MITSUBISHI HEAVY INDUSTRIES, LTD.
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TOKYO, JAPAN

September 16, 2008

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-08181

Subject: MHI's Responses to US-APWR DCD RAI No.49 Revision 0

Reference: 1) "Request for Additional Information No. 49 Revision 0, SRP Section: 06.04, Application Section: 6.4," dated August 19, 2008.

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.49 Revision 0."

Enclosed are the responses to 24 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.49 Revision 0

CC: J. A. Ciocco
C. K. Paulson

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Enclosure 1

UAP-HF-08181
Docket Number 52-021

Response to Request for Additional Information No.49 Revision 0

September, 2008

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-1

US APWR DCD section 6.4 MCR HVAC system does not completely assure conformance with the requirements of GDC 4 in accordance with NRC SRP 6.4 acceptance criteria item II.1. The review of DCD section 6.4 could not find GDC 4 addressed completely by reference. Provide additional information that clarifies where GDC 4 is addressed completely by reference in DCD section 6.4.

ANSWER:

RG 1.206 prescribes a requirement for environmental and dynamics effects design bases in Section 6.0. Section 6.0, paragraph 6.0 of the DCD refers to compliance with GDC 4. Unlike reference to GDC 19 in section 6.4, there is no specific reference to requirements for GDC 4 in section 6.4 of RG 1.206. MHI believes that the reference to GDC 4 which applies to all sections of Chapter 6 in Section 6.0 is adequate without additional DCD modification.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-2

US APWR DCD Section 6.4 does not reference or address RG 1.196 and RG 1.197 in accordance with SRP 6.4 acceptance criteria item 1.E. Provide additional information that clarifies where RG 1.196 and RG 1.197 are addressed completely or by reference in DCD section 6.4.

ANSWER:

MHI concurs with the NRC that full compliance with the RG 1.196 and RG 1.197 needs to be documented and will revise Subsection 6.4.1 and Subsection 6.4.8 to address compliance with RG 1.196 and RG 1.197 in DCD revision 2. Furthermore, RAI question No.06.04-3 requires similar documentation for compliance with GDC 19. The response to this RAI question No.06.04-2 is prepared in conjunction with responses to RAI question No.06.04-3 and No.06.04-23.

Impact on DCD

Discussion of the compliance with RG 1.196 and RG 1.197, including compliance with GDC 19, will be added in the first paragraph of DCD Subsection 6.4.1 in DCD revision 2. DCD Subsection 6.4.8 will be revised to add RG 1.196 and RG 1.197 as references in DCD revision 2. DCD Subsection 1.9.1, Table 1.9.1-1 will be also revised to reflect this response in DCD revision 2.

The revision of DCD should be as follows:

6.4.1 Design Bases

The CRE is designed in accordance with requirement of Criterion 19 of Appendix A to 10 CFR 50 (Ref 6.4-1) to permit access to and occupancy of the MCR under accident condition. The CRE also address the guidelines of RG 1.196 (Ref. 6.4-8) and RG 1.197 (Ref 6.4-9), including referenced consensus standards to the extent endorsed by the NRC described in the guidance. The radiation exposure of control room personnel through the duration of any one of the postulated limiting faults discussed in chapter 15 does not exceed the limits set by GDC 19.

6.4.8 References

6.4-8 U.S. Nuclear Regulatory Commission, Control Room Habitability at Light-Water Nuclear Power Reactors, Regulatory Guide 1.196, Rev.1, January 2007.

6.4-9 U.S. Nuclear Regulatory Commission, Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors, Regulatory Guide 1.197, May 2003.

Table 1.9.1-1, US-APWR Conformance with Division 1 Regulatory Guides will be revised as follows:

Reg Guide Number	Title	Status	Corresponding Chapter/Section /Subsection
1.196	Control Room Habitability at Light-Water Nuclear Power Reactors (Rev.1, January 2007)	~~Not applicable. RG applies to evaluation of changes to control room; initial habitability is established according to RGs 1.78, 1.183 and 1.194.~~ **Conformance with no exceptions identified.**	~~N/A~~ **6.4**
1.197	Demonstrating Control Room Envelope Integrity at Nuclear Power Reactors (Rev. 0, May 2003)	~~Not applicable. RG applies to a periodic, site-specific test program of control room in-leakage.~~ **Conformance with no exceptions identified.**	~~N/A~~ **6.4.5**

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-3

US APWR DCD section 6.4 MCR HVAC system does not completely assure conformance with the requirements of GDC 19 in accordance with NRC SRP 6.4 acceptance criteria item II.3. The review of DCD section 6.4 could not find GDC 19 addressed completely or by reference. Provide additional information on where GDC 19 is addressed completely or by reference in DCD section 6.4.

ANSWER:

MHI concurs with the NRC that full compliance with GDC 19 needs to be documented and will revise Subsection 6.4.1 to address compliance with GDC 19 in DCD revision 2. The response to this RAI question No.06.04-3 is included in the response to RAI question No.06.04-2 since it affects the same text.

Impact on DCD

See "Impact on DCD" of RAI question No.06.04-2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-4

US APWR DCD section 6.4, Table 6.4-1, provides equipment specifications for the MCR Emergency Filtration Unit (EFU). Provide additional details for the DCD section 6.4 calculations used to establish the MCR EFU electric heating coil capacity, fan airflow rate, and HVAC System Isolation Dampers closure time as described in Table 6.4-1 for equipment design data specifications, including assumptions and margins. This information is required by the staff in its review of the application to satisfy the review requirements per SRP 6.4 Section II and III.

ANSWER:

The MCR emergency filtration unit (EFU) electric heating coil capacity is designed to be capable of reducing relative humidity of filtration air from 100%RH to 70%RH.

The formula to calculate the MCR EFU electric heating coil capacity is as follows:

$$q = \rho \, Cp \, Q \, dT \, 60$$

where,

- q : Electric heating coil capacity (BTU/h)
- ρ : Density (0.075 lb/ft^3)
- Cp : Specific heat (0.24 BTU/lb-F)
- Q : Flow rate (3600 CFM)
- dT : Differential temperature (13 deg F)

Margin is also considered more than 15% in electric heating coil capacity.

The MCR EFU fan airflow rate is design parameter for dose analysis. The results of dose analysis show that the MCR EFU fan airflow rate is sufficient. The results of dose analysis are show in Chapter 15.

Damper closure time is also design parameter, but this parameter directly affects to dose analysis. This parameter comes from existing plant experience and becomes the requirement for the isolation dampers of the MCR HVAC system.

Impact on DCD

There is no impact on DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-5

US APWR DCD section 6.4, Figure 6.4-2, shows the layout which includes the charcoal adsorber after the HEPA filter. GDC 19 requires provision of a control room from which actions can be taken to maintain the plant in the safe state under accident conditions, including LOCAs. Provide additional information about the design of the charcoal adsorber component that addresses and prevents the potential for the charcoal to ignite and burn, particularly when exposed to radioactive material during a LOCA.

ANSWER:

RG 1.52, Section 4.10 reads "The design of the adsorber section should consider possible iodine desorption and adsorbent auto-ignition that may result from radioactivity-induced heat in the adsorbent and concomitant temperature rise. Acceptable designs include a low-flow air bleed system, cooling coils, water sprays for the adsorber section, or other cooling mechanisms. Any cooling mechanism should satisfy the single-failure criterion."

In US-APWR, ignition and burning of the charcoal bed is mitigated by a fixed water spray system designed into the charcoal filter unit enclosure. The water spray is directed at the charcoal bed(s). Subsection 9A.3.52 and 9A.3.53 of DCD revision 1 reads "A fixed water suppression system and automatic fire detection is provided for the charcoal filter in MCR filter unit." If a MCR emergency filtration unit starts alarming due to a fire scenario, redundancy of the MCR emergency filtration units allows the affected unit to be isolated and the other unit to take over operation.

Thus, US-APWR design appropriately addresses the potential for the charcoal to ignite and burn.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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09/16/2008

US-APWR Design Certification

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Docket No. 52-021

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QUESTION NO. : 06.04-6

US APWR DCD section 6.4, Figure 6.4-1 shows the MCR envelope which has 2 access doors. No airlock, vestibule, or other design detail is shown at the doors to maintain a proper air balance and control room environment for accessibility and occupancy when the doors are opened, particularly during periods of emergency pressurization, emergency isolation, and smoke purging operation modes. SRP section III.3.C addresses system layout diagrams and single failure criteria to mitigate the quantity of unfiltered air that enters the control room and the air balance. Provide additional details about design and procedure provisions employed to maintain door use accessibility and control room occupancy that meets SRP 6.4 acceptance criteria during all MCR operating modes.

ANSWER:

The MCR of US-APWR has a vestibule at the two access door to the CRE. DCD Figure 1.2-18, "Reactor Building at Elevation 25'-3" - Plan View", shows a short corridor at both entrances to the CRE. A door is installed at the end of the short corridor leading to the main corridor. Therefore, the short corridors will serve as vestibules.

In access by the MCR personnel, the air balance of MCR will be maintained by this vestibule during the emergency pressurization mode of operation.

During the emergency isolation mode of operation, when there is no positive pressure in the CRE, the access doors will be administratively controlled to prevent their being opened during the event.

The CRE may be under negative pressure during the smoke purge mode of operation since it is necessary to purge smoke in CRE. Therefore, there are no concerns about the door being opened during the smoke purge mode of operation.

Impact on DCD

DCD Figure 6.4-1 will be revised to show the vestibule and doors at each access point to the CRE, in DCD revision 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
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APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-7

US APWR DCD section 6.4, Figure 6.4-5, illustrates the MCRE ventilation system plan view which shows intake air flow through the MCR emergency filtration units, which applies to only the emergency pressurization mode of operation. The air flow for the normal and emergency isolation operation modes for the MCRE ventilation system does not pass through the MCR emergency filtration units. SRP section III.3.A.ii & iii addresses ventilation layout and functional design including, zone isolation and maintaining positive pressure in the control room. Provide additional information that clarifies by adding a note or another indicator on Figure 6.4-5 that the intake air flow shown applies only to the emergency pressurization mode of operation.

ANSWER:

DCD Figure 6.4-5 will be revised to indicate that the air flow configuration shown applies only to the emergency pressurization mode of operation in DCD revision 2.

Impact on DCD

DCD Figure 6.4-5 will be revised to add the following notes in DCD revision 2.

"Note: Air flow configuration applies only to the emergency pressurization mode."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
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DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-8

US APWR DCD section 6.4, Figure 6.4-6, shows the MCRE ventilation system sectional (elevation) view. The main steam and feed water valve (MSFV) room is shown directly above the emergency filtration units and air handling unit (EFU&AHU) rooms, which in turn, is located directly above the MCR. SRP section III.5.C.iii addresses confined area releases and all pressurized piping that could cause a pressure gradient when failed inside buildings. Provide additional information on the risk assessment for potential steam/water boundary failure leaks from the MSFV room migrating to the EFU&AHU rooms and MCR room below.

ANSWER:

MCR integrity after postulated break of the piping is discussed in DCD Subsection 3.6.1.2.3.2. The conclusion of DCD Subsection 3.6.1.2.3.2 shows that the MCR is not affected by any of the effects of a postulated break of main steam piping. Please refer to DCD Subsection 3.6.1.2.3.2.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
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QUESTION NO. : 06.04-9

US APWR DCD section 6.4 contains very little information about the fire protection system. It defers to the fire protection system discussed in Chapter 9, Section 9.5.1. In subsection 6.4.2.5 it states "*There are no pressure-containing tanks or piping systems in the CRE that could on failure, transfer or introduce hazardous material into the CRE (with exception of installed gaseous fire suppression in the cable spreading area below the floor).*" Provide additional information that describes what the gaseous fire suppression material is and why it is hazardous. However, section 9.5.1, Table 9.5-1, position number 6.1.2, under remarks states: "The MCR raised-floor compartment is also provided with a fire suppression system that discharges an environmentally friendly clean fire extinguishing agent that does not present a hazard to MCR personnel." Provide additional information that clarifies whether the MCR cable spreading area beneath the floor uses hazardous fire suppression material or not and provide an accurate assessment of the fire suppression material and how it meets the requirements of RG 1.189 for use in the MCR envelope area.

ANSWER:

DCD Subsection 9.5.1.2.5, Automatic Extinguishing Systems, states "Halon and carbon dioxide total flooding systems are not used; however, a clean agent gaseous fire suppression agent in conjunction with very early warning fire detection is used for selected areas with heavy cable fire loading." Automatic Gaseous Suppression Systems in DCD subsection 9.5.1.2.5 further states "The US-APWR employs several gaseous fire suppression systems in select critical plant areas with heavy fire loading or raised-floor compartments where access for fire fighting may be difficult. For each area where a total flooding gaseous fire suppression system is identified, an environmentally-friendly fire suppression clean agent is used (Novec® 1230 fluid in a 5.6% concentration for cable raised-floor areas, or equal). In conjunction with the gaseous system, an air aspirating, very early warning fire detection system (VESDA® or equal) is used to provide notification of a fire. Such an early notification provides a defense-in-depth fire protection approach for these areas which helps assure adequate fire safety for the areas."

DCD Subsection 9.5.1.2.7, Building Ventilation, states "The MCR ventilation system purges smoke in the event of a fire inside the MCR and isolates the room if smoke is detected in the normal outside air intake ducts."

DCD Subsection 9.5.1.2, System Description, provides/references Table 9.5.1-1 which is a point-by-point comparison of the conformance of the US-APWR fire protection program with the guidelines of RG 1.189, Rev. 1.

An accurate description of the gaseous extinguishing material is provided above and the text in Chapter 6, Subsection 6.4.2.4 will be revised to clarify that hazardous materials are not used in the area below the floor in DCD revision 2.

Impact on DCD

The last sentence of DCD Subsection 6.4.2.4 will be revised as follows in DCD revision 2:

"There are no pressure-containing tanks or piping systems in the CRE that could, on failure, transfer or introduce hazardous material into the CRE ~~(with the exception of installed gaseous fire suppression in the cable spreading area below the floor)~~."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-10

US APWR DCD section 6.4 does not define or discuss iodine protection factors (IPF) and zone isolation as covered in SRP 6.4 III.3.D, III.3.E.i, III.3.E.ii, and III.3.E.iii. Provide additional information and clarification in regard to iodine protection factor and zone isolation.

ANSWER:

As noted in SRP 6.4 III.3.D, the iodine protection factor (IPF) methodology described in the "Murphy-Campe paper" (Reference 9 of SRP 6.4) models a steady-state control room condition. However, as noted in US-APWR DCD Subsection 15.6.5, the time dependent analysis program RADTRAD was utilized for control room evaluation for LOCA. Therefore, per SRP 6.4 III.3.D, IPF methodology does not apply.

With regards to zone isolation, US-APWR utilizes SRP 6.4 III.3.E.iii, "Zone isolation with filtered recirculated air and a positive pressure" type of system. Associated input parameters used in the Main Control Room Consequence Analysis for the LOCA are provided in Table 15.6.5-5, Chapter 15.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-11

US APWR DCD section 6.4 indicates the Habitability system has a smoke purge mode of operation. But this smoke mode is not shown in the referenced DCD section 9.4.1, Table 9.4-1, sheet 1, as an abnormal condition like LOOP or SBO. SRP 9.4.1 section III.1 requires a review for normal and emergency operations, and the ambient temperature limits for the areas serviced. Clarify if Table 9.4-1, sheet 1, should include an additional smoke purge mode under abnormal conditions for the main control room area minimum and maximum temperature and humidity control levels. If the smoke purge mode is added to Table 9.4-1, provide additional details for the DCD section 9.4.1, Table 9.4-1, sheet 1 values for the control room area ventilation system calculation procedures and methods, including assumptions and margins. This information is required by the staff in its review of the application to satisfy the review requirements per SRP 6.4 Section II and III.

ANSWER:

The smoke purge mode of operation is not considered an abnormal condition. The smoke purge mode of operation is normally used after a fire has been extinguished. Typically, when smoke is detected, the ventilation system is automatically shutdown to minimize the spread of the smoke. After a fire in an area has been extinguished, the ventilation system is manually placed into the smoke purge mode of operation for quick removal of smoke from the area. The smoke purge mode of operation serves no safety-related function.

According to the SRP, the reviewer determines whether the ventilation system or portions of the system have been designed or need to be designed as safety-related systems and reviews them with respect to functional performance requirements during adverse environmental conditions, normal operation, anticipated operational occurrences and after a postulated accident, including the LOOP. The smoke purge portion of the MCR HVAC system outside the CRE and downstream of the safety-related isolation damper at the wall of the CRE does not serve any safety-related function and has no safety design bases.

Therefore, DCD Table 9.4-1 does not have to include smoke purge mode of operation under abnormal conditions.

Impact on DCD

DCD Subsection 6.4.2 will be added the following paragraph to clarify the function of the smoke purge portion of the system in DCD revision 2.

"The smoke purge mode is utilized for the removal of smoke from the MCR only after the fire has been extinguished. The smoke purge portion of the MCR HVAC system serves no safety-related function."

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

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09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-12

The US APWR DCD section 6.4 Habitability system states that the MCR HVAC system (Chapter 9, subsection 9.4.1) is one of the applicable chapter and subsection references for DCD section 6.4. SRP 9.4.1 sections III.1, III.3 and III.4 make reference to use of a failure modes and effects analysis, as appropriate, to confirm that the essential safety-related portions of the system are capable of functioning in spite of the failure of any active component, in the event of an earthquake, during loss of offsite power, or a concurrent single active failure. DCD section 6.4 does not contain any references to or COL items for a failure modes and effects analysis for the Habitability system. . The staff requests the DC applicant provide detailed information about the failure modes and effects analysis for the Habitability system as well as the MCR HVAC system

ANSWER:

The failure modes and effects analysis for MCR HVAC system will be added in DCD revision 2.

Impact on DCD

The failure modes and effects analysis for MCR HVAC system will be added in DCD revision 2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-13

US APWR DCD section 6.4 refers to the control room envelope (CRE) boundary used in the text discussion as being shown in Figure 6.4-1. Figure 6.4-1 is titled Main Control Room Envelope. SRP Section III.3.C requires that the system layout diagrams and components be examined. It appears that Figure 6.4-1 should be entitled Control Room Envelope to be consistent with the acronym CRE used throughout the text. Provide additional information to clarify why Figure 6.4-1 was not labeled Control Room Envelope to be consistent with the acronym CRE used throughout the text of DCD Section 6.4.

ANSWER:

DCD revision 1 is revised the title of Figure 6.4-1 to "Control Room Envelope", consistent with the CRE acronym used throughout section 6.4.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

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QUESTION NO. : 06.04-14

DCD Table 3.2-2 "Classification of Mechanical and Fluid Systems, Components and Equipment (Sheet 40 of 50)" lists the Tornado Dampers as Equipment Class "5".

DCD Section 3.2.2.5 "Other Equipment Classes" reads "Equipment Class 5".

Equipment Class 5 is assigned to non safety-related components that are not part of the RWMS and not within the purview of RG 1.26 (Reference 3.2-13). The equipment class is also assigned to non safety-related structures and structural components, instrumentation, controls, and electrical components. Equipment Class 5 SSCs are classified NS or seismic category II, and 10 CFR 50, Appendix B (Reference 3.2-8) is not applied. Specific quality assurance program controls are applied to non safety-related SSCs, to a degree consistent with their importance to safety (graded approach), as described in Chapter 17. Codes and standards, as defined in the design bases, are applied to equipment Class 5 components."

The staff requests that the DC applicant state the basis for installing non-safety related tornado dampers in Equipment Class 3 air intake ductwork to the ESF filtration units.

ANSWER:

"Tornado dampers" of MCR HVAC system is deleted from Table 3.2-2 in DCD revision 1. Tornado dampers are included in "Dampers", and classified as Equipment Class 3.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

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Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-15

Specific area of review I.2 from SRP 6.4 "Areas of Review" reads "The capacity of the control room in terms of the number of people it can accommodate for an extended period of time is reviewed to confirm the adequacy of self-contained breathing apparatus and to determine the length of time the control room can be isolated before CO2 levels become excessive."

Neither DCD Section 6.4 "Habitability Systems" nor Section 9.4.1 "Main Control Room Heating, Ventilation and Air Conditioning System" address the issue of length of time the control room can be isolated before CO2 levels become excessive and the requirements for self-contained breathing apparatus (SCBA). The requirements for SCBAs could be site specific. The maximum isolation time of the CRE before CO2 levels become toxic may also be site specific.

The staff requests that the DC applicant provide information about these two issues in the DCD.

ANSWER:

SRP 6.4 III.2 "Control Room Personnel Capacity" of "Review Procedures" reads "A control room designed with complete isolation capability from the outside air to provide radiation and toxic gas protection is reviewed to determine if the buildup of carbon dioxide could present a problem. The air inside a 2830 m3 (100,000 cubic foot) control room would support five persons for at least six days. Thus, CO2 buildup in an isolated emergency zone is not normally considered a limiting problem."

On the other hand, the CRE volume of US-APWR is approximately 140,000 cubic foot, as stated in Table 15.6.5-5.

Thus, the CO2 buildup in an emergency isolation mode is not considered a limiting problem in US-APWR.

Impact on DCD

DCD Subsection 6.4.1 "Design Basis" will be revised to discuss the CRE volume that is not considered a limiting problem for CO2 buildup in DCD revision 2.

6.4.1 Design Bases

The CRE volume is approximately 140,000 ft^3 which exceeds 100,000 ft^3. The air inside the CRE can support five persons for at least six days. Therefore, the CO2 buildup in emergency isolation mode is not considered a limiting problem.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
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QUESTION NO. : 06.04-16

Table 6.4-1 "Main Control Room Emergency Filtration System – Equipment Specifications" lists a flow rate of 2,000 scfm for the HEPA Filter Type and a Design Air Flow Rate of 3,600 scfm for the fans of the MCREFS unit.

The staff requests that the DC applicant provides additional information about this apparent mismatch of flow rates for these two in-series filter train components.

ANSWER:

The flow rate of 2,000 scfm, as indicated in the Table 6.4-1 for the HEPA filter, is based on a HEPA filter with a No. Designation of 8 as listed in ASME AG-1, Table FC-4110.

Each Main Control Room Emergency Filtration Unit has a HEPA Filter assembly consisting of two (2) of these HEPA filters in parallel, for a total airflow capacity of 4000 scfm. Therefore, the 3600 cfm, supplied by the Main Control Room Emergency Filtration Unit fan, does not exceed the HEPA filters capacity.

The actual flow rate that is arranged in the construction phase will be balanced above the specified airflow rate. Therefore, the filter assemblies in the filtration unit include margin to accommodate future airflow rate balancing.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
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QUESTION NO. : 06.04-17

"SRP Acceptance Criteria" 3.A & B "Pressurization Systems" of SRP 6.4 reads:

"*A. Systems having pressurization rates of greater than or equal to 0.5 volume changes per hour should be subject to periodic verification (every 18 months) that the makeup is + 10% of design value. During plant construction or after any modification to the control room that might significantly affect its capability to maintain a positive pressure, measurements should be taken to verify that the control room emergency zone is pressurized to at least to the value used in the accident analysis relative to all surrounding air spaces while applying makeup air at the design rate.*"

"*B. Systems having pressurization rates of less than 0.5 and equal to or greater than 0.25 volume changes per hour should have identical testing requirements as indicated in acceptance criteria 1 above. In addition, at the construction permit (CP), combined license, or standard design certification stage, an analysis should be provided (based on the planned leaktight design features) that ensures the feasibility of maintaining the tested differential pressure with the design makeup airflow rate.*"

DCD Section 6.4.2.3 "Leaktighness" reads;

"*The potential leak paths of the CRE are cable, pipe, and ducting penetrations, doors, and HVAC equipment. Total system leakage in pressurization mode is less than 120 ft3/min (0.05 volume changes of the CRE per hour). Air exchange in pressurization mode is less than 1,200 ft3/min (0.5 volume changes of the CRE per hour).*" Based on the above excerpts, an 18 month test frequency seems appropriate.

DCD Chapter 16 surveillance requirement SR 3.7.10.4 lists a Frequency "24 months on a staggered test basis" The bases for SR 3.7.10.4 reads "... The Frequency of 24 months on a staggered test basis is consistent with the guidance provided in NUREG-0800" (i.e. Section 6.4, Rev. 3, March 2007)

The staff requests that the DC applicant provide additional information that would explain the basis for the difference in the frequencies specified in SR 3.7.10.4 when compared to Section 6.4 of NUREG-800. In addition, the staff could not locate with in the Tier 1 or Tier 2 documents a value for the CRE volume. The staff requests that the DC applicant provide this information as well.

ANSWER:

DCD Chapter 16 SR 3.7.10.4 is revised to be consistent with TSTF-448 revision 3 in DCD revision 1. The surveillance frequency of SR 3.7.10.4 is changed to "In accordance with the Control Room Envelope Habitability Program". In addition, Control Room Envelope Habitability Program is added in Subsection 5.5.20 of Chapter 16, DCD revision 1.

Measurement of the CRE pressure relative to all external areas adjacent to the CRE boundary is required at a frequency of 24 months on a STAGGERED TEST BASIS in DCD revision 1. RG 1.197 requires the periodic test in every six years, if no changes are made to structure, systems, and components that could impact CRE integrity. The CRE integrity is permitted to carry out a periodic test in every six years, though the CRE pressure affects CRE integrity. Therefore, MHI believes that the frequency of 24 months on a STAGGERED TEST BASIS is acceptable.

The CRE Volume of 140,000 ft^3 will be added in DCD Subsection 6.4.1. See answer for RAI question No.06.04-15.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-18

The last paragraph of SRP 6.4 Section III.3.E.iv Review Procedures/ Ventilation System Layout and Functional Design contains the following words "... The location of the intakes with respect to the plant security fence should also be reviewed. Evaluation of the design options described above depends on the physical characteristics of the site as well as the plant design and, thus, can be finalized only at the COL stage of review."

DCD Section 6.4.7 "Combined License Information" does not contain a requirement that the COL Applicant perform the above review.

The staff requests that the DC applicant amend DCD Section 6.4.7 to reflect this requirement.

ANSWER:

MHI concurs with the NRC that the COL applicant needs to evaluate the location of the intakes with respect to the plant security fence.

Impact on DCD

DCD Subsection 6.4.2.2 will be revised to discuss the location of the intakes with respect to the plant security fence and DCD Subsection 6.4.7 will also be revised to add this COL item.

6.4.2.2 Ventilation System Design

The COL Applicant is responsible to evaluate design options and operating strategy relative to physical characteristics of the site, location of the intakes with respect to the plant security fence, including physical characteristics of areas adjacent to the security fence which may influence flow of contaminated air.

6.4.7 Combined License Information

COL 6.4(6) **The COL Applicant is responsible to evaluate design options and operating strategy relative to physical characteristics of the site, location of the intakes with respect to the plant security fence, including physical characteristics of areas adjacent to the security fence which may influence flow of contaminated air.**

Impact on COLA

There is impact on COLA to incorporate the DCD change.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-19

SRP 6.4 Section III.5.C.i Review Procedures/ Relative Location of Source and Control Room contains the following words "*...the organization responsible for ventilation and air filtration for its toxic gas estimates for use in the control room habitability analysis. There are three basic categories: Radioactive sources, toxic gases such as chlorine, and gases with the potential for being released inside confined areas adjacent to the control room.*"

Chillers that use the new HCFC and HFC refrigerants are of particular concern. The new refrigerants can be more toxic and have some safety behavioral concerns that the old CFC refrigerants did not have. In the event of a large release of the new refrigerants as a result of operator error or chiller refrigerant pressure boundary leak incident, the danger to personnel due to potential asphyxiation from air displaced by the refrigerant, refrigerant toxicity, and potential chemical reactions can be devastating (e.g., HCFC and HFC refrigerants breakdown when exposed to heat and can create hydrofluoric and hydrochloric acid fumes when combined with water, burning the refrigerant in and open flame or arc can create deadly gas comparable to phosgene, etc.). The design of chiller equipment and their rooms require the capability to rapidly vent gas and fumes out of the room/plant and away from potential pathways to the CRE and CRE air intakes, preclude operator errors, prevent external damage to the chiller refrigerant boundary, provide refrigerant leak detectors and alarms, and address other areas of concern due to the use of new refrigerants during the analysis and design procedures.

With respect to the existing US APWR design and with respect to gases (e.g. fire fighting materials, CO2, chiller refrigerants, etc.) with the potential for being released inside confined areas adjacent to the control room envelope, the staff requests that the DC applicant provide additional information as to whether the existing design will house any sources of gases in the areas adjacent to the CRE.

ANSWER:

There is no asphyxiation hazard associated with the control room atmosphere due to a potential release of refrigerants in areas adjacent to the control room, because of the remote location and structural barriers between the refrigerant and the control room air inlets. Essential chiller units are located on B1F in the Power Source Building. The non-essential chiller units are located on 3F in the Auxiliary Building. There are no refrigeration units used in the control room equipment.

Impact on DCD

DCD Subsection 6.4.4.2 will be revised to discuss asphyxiation hazard in the area adjacent to CRE in DCD revision 2.

The last sentence of first paragraph Subsection 6.4.4.2 is as follows:

The designated storage areas of hazardous chemicals as recommended by RG 1.78 are sited at distances greater than 330 feet from the MCR or the fresh air inlets shown in Figures 6.4-5 and 6.4-6. **There is no asphyxiation hazard associated with the MCR atmosphere in areas adjacent to the CRE.**

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-20

SRP 6.4 Section III.5.C.ii Review Procedures/ Relative Location of Source and Control Room/Confined Area Releases reads "*The ventilation zones adjacent to the emergency zone should be configured and balanced to preclude airflow toward the emergency zone.*"

The staff could find no evidence in its review of DCD section 9.4 that this requirement in being invoked in the "Inspection and Testing requirements" DCD sections for the applicable HVAC system that provide ventilation to the areas adjacent to the CRE

The staff requests that the DC applicant amend the relevant DCD HVAC system sections and the relevant preoperational tests of DCD chapter 14 to reflect this requirement.

ANSWER:

MHI will revise affected sections in Chapters 6, 9 and 14 to include balancing and testing requirements that ensure airflow is not directed toward CRE boundaries.

Impact on DCD

DCD Subsection 6.4.2.4, 9.4.1.4 and will be revised to as follows:

6.4.2.4 Interaction with Other Zones and Pressure-Containing Equipment

A positive ventilation pressure is established at each CRE access when in the pressurization mode. This pressure reduces infiltration of potentially harmful CRE inleakage by maintaining an outward ventilation flow from the CRE. **In addition, the ventilation zones adjacent to CRE are configured and balanced to preclude airflow toward CRE.**

14.2.12.1.101 MCR HVAC System Preoperational Test (including MCR Habitability)

C. Test Method

7. Ventilation zones adjacent to the CRE are configured and balanced to preclude airflow toward CRE.

D. Acceptance Criteria

7. CRE is not directed airflow from ventilation zones adjacent to CRE.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
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DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-21

The second paragraph of SRP 6.4 section I "Areas of Review" contains the words "*...Additionally, review is performed to ensure that the control room can be maintained as the backup center from which technical support center personnel can safely operate in the case of an accident.*"

In its review of DCD sections 6.4 and 9.4.1 the staff found insufficient evidence to conclude that the DC applicant considered this requirement in the design of the CRE Habitability System and the Main Control Room HVAC System.

The staff requests that the DC applicant provide additional information about how the design of the CRE and the MCR HVAC system satisfies this requirement.

ANSWER:

The technical support center (TSC) is discussed in DCD Subsection 13.3. Subsection 13.3, DCD revision 1 reads "The TSC is close to the main control room (MCR), located in the access building (AC/B). The walking time from the TSC to the MCR does not exceed 2 minutes."

The MCR is not intended as a backup to TSC. The MCR has the capability to protect its personnel during an accident condition. This is analyzed in Chapter 15. Typically there are about 25 people in the TSC. The MCR is not equipped to hold this number of people.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
DATE OF RAI ISSUE:	**08/19/2008**

QUESTION NO. : 06.04-22

The first paragraph of DCD Section 6.4.3 System Operational Procedures reads "*...Smoke purge operation cannot be initiated during MCR emergency filtration system operation.*"

Will the interface between these two operational modes be administratively controlled? Or, is there an electrical permissive and/or interlock that prevents the subject operation from occurring?

The staff requests that the DC applicant provide additional information about this MCR HVAC system mode of operation interface. If an electrical permissive and/or interlock will control this interface, preoperational test 14.2.12.1.101 "MCR HVAC System Preoperational Test (including MCR Habitability) does not detail the testing of this mode interface.

ANSWER:

Operational procedures will provide administrative controls to prevent initiation of smoke purge operation during MCR emergency filtration mode. No interlocks or permissive are included in the system design.

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

RAI NO.:	**NO.49 REVISION 0**
SRP SECTION:	**06.04 – CONTROL ROOM HABITABILITY SYSTEM**
APPLICATION SECTION:	**06.04 HABITABILITY SYSTEMS**
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QUESTION NO. : 06.04-23

For "Reg Guide Number" 1.196 of DCD Tier 2 Table 1.9.1-1 "US-APWR Conformance with Division 1 Regulatory Guides (sheet 14 of 15)" reads: "*Not Applicable; RG applies to evaluation of changes to control room; Initial habitability is established according to RGs 1.76, 1.183 and 1.194 ...*"

The review guidance of SRP 6.4 invokes Regulatory Guide 1.196 "Control Room Habitability at Light-Water Nuclear Reactors" several times. RG 1.196 provides a comprehensive approach to the issue of control room habitability. An excerpt from the first paragraph of RG 1.196 reads "*Specifically, this guide outlines a process that licensees may apply to control rooms that are modified, are newly designed, or must have their conformance to the regulations reconfirmed.*"

By this last excerpt, the "Status" in DCD Table 1.9.1-1for RG 1.196 is not accurate.

The lead in paragraph of DCD Section 9.4.1 "Main Control Room Heating, Ventilation and Air Conditioning System" reads that the design of the system complies with RG 1.196. This DCD section does not invoke RG 1.196 anywhere else.

The third paragraph of SRP 6.4 Section II Acceptance Criteria/Technical Rational #3 contains and reads:

"*Regulatory Guides 1.195, 1.196 and 1.197 provide acceptable guidance for meeting control room habitability requirements. For future reactors or for plants implementing an alternate source term (AST) pursuant to 10 CFR 50.67, the guidance on dose analysis of Regulatory Guide 1.183 is applicable in place of Regulatory Guide 1.195.*"

The staff requests that the DC applicant incorporate additional information into DCD Section 6.4 that displays evidence of how the Regulatory Positions of RG 1.196 are satisfied in the design of the CRE Habitability System and the Main Control Room Heating, Ventilation and Air Conditioning System. The staff requests that the DC applicant clearly establish the licensing bases for its CRHSs in accordance with Section 2.1.2 of RG 1.196.

ANSWER:

MHI concurs with the NRC that full compliance with RG 1.196 needs to be documented and will revise subsection 6.4.1, Design Bases, to address compliance with RG 1.196 in DCD revision 2. The response to this RAI question No.06.04-23 is included in the response to RAI question

No.06.04-2 since it affects the same text.

Impact on DCD

See "Impact on DCD" of RAI question No.06.04-2.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

09/16/2008

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

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QUESTION NO. : 06.04-24

The Remote Shutdown Console (RSC), which is 2 levels above the control room envelope and 1 level above the Main Control Room Emergency Air Filtration and Air Handling Unit Rooms provides backup reactor control and shutdown capability. Details about the RSC are provided in DCD Sections 6.2, 6.3, and 9.A, but no information is provided in DCD Sections 6.4 and 9.4.1. Provide additional information that will clarify why the RSC is not remote and is located very close to the MCR and the MCREAF facilities and how it relates to GDC 19.

ANSWER:

The requirements for the remote shutdown console (RSC) are detailed in Section 5.4, "Alternative and Dedicated Shutdown Capability" of the RG 1.189, as the basis for RSC facility provisions. Under that scenario, the RSC is required for shutdown of the plant only in the event of a fire in the MCR with no other coincident event, including any radiological events.

The RSC complies with GDC 19 as it houses equipment and controls necessary for continued safe shutdown of the reactor, at an alternate location away from the MCR. Section 6.16, "Alternative/Dedicated Shutdown Panels" of the RG 1.189, which describes the specific requirement for RSC about separation from MCR, reads "Barriers having a minimum fire rating of 3 hours should separate panels providing alternative/dedicated shutdown capability from the control room complex." The MCR is enclosed by 3-hr rated fire-barriers and the RSC is 2 levels above the MCR. Therefore, the RSC is unaffected by a fire in the MCR.

Fire and Radiological events are permitted to be mutually exclusive (See R.G. 1.53 – Application of Single-Failure Criterion to Safety Systems).

Impact on DCD

There is no impact on the DCD.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.