to be dependent on room cooling during the mission time.
Pumps train B and C	RAW/CCW/LPSD	

Table 17.4-1 Risk significant SSCs (sheet 27 of 29)

System, Structure or Component (SSC)	Rationale[1]	Insights and Assumptions
Essential service water system (ESWS)		
Pump discharge line check valves [VLV-502A (B,C,D)]	RAW/CCF/LPSD	The essential service water (ESW) system transfers heat from the CCW system as Ultimate Heat Sink (UHS). This system supports the CCW system, which supports various safety and non-safety mitigation systems. Accordingly, reliability of CCWS EFW system has significant impact on risk. Since ESW system consists of four independent trains, failure of one train does not have significant impact on risk. However, failures of SSCs that impact multiple trains have risk significant impact on risk. Accordingly, SSCs that have potential to cause common cause failures among multiple trains are risk significant.
ESW pump motor cooling line check valves [VLV-602A (B,C,D)]	RAW/CCF/LPSD	
A~D-Essential service water pump [EWS-OPP-001A (B,C,D)]	FV/RAW/CCF/LPSD	
A1~D1-Essential service water pump outlet strainer A2~D2-Essential service water pump outlet strainer [EWS-OSR-001A (B,C,D)] [EWS-OSR-002A (B,C,D)]	RAW/LPSD	
Valves located in esw pump motor cooling line of train B & C [VLV-601B (C)], [VLV-601B (C)]	RAW/LPSD	
ESW pump motor cooling line valves of train A & D [VLV-601A (D)], [VLV-601A (D)]	RAW(L2)	
Orifices located in esw pump motor cooling line of train B & C [FT-2061 (2)]	RAW/LPSD	
Orifices located in main piping of train B and C [FE2025], [FE2026]	RAW/LPSD	
Main piping orifices of train A and D [FE2024], [FE2027]	RAW(L2)	

Table 17.4-1 Risk significant SSCs (sheet 28 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
Main piping valves of train B and C [MOV-503B (C)], [VLV-506B (C)], [VLV-507B (C)], [VLV508B (C)], [VLV-509B (C)], [VLV-511B (C)], [VLV-514B (C)], [VLV-517B (C)], [VLV-520B (C)]	RAW/LPSD	
Main piping valves of train A and D [MOV-503A (D)], [VLV506A (D)], [VLV-507A (D)], [VLV508A (D)], [VLV-509A (D)], [VLV-511A (D)] , [VLV-514A (D)], [VLV-517A (D)] , [VLV-520A (D)]	RAW(L2)	
Piping of train B and C	RAW/LPSD	
Piping of train A and D	RAW(L2)	

Table 17.4-1 Risk significant SSCs (sheet 29 of 29)

System, Structure or Component (SSC)	Rationale(1)	Insights and Assumptions
Spent fuel pit cooling and purification system (SFPCS)		
RWS – SFP inlet line boundary check valve [VLV-027]	RAW/LPSD	Large External leak of valves that form boundary between RWS result in loss of inventory of the RWS system. Accordingly, systems that relies on the RWS as water source is affected by failure of these valves.
RWS – SFP inlet line manual valve [VLV-028]	RAW/LPSD	
RWS – SFP demineralizer line boundary manual valves [VLV-103A (B)]	RAW	During RCS is atmospheric pressure at LPSD operation, the spent fuel pit is used as water source of gravitational injection in case loss of decay heat removal function occurs. SSCs associated with gravitational injection line are considered to be risk significant.
RWS – SFP inlet line manual valve [VLV-029], [VLV-015], [VLV-017]	LPSD	
Spent fuel pit [RPT-001]	LPSD	
A~D-Spent fuel pit strainer [SFS-RSR-001A (B,C,D)]	LPSD	
Spent fuel pit discharge line manual valves [VLV-021A(D)]	LPSD	
Spent fuel pit discharge cross tie-line manual valve [VLV-022]	LPSD	

Notes:

1. Definition of Rationale Terms:
   CCF = Common Cause Failure
   FV = Fussell-Vesely
   RAW = Risk Achievement Worth
   FV(L2) = Fussell-Vesely for Level 2 PRA (L2)
   RAW(L2) = Risk Achievement Worth for L2
   CCF(L2) = Common Cause Failure for L2
   LPSD =Low Power and Shut Down Operation
   EJ = Engineering Judgment
   EP = Expert Panel

17.4.8 ITAAC for the D-RAP

Tier 1 ITAAC are proposed to verify that the D-RAP provides reasonable assurance that the design of SSCs within the scope of the RAP is consistent with their assumed design reliability. The list of risk-significant SSCs for ITAAC will be prepared by introducing the plant's site-specific information to the list shown in Table 17.4-1 in the Phase II of the D-RAP. The ITAAC acceptance criteria are established to ensure that the estimated reliability of each as-built SSC is at least equal to the assumed design reliability and that industry experience including operations, maintenance, and monitoring activities were assessed in estimating the reliability of these SSCs.

17.4.9 Combined License Information

COL 17.4(1) *The COL Applicant shall be responsible for the development and implementation of the Phases II and III of the D-RAP. In the Phase II, the plant's site-specific information should be introduced to the D-RAP process and the site-specific SSCs should be combined with the US-APWR design SSCs into a list for the specific plant. In the Phase III, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the RAP should ensure that significant assumptions, such as equipment reliability, are realistic and achievable. The QA requirements should be implemented during the procurement, fabrication, construction, and pre-operation testing of the SSCs within the scope of the RAP.*

COL 17.4(2) *The COL Applicant shall be responsible for the development and implementation of the O-RAP, in which the RAP activities should be integrated into the existing operational program (i.e., Maintenance Rule, surveillance testing, in-service inspection, in-service testing, and QA). The O-RAP should also include the process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP.*

17.4.10 References

17.4-1 "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Design," SECY 95-132, U.S. Nuclear Regulatory Commission, Washington, DC, May 1995.

17.4-2 'Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants,' "Domestic Licensing of Production and Utilization Facilities," Energy. Title 10, Code of Federal Regulations, Part 50.65, U.S. Nuclear Regulatory Commission, Washington, DC.

17.5 Quality Assurance Program Guidance

The MHI-NESH US-APWR Project Quality Assurance Program (QAP) is the top-level policy document that establishes the quality assurance policy and assigns major functional responsibilities for plants designed by MHI-NESH. The QAP describes the methods and establishes QAP and administrative control requirements that meet 10 CFR Part 50, Appendix B and 10 CFR Part 52. The QAP is based on the requirements of ASME NQA–1-1994, “Quality Assurance Requirements for Nuclear Facility Applications,” Parts I and II, as specified in Ref.17.5.5-4.

The QAP is defined by the NRC approved regulatory document that describes the Quality Assurance Program elements, along with the associated implementing documents.

Business policies of MHI-NESH establish high level responsibilities and authority for carrying out administrative functions which are outside the scope of the QAP.

Procedures establish practices for certain activities which are common to all MHI-NESH organizations performing those activities such that the activity is controlled and carried out in a manner that meets QAP requirements. Organization specific procedures establish detailed implementation requirements and methods, and may be used to implement the business policies of MHI-NESH or be unique to particular functions or work activities.

17.5.1 Scope / Applicability

The scope / applicability of the Quality Assurance Program performed during the design certification phase is described in “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1) Part I, Section 1.1” (Ref 17.5.5-4).

The COL applicant shall develop a Quality Assurance Program applicable to its activities during design, fabrication, construction, testing and operation.

17.5.2 Updated SRP Section 17.5 and the QA Program Description

A Organization

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION I” (Ref 17.5.5-4), establishes the Organization structure used during design certification phase of the US-APWR.

B Quality Assurance Program

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION II” (Ref 17.5.5-4), establishes the Quality Assurance Program used during design certification phase of the US-APWR.

C Design Control

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION III” (Ref 17.5.5-4), establishes Design Control used during design certification phase of the US-APWR.

D Procurement Document Control

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION IV” (Ref 17.5.5-4), establishes Procurement Document Control used during design certification phase of the US-APWR.

E Instructions, Procedures, and Drawings

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION V” (Ref 17.5.5-4), establishes the Instructions, Procedures, and Drawings used during design certification phase of the US-APWR.

F Document Control

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION VI” (Ref 17.5.5-4), establishes Document Control used during design certification phase of the US-APWR.

G Control of Purchased Material, Equipment, and Services

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION VII” (Ref 17.5.5-4), establishes Control of Purchased Material, Equipment, and Services used during design certification phase of the US-APWR.

H Identification and Control of Materials, Parts, and Components

“Identification and Control of Materials, Parts, and Components” is not applicable during design certification phase of the US-APWR.

I Control of Special Processes

“Control of Special Processes” is not applicable during design certification phase of the US-APWR.

J Inspection

MHI-NESH “Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION X” (Ref 17.5.5-4), establishes Inspection used during design certification phase of the US-APWR.

K Test Control

MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION XI" (Ref 17.5.5-4), establishes Test Control used during design certification phase of the US-APWR.

L Control of Measuring and Test Equipment

MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION XII" (Ref 17.5.5-4), establishes Control of Measuring and Test Equipment used during design certification phase of the US-APWR.

M Handling, Storage, and Shipping

"Handling, Storage, and Shipping" is not applicable during design certification phase of the US-APWR.

N Inspection, Test, and Operating Status

"Inspection, Test, and Operating Status" is not applicable during design certification phase of the US-APWR.

O Nonconforming Materials, Part, or Components

MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION XV" (Ref 17.5.5-4), establishes the control of Nonconforming Materials, Part, or Components used during design certification phase of the US-APWR.

P Corrective Action

MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION XVI" (Ref 17.5.5-4), establishes the Corrective Action Program used during design certification phase of the US-APWR.

Q Quality Assurance Records

MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION XVII" (Ref 17.5.5-4), establishes control of Quality Assurance Records used during design certification phase of the US-APWR.

R Audits

MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION XVIII" (Ref 17.5.5-4), establishes a comprehensive system of QA Audits used during design certification phase of the US-APWR.

S Training and Qualification Criteria – Quality Assurance

In accordance with MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION II" (Ref 17.5.5-4), Training and Qualification of QA personnel is procedurally established and maintained.

T Training and Qualification – Inspection and Test

In accordance with MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part II SECTION II" (Ref 17.5.5-4), Training and Qualification of Inspection and Test personnel is procedurally established and maintained.

U QA Program Commitments

Regulatory Guides and Standards and their respective revisions are addressed in MHI-NESH "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part IV " (Ref 17.5.5-4).

V Nonsafety-Related SSC Quality Control

The quality control of nonsafety-related SSCs which are significant contributors to plant safety, is described in "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part III-1) " (Ref 17.5.5-4).

The quality control of nonsafety-related SSCs Credited for Regulated Events is described in "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1), Part III-2) " (Ref 17.5.5-4).

17.5.3 Evaluation of the QAPD Against the SRP and QAPD Submittal Guidance

The QAPD for the Design Certification Phase has been prepared on the basis of the NRC approved QAP template (NEI, 06-14A Rev.4 and earlier revisions) (Ref 17.5.5-3) prepared by the Nuclear Energy Institute and has been evaluated against the SRP. The MHI-NESH QAP description for the US-APWR (PQD-HD-19005 Rev.1) provides the QAP controls implemented. MHI performed the comparison of SRP (Mar. 2007) (Ref 17.5.5-2) and draft SRP (Sept. 2006) (Ref 17.5.5-1) which was used as a reference for the QAPD (PQD-HD-19005 Rev.1) and determined that there is no impact to the QAPD (PQD-HD-19005 Rev.1) (Ref. 17.5.5-4).

The COL applicant is also responsible to perform an evaluation of the QAPD against the SRP.

17.5.4 Combined License Information

COL 17.5(1) *The COL applicant shall develop and implement the Construction and Operational QAP that also covers the activities described in Section 17.5.*

17.5.5 References

17.5.5-1 "Draft Standard Review Plan (SRP) 17.5 dated September 22, 2006"

17.5.5-2 "Standard Review Plan (SRP) 17.5 March 2007"

17.5.5-3 "Quality Assurance Program Description (NEI 06-14A Rev.4 and earlier versions)"

17.5.5-4 "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.1)"

17.6 Description of the Applicant's Program for Implementation of 10 CFR 50.65, the Maintenance Rule

The COL Applicant is responsible for development of the program for implementation of 10 CFR 50.65, the Maintenance Rule.