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July 18, 2009

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey A. Ciocco

Docket No. 52-021
MHI Ref: UAP-HF-09391

Subject: MHI's Responses to US-APWR DCD RAI No.398-1961 REVISION 1

Reference: 1) "Request for Additional Information No. 398-1961 Revision 1, SRP Section: 17.04 - Reliability Assurance Program (RAP), Application Section: 17.4 Reliability Assurance Program," dated June 18, 2009.

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") a document entitled "Responses to Request for Additional Information No. 398-1961 Revision 1".

Enclosed are the responses to the RAIs contained within Reference 1.

Please contact Dr. C. Keith Paulson, Senior Technical Manager, Mitsubishi Nuclear Energy Systems, Inc. if the NRC has questions concerning any aspect of the submittals. His contact information is below.

Sincerely,

Y. Ogata

Yoshiki Ogata,
General Manager- APWR Promoting Department
Mitsubishi Heavy Industries, LTD.

Enclosure:

1. Responses to Request for Additional Information No.398-1961 Revision 1.

CC: J. A. Ciocco
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Enclosure 1

UAP-HF-09391
Docket Number 52-021

Responses to Request for Additional Information No. 398-1961
Revision 1

July 2009

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.398-1961 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/18/2009**

QUESTION NO. : 17-04-46

The staff requested in RAI 17.04-9 that MHI describe in Section 17.4 of the US-APWR DCD the process to determine dominant failure modes for risk-significant SSCs in scope of D-RAP. In response to RAI 17.04-9, MHI described a process to determine dominant failure modes for risk-significant SSCs that are modeled in the PRA for which an importance analysis was performed. MHI's process does not, however, address: a) determination of dominant failure modes for risk-significant SSCs that are not modeled in the PRA, and b) use of PRA models for which importance measures were not determined (e.g., MHI's process to determine dominant failure modes would disregard the following PRA models because risk achievement worth's and Fussell-Vesely's were not computed, yet these models could identify other important failure modes: various plant operational states in the internal events at low power/shutdown (LPSD), internal fire at LPSD, internal flood at LPSD). The staff requests that MHI also describe in Section 17.4 of the US-APWR DCD: a) the process to determine dominant failure modes for risk significant SSCs that are not modeled in the PRA, and b) how PRA models that do not compute importance measures would be used to identify dominant failure modes.

The staff requested in RAI 17.04-9 that MHI describe who is responsible for determining the dominant failure modes for risk-significant SSCs and include this as a COL information item, if necessary. Typically, a DCD will specify, through a COL information item, that the COL license holder is ultimately responsible for determining the dominant failure modes in accordance with the process described in that DCD. In response to RAI 17.04-9, MHI stated that they will be responsible for determining the dominant failure modes for risk significant SSCs. If these dominant failure modes are not included/referenced as part of the DCD, then the COL license holder that references the DCD would ultimately be responsible for determining these dominant failure modes. In this case a COL information item would need to be included in the DCD for the COL license holder to determine the dominant failure modes. The staff requests that MHI provide the dominant failure modes for the risk-significant SSCs in Section 17.4 of the US-APWR DCD or in a report and reference this report in Section 17.4 of the US-APWR DCD. Otherwise, include a COL information item in Section 17.4.9 ("Combined License Information") of the US-APWR DCD for the COL license holder being responsible for determining the dominant failure modes for risk-significant SSCs prior to initial fuel load and in accordance with the process provided in the DCD.

ANSWER:

In response to RAI 17.04-9, MHI described a process to determine dominant failure modes for risk-significant SSCs that are modeled in the PRA. Nevertheless in Table 17.4-1 of the US-APWR DCD, Revision1, there are some SSCs which are not modeled in PRA or for which risk importance analysis are not computed. In this response, it is described that how to determine dominant failure modes and how to use PRA models to identify dominant failure modes for these SSCs.

- The process to determine dominant failure modes for risk-significant SSCs that are not modeled in the PRA:

  For risk-significant SSCs that are not modeled in the PRA, dominant failure modes are supposed from the following points of view:
  - The required mitigation function during the accident.
  - The equality and similarity in function and failure behavior with other risk significant SSCs
  - The concerning risk significant human error
  - The concerning risk significant software error, etc.

  Supposed failure modes are listed in the following table. SSCs of this table are not modeled in PRA but are listed as risk significant in Table 17.4-1 (see the attachment to this RAI response). For these SSCs, dominant failure modes are supposed from the point of view shown in this table.

# in Table 17.4-1	SSCs	Supposed failure mode	Point of view to suppose the dominant failure mode
1-1	Accumulators [SIS-CTK-001A (B, C, D)]	Water injection failure to the reactor vessel	Based on the required mitigation function during the accident
2-32	RCP seal water injection line filters [KFT-003A(B)]	Plugging / Large external leakage	Based on the equality and similarity in function and failure behavior with other risk significant SSCs
3-36	Charging injection pump motor line orifice [NCS-FE-1266(1267)]	Plugging / Large external leakage	Based on the equality and similarity in function and failure behavior with other risk significant SSCs
3-37	Charging injection oil cooler line orifice [NCS-FE-1260(1261)]	Plugging / Large external leakage	Based on the equality and similarity in function and failure behavior with other risk significant SSCs
4-1	Containment vessel [TBD]	Leakage of contained content	Based on the required function during the accident
4-2	Hydrogen ignition system [TBD]	Failure to ignite hydrogen	Based on the required function during the accident
6-25	EFW pit water level transmitter [EFS-LT-3760, 3761, 3770, 3771]	Mis-indication by mis-calibration	Based on the risk significant human error concerning the SSCs
15-8	Steam generator water level sensors [TBD]	Signal failure	Based on the risk significant signal error concerning the SSCs

15-9	CCW pump breaker position sensing device [TBD]	Signal failure	Based on the risk significant signal error concerning the SSCs
15-10	Reactor Protection System	Signal failure	Based on the risk significant signal error concerning the SSCs
15-11	Engineered Safety Features Actuation System	Signal failure	Based on the risk significant signal error concerning the SSCs
15-12	Safety Logic System	Signal failure	Based on the risk significant signal error concerning the SSCs

These supposed failure modes will be discussed and determined by the review of expert panel.

The process described above will be included in Section 17.4.1 of US-APWR DCD.Rev.1.

➢ The process of how PRA models that do not compute importance measures would be used to identify dominant failure modes:

For the event whose PRA models do not compute importance measures, dominant failure modes extracted based on the following comparison with similar event whose PRA models compute importance measures.

- The difference in assumption applied for the concerned PRA model from that of similar PRA models that have importance analysis results.
- The commonality in assumption applied for the concerned PRA model from that of similar PRA models that have importance analysis results.

In case of the internal events at LPSD, CDFs were evaluated for POS 3, 4-1, 4-2, 4-3, 8-1, 8-2, 8-3, 9 and 11, respectively. Among these POSs only for POS 8-1, PRA model was prepared and risk significant SSCs were extracted by means of risk importance analysis. Nevertheless, for POSs other than 8-1, importance measures are not computed. For these POSs the important SSCs are qualitatively extracted based on the mitigation system which is available for each POS.

For POSs other than 8-1, the additional important SSCs to those of POS 8-1 are "Emergency feed water system" and "Gravitational injection system". (See the subsection 19.1.6.2 of US-APWR DCD, Revision 1).

Since almost all of mitigation systems of LPSD need operator action, the results of quantitative analysis are greatly dominated by human errors. For example, Table 19.1-87of the US-APWR DCD (Revision.1) shows that the dominant cutsets of CDF are human errors. This seems to be applied to other POSs. Therefore, dominant failure modes for "Emergency feed water system" and "Gravitational injection system" are "Operator fails to start standby EFW pump (HE)" and "Operator fails to establish Gravitational injection (HE)", respectively. (See Table19.1-98 to 105 of the US-APWR DCD ,Rev.1). Corresponding SSCs are tabulated as bellow and these SSCs are included in Table 17.4-1 of US-APWR DCD. Rev.1.

Important System	Dominant Failure Modes	Corresponding SSCs
Emergency feed water system	Operator fails to start standby EFW pump (HE)	Motor Driven EFW Pump C[EFS-RPP-001C)]
Gravitational injection system	Operator fails to establish Gravitational injection (HE)	Spent Fuel Pit[SFS-RPT-001] CS/RHR-Spent Fuel Pit Boundary Manual Valves (Suction line) [RHS-VLV-033A(D),034A(D)] Refueling Water Recirculation Pump [RWS-RPP-001A (B)] Spent Fuel Pit Suction line from Refueling Water Storage Pit [-]

As mentioned above, in case of LPSD PRA model dominant failure modes for the POSs other than 8-1, which do not compute importance measures, are determined based on the results of similar PRA model that is for POSs 8-1.

The process described above will be included in Section 17.4.1 of US-APWR DCD.Rev.1.

In this RAI, internal fire at LPSD and internal flood at LPSD are mentioned. In case of internal fire at and internal flood at LPSD, CDF for these events of POS 8-1 are evaluated 1.9E-8/RY and 1.8E-08/RY respectively. Considering that the assumptions applied for these LPSD external events are conservative, CDFs are so small that it can be judged that SSCs concerning these LPSD external events are not included risk significant SSCs list. Therefore these SSCs are disregarded.

In response to RAI 17.04-9, it was described that MHI is responsible for determining the dominant failure modes of risk significant SSCs. Accordingly, MHI will provide the dominant failure modes for each risk-significant SSCs in Section 17.4 of the US-APWR DCD. This will be done at some revision of the US-APWR DCD tracking report.

Impact on DCD

The process to determine dominant failure modes for risk-significant SSCs that are not modeled in the PRA or for that importance measures are not computed will be revised as noted above (See the Attachment to this RAI response, page 17.4-4 and 17.4-5).

List of risk significant SSCs will be revised to include the dominant failure modes for SSCs in some revision of the US-APWR DCD tracking report, considering the discussion of expert panel.

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.398-1961 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/18/2009**

QUESTION NO. : 17-04-47

The staff requested in RAI 17.04-10 that COL Information Item 17.4(2) in Section 17.4.9 of the US-APWR DCD, Revision 1 should also address (in accordance with SECY-95-132, Item E) establishment of: 1) reliability performance goals for risk-significant SSCs within the scope of RAP, and 2) performance and condition monitoring requirements to provide reasonable assurance that risk significant SSCs do not degrade to an unacceptable level during plant operations. In response to RAI 17.04-10, MHI stated "All SSCs identified as risk-significant within the scope of the D-RAP should be categorized as high-safety-significant (HSS) within the scope of initial Maintenance Rule." MHI's approach is acceptable provided that maintenance rule will be implemented by the COL license holder in accordance with guidance contained in Regulatory Guide (RG) 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." However, from COL Information Item 17.6(1), there are no requirements for the COL applicant to use RG 1.160 for development/implementation of maintenance rule. The COL applicant could choose to use other guidance for maintenance rule (in which case then the use of HSS may not ensure establishment of reliability performance goals and performance/condition monitoring requirements). Therefore, in general, categorizing all SSCs in scope of D-RAP as HSS may not necessarily lead to establishment of reliability performance goals and performance/condition monitoring requirements for those SSCs.

The staff requests that MHI revise COL Information Item 17.4(2) such that the integration of reliability assurance activities into existing operational programs will also address establishment of:

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 following the guidance contained in RG 1.160 is one acceptable method for establishing performance goals provided that SSCs are categorized as HSS within the scope of the Maintenance Rule program), and

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

ANSWER:

Regarding the NRC comment, MHI will add the following paragraphs after the COL Information Item 17.4(2) in Section 17.4.9 of the US-APWR DCD, Revision 1:

The integration of reliability assurance activities into existing operational programs will also address establishment of:

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 following the guidance contained in RG 1.160 is one acceptable method for establishing performance goals provided that SSCs are categorized as HSS within the scope of the Maintenance Rule program), and*
2) *Performance and condition monitoring requirements to provide reasonable assurance that risk-significant SSCs do not degrade to an unacceptable level during plant operations.*

<u>Impact on DCD</u>

The COL Information Item 17.4(2) in Section 17.4.9 of the US-APWR DCD, Revision 1 will be revised as noted above. (See the page 17.4-44 of the Attachment to this RAI).

<u>Impact on COLA</u>

There is no impact on COLA from this RAI.

<u>Impact on PRA</u>

There is no impact on PRA from this RAI.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.398-1961 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/18/2009**

QUESTION NO. : 17-04-48

The staff requested in RAI 17.04-16 that MHI include the remote shutdown panel/console (RSP) in Table 17.4-1 of the US-APWR DCD. Otherwise, provide the basis for not including RSP in Table 17.4-1. MHI stated in their response to RAI 17.04-16 that:

"Remote shutdown panel is not considered risk-significant for the following reason.
- it is a backup system of the main control board in the event the MCR is uninhabitable and is not considered in PRA
- it is kept isolated from HSIS while the MCR is inhabitable, and provides no impact on the plant safety and plant operation in the case of its failure"

For the following reasons, the staff found that MHI's response to RAI 17.04-16 does not provide a sufficient basis for excluding RSP from Table 17.4-1:

a) MHI stated that the RSP is not considered in the PRA. However, RSP is modeled (through operator actions at RSP) in the fire PRA at full power (US-APWR PRA, MUAP-07030, Revision 0).

b) MHI stated that the RSP provides no impact on plant safety and plant operation in the case of its failure. However, RSP is implicitly modeled in the fire PRA at full power for main control room evacuation due to fire and, from a sensitivity analysis, the core damage frequency (CDF) due to RSP failure during main control room fire increases from 1.0E-08/ry to 5.8E-07/ry (i.e., Case 3, "Probability of Operator Manual Operation" provided in Section 2.3, "Sensitivity Analysis", of Chapter 23, Attachment R of the US-APWR PRA, MUAP-07030, Revision 0).

c) From Table 23R-13 in MUAP-07030, Revision 0, basic event HPIOO02FWBD-R ("Operator Fails Bleed and Feed Operation at RSP") has a Fussell-Vesely (FV) of 5.9E-03, which would make this event risk-significant based on the criteria used in Section 17.4.7.1 of the US-APWR DCD, Revision 1. From Table 23R-13 in MUAP-07030, basic event EFWOO01PW2AB-R ("Operator Fails to Open EFW Pit Discharge Cross Tie-Line for Continuous SG Feed Water at RSP") has a FV= 3.4E-03. Failure of RSP would lead to failure of both human error events that were described above (i.e., these human actions are dependent on success of the RSP). This suggests that the RSP may be risk-significant. Note, the PRA assumption that RSP has a low failure probability and is bounded by the human error events does not provide a sufficient basis for excluding RSP from D-RAP. This assumption is only true if the RSP is subjected to appropriate reliability assurance activities. Therefore, the assumption in the PRA that the RSP has high reliability further emphasizes the need to include RSP in D-RAP (the intent of D-RAP is to ensure the reliability assurance activities that were accomplished prior to initial fuel load for the risk significant SSCs provide reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for the risk-significant SSCs).

The staff requests that MHI include RSP in Table 17.4-1 of the US-APWR DCD. Otherwise, provide a more acceptable basis for not including RSP in Table 17.4-1 of the US-APWR DCD.

ANSWER:

In response to RAI 17.04-16, MHI described the reasons to exclude RSP from Table 17.4-1 of the US-APWR DCD.

Nevertheless, comments provided in this RAI to include RSP to the table seem to be agreeable.

Therefore RSP will be included in Table 17.4-1 incorporating the discussion of expert panel. This will be also done by the next revision of the US-APWR DCD.

<u>Impact on DCD</u>

List of risk significant SSCs will be revised to include the "RSP", considering the discussion of expert panel (See the Attachment to this RAI response, page 17.4-41).

<u>Impact on COLA</u>

There is no impact on COLA from this RAI.

<u>Impact on PRA</u>

There is no impact on PRA from this RAI.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

7/18/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No.52-021

RAI NO.: **NO.398-1961 REVISION 1**

SRP SECTION: **17.04 – Reliability Assurance Program (RAP)**

APPLICATION SECTION: **17.4 Reliability Assurance Program**

DATE OF RAI ISSUE: **6/18/2009**

QUESTION NO. : 17-04-49

The staff requested in RAI 17.04-17 that MHI include "hardware" of instrumentation and control (I&C) systems in Table 17.4-1 of the US-APWR DCD. Otherwise, provide the basis for not including hardware in Table 17.4-1. For the following reasons, the staff found that MHI's response to RAI 17.04-17 does not provide a sufficient basis for excluding hardware of I&C from Table 17.4-1:

a) MHI's basis for not including hardware of I&C in Table 17.4-1 specifically relies on probabilistic arguments, which is not sufficient. As supported by DI&C-ISG-03 ("Task Working Group #3: Review of New Reactor Digital Instrumentation and Control Probabilistic Risk Assessments Interim Staff Guidance," Revision 0, August 11, 2008), uncertainties inherent with the probabilistic risk assessment (PRA) modeling of digital I&C are large (e.g., large uncertainties are associated with PRA modeling of digital I&C: common cause failures, dependencies, interactions between hardware and software, level of modeling detail, failure modes, unknown or unforeseen failure modes, failure data, software reliability, adequacy of modeling methods, interfacing digital system with the rest of the PRA). Therefore, it is not sufficient to specifically rely on PRA models and risk importance measures (e.g., risk achievement worth, Fussell-Vesely) alone to show that software/hardware of digital systems are not risk-significant. Other methods would need to be assessed (e.g., deterministic methods, defense-in-depth, expert panel).

b) MHI stated in their response to RAI 17.04-17 that "CCF of software were modeled as basic events and showed high RAW values. In the PRA, CCFs of hardware of I&C systems were represented by CCF of software. This is because CCF probabilities of software used in the PRA model were assumed to bound the CCF probability of hardware that have similar impact on the system reliability." This statement suggests that hardware would have similar risk significance as software (i.e., similar high RAW values or impact on risk given a failure). This remains true even if the failure probability of hardware were much lower than that of software.

c) MHI stated that software CCF probabilities were assumed to bound hardware CCF probabilities. This assumption does not provide a sufficient basis for excluding hardware from D-RAP. It is assumed in the PRA that hardware has high reliability. This assumption is only true if the hardware is subjected to appropriate reliability assurance activities. Therefore, the assumption in the PRA that the hardware has high reliability further emphasizes the need to include hardware in D-RAP (the intent of D-RAP is to ensure the reliability assurance activities that were accomplished prior to initial fuel load for the risk-significant SSCs provide reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for the risk-significant SSCs).

The staff requests that MHI include hardware of I&C in Table 17.4-1 of the US-APWR DCD. Otherwise, provide a more acceptable basis for not including hardware in Table 17.4-1 of the US-APWR DCD.

ANSWER:

MHI is now developing the PRA model to deal the CCF of "hardware" of instrumentation and control (I&C) systems. The evaluation of new PRA model will be over in one or two months.

Based on the results of PRA, risk importance for each I&C system will be evaluated and risk significant I&C system will be included in Table 17.4-1 of the US-APWR DCD.

This will be also done by the next revision of the US-APWR DCD.

Impact on DCD

List of risk significant SSCs will be revised to include hardware of I&C system considering the results of PRA and discussion of expert panel by the next revision of the US-APWR DCD.

Impact on COLA

There is no impact on COLA from this RAI.

Impact on PRA

There is no impact on PRA from this RAI.

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~~3) 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 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 EP. 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.

In the PRA, failure modes of SSCs were extracted from available generic data sources of failure rates and probabilities such as NUREG/CR-6928, IEEE std-500, NUREG/CR-4550 and others. Failure modes applicable to the SSCs credited in the US-APWR PRA were selected from the list of failure modes reported in the generic data sources. These failure modes were modeled in the fault trees as basic events in the PRA. Failure rates and failure probabilities of each failure modes that were considered to be most applicable to the US-APWR were also chosen from the generic data sources. Consequently plural failure modes are applied for each SSC. Among the failure modes for the SSC, dominant failure mode are determined by the results of importance analysis.

There are some SSCs that are not modeled in the PRA but can be identified as risk significant from the following points of view.

- The required mitigation function during the accident.
- The equality and similarity in function and failure behavior with other risk significant SSCs
- The concerning risk significant human error or software error and so on.

And there are other SSCs, in whose PRA models importance measures are not computed but which are identified as risk significant based on the following comparison.

- The difference in assumption applied for the PRA model from that of similar PRA models that have importance analysis results.
- The commonality in assumption applied for the concerned PRA model from that of similar PRA models that have importance analysis results.

These SSCs are also included in risk significant SSCs list and dominant failure modes for these SSCs are supposed from the above points of view or comparison of assumptions with those of similar PRA models. These supposed failure modes will be discussed and determined by the review of expert panel.

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. The EP also reviews the categorization of SSCs determined to be not risk significant (NRS) from 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 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~~ at least one person with design engineering experience, at least one person with PRA experience, at least one person with operations and maintenance experience, and at least one person with quality assurance experience, 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.~~ Industry operating experience and use of the Expert Panel are used as the part of deterministic approach and other processes.

Table 17.4-1 Risk significant SSCs (sheet 36 of 36~~34~~)

#	Systems, Structures and Components (SSCs)	Rationale[1]	Insights and Assumptions
26	Spent fuel pit cooling and purification system (SFPCS)		
1	RWS – SFP inlet line boundary check valves [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. 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.
2	RWS – SFP inlet line manual valve [VLV-028]	RAW/LPSD	
3	RWS – SFP demineralizer line boundary manual valves [VLV-103A (B)]	RAW	
4	RWS – SFP inlet line manual valves [VLV-029] [VLV-015] [VLV-017]	LPSD	
5	Spent fuel pit [RPT-001]	LPSD	
6	A~D-Spent fuel pit strainers [SFS-RSR-001A (B,C,D)]	LPSD	
7	Spent fuel pit discharge line manual valves [VLV-021A(D)]	LPSD	
8	Spent fuel pit discharge cross tie-line manual valve [VLV-022]	LPSD	
27	Remote Shutdown Panel (RSP)		
1	Remote shutdown panel	FIRE	In case of Fire event at power some operations are required to be carried out in remote shutdown panel therefore remote shut down panel are considered risk significant.

Table 17.4-1 Risk significant SSCs (sheet 37 of 36~~34~~)

Notes:

1. Definition of Rationale Terms:

CCF = Common Cause Failure	CCF(L2) = Common Cause Failure for L2
FV = Fussell-Vesely	LPSD =Low Power and Shut Down Operation
RAW = Risk Achievement Worth	EJ = Engineering Judge
FV(L2) = Fussell-Vesely for L2	FLOOD = FLOOD Event
RAW(L2) = Risk Achievement Worth for L2	FIRE = FIRE Event
	EP = Expert Panel

*1 = Based on the equality and similarity in function and failure behavior to other SSCs, which are risk significant

*2 = Based on the risk significant human error concerning the SSCs

*3 = Based on the risk significant signal error concerning the SSCs

DCD_17.04-11
DCD_17.04-10
DCD_17.04-36
DCD_17.04-39
DCD_17.04-47

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. A description of the proposed method for developing/integrating the operational RAP into operating plant programs (e.g., maintenance rule, quality assurance) is performed during the COL application phase. The development/integration of the operational 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 D-RAP should be categorized as high-safety-significant (HSS) within the scope of initial Maintenance Rule. The integration of reliability assurance activities into existing operational programs will also address establishment of:*

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 following the guidance contained in RG 1.160 is one acceptable method for establishing performance goals provided that SSCs are categorized as HSS within the scope of the Maintenance Rule program), and*

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

17.4.10 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 "Quality Assurance Program (QAP) Description For Design Certification of the US-APWR (PQD-HD-19005 Rev.2)"

17.4-~~2~~3 '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.