REQUEST FOR ADDITIONAL INFORMATION 262-1972 REVISION 1

3/3/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 12.03-12.04 - Radiation Protection Design Features
Application Section: 12.3

QUESTIONS for Health Physics Branch (CHPB)

12.03-12.04-13

10 CFR 50 Criterion 64 “Monitoring radioactivity releases” states, in part, that means shall be provided for monitoring the spaces containing components for recirculation of loss-of-coolant accident fluids, and for anticipated operational occurrences.

10 CFR 20.1501(b) requires licensees to ensure that the instruments and equipment used for quantitative radiation measurements are calibrated periodically for the radiation measured.

Regulatory Guide 1.97 Rev-3 1983 notes that the applicant is to provide rate monitors for areas inside buildings containing components for the recirculation of loss-of-coolant accident fluid where access is required to service equipment important to safety. IEEE 497-2002 contains functional and design requirements for accident monitoring instrumentation for nuclear plants and RG 1.97 endorses IEEE 497-2002.

NUREG-0800 12.3 calls for the provision of Area and Airborne Radiation Monitoring equipment meeting the specifications of RG-1.97.

QUESTION 8866-Q1

Following an accident some areas in the RB and AB, such as the RHR & SI pump areas, the RHR heat exchangers and associated pipe areas, Boric Acid Transfer Pumps, CVCS HUT and WHUT will have elevated dose rates and require access. Other areas in the A/B such as the Waste Gas Compressors the Boric Acid Evaporator the Boric Acid Transfer pump the Solid Waste Dewatering Area) and the Charging Pumps will subject to large transient dose rates and will also require access during AOO or operational transients. Additionally, the Area for the Future Mobile System, which is adjacent to a major travel path to the RB and is unshielded on one side of the travel path, does not have a radiation monitor.

Contrary to the guidance noted, APWR Tier 2 Table 12.3-4 “Area Radiation Monitors” does not show radiation monitors at the locations discussed above.

In accordance with GDC 64, and NUREG-0800 Section 12.3, please modify Table 12.3-4 to include area monitors at these locations or provide the specific alternative approaches used and the associated justification.

QUESTION 8866-Q2

APWR FSAR Tier 2 section 12.3.4.2 and Table 12.3-5 “Airborne Radioactivity Monitors” includes radiation monitors for spaces containing components for recirculation of loss-of-coolant accident fluids. FSAR section 3.1.6.5 notes that radioactivity levels in the plant environs are continuously monitored during accident conditions by the plant Radiation Monitoring Systems. Some of the spaces monitored by these radiation detectors contain active components, which may require personnel access for equipment monitoring and condition assessment. In addition, some of the monitors noted in this table provide MCR alarms that require manual operator action. Contrary to the guidance in IEEE-497 sections 4.1 and 4.5, FSAR section 12.3.4.2 and Table 12.3-5 do not provide the type classification of these monitors.

In accordance with Criterion 64, NUREG-0800 12.3 and RG-1.97, please modify FSAR Tier 2 section 12.3.4.2 and Table 12.3-5 to include type classification and the basis for the classifications selected or provide the specific alternative approaches used and the associated justification.

QUESTION 8866-Q3

APWR FSAR Tier 2 section 12.3.6 “Combined License Information” COL 12.3(1) only addresses portable air sampling equipment during accident conditions, while Table 7.5-3 “PAM Variables” notes that in addition to portable air sampling equipment, portable survey instruments used for dose rate and radioactivity measurements. Contrary to the information provided in Table 7.5-3, FSAR Tier 2 section 12.3.6 does not address the Type Classification requirements for portable dose rate and activity monitoring instrumentation. IEEE-497 notes that portable equipment used as accident monitoring instrumentation shall meet the criteria for the applicable variable type.

In accordance with NUREG-0800 12.3 and RG-1.97, please modify FSAR Tier 2 section 12.3.6 to include portable dose rate monitoring instruments and to specify the type classification requirements portable for dose rate and activity measuring instrument or provide the specific

QUESTION 8866-Q4

The APWR FSAR Tier 2, section 12.3.4, “Area and Airborne Radioactivity Monitoring Instrumentation”, states that radiation instrumentation assures compliance with 10CFR20. Chapter 12 only notes the types of sources that will be used for calibration. Contrary to the guidance provided in RG-1.206 C.I.12.3.4, FSAR Section 12.3 does not provide any information regarding the calibration methods, calibration frequencies and their bases.

In accordance with RG 1.206, provide information on the calibration methods, frequency and their bases, of the installed area and airborne monitors or provide the specific alternative approaches used and the associated justification.

QUESTION 8866-Q5

The APWR FSAR Tier 2, Table 12.3-4 “Area Radiation Monitors”, states that Containment High Range Area Radiation Monitors are Safety Related. In addition, Table 7.3-3 “Engineered Safety Features Actuation Signals” notes that the MCR Outside Air Intake Airborne Radiation Monitors provide an ESF MCR ventilation isolation signal. FSAR section 15.6.2, regarding the SBLOCA outside containment, notes that the charging flow is sufficient to maintain Pressurizer level, so an automatic ESF ECCS signal would not be generated, but the filtration system for the MCR is still credited for limiting dose to the operators. The Containment High Range Radiation Monitors provide ESF actuation signal for containment purge isolation. RG-1.29 Rev 4 C.1 notes that all equipment needed to maintain the control room within safe habitability limits for personnel or that could result in off site dose should be classified as Seismic Category I. Contrary to this guidance, Item 48 “Radiation Monitoring System” in FSAR Tier 2 Table 3.2-2 “Classification of Mechanical and Fluid Systems, Components, and Equipment” is blank.

In accordance with RG 1.29 Rev 4, RG-1.97 and IEEE-497-2002, please clarify the Classification and Type information provided in Chapters 12, 3 and 7, including the basis for these determinations, or provide the specific alternative approaches used and the associated justification.

QUESTION 8866-Q6

APWR FSAR Tier 2 Reference 12.3-25 References ANSI-N13.1-1997. This should be ANSI-N13.1-1999.

Please revise Reference 12.3-25 to provide the correct revision date.

QUESTION 8866-Q7

Contrary to NUREG-0800 which states that each location have local audible alarm and that monitors located in high noise areas should also have visual alarms, the APWR FSAR section 12.3.4 “Area Radiation and Airborne Radioactivity Monitoring Instrumentation”, states that all airborne radioactivity monitors have no local annunciation.

In accordance with NUREG-0800 Section 12.3 and RG-8.8 C.2.g, please provide revise FSAR Tier 2 section 12.3.4 to change the radiation monitor specifications, or provide the specific alternative approaches used and the associated justification.

QUESTION 8866-Q8

APWR FSAR Tier 2 Table 1.9.1-1 US-APWR Conformance with Division 1 Regulatory Guides (sheet 7 of 15) specifies the use of RG-1.97 Rev-4. Table 1.9.2-7 notes that plants licensed after June 2007 should reference RG-1.97 Rev-4. Contrary to the specification of the use of RG1.97 Rev-4, APWR FSAR Reference 12.3-23 and FSAR Table 1.9.2-14, reference RG-1.97 Rev-3. In addition, Chapter 12 does not contain a reference to IEEE-497-2002.

Please modify APWR FSAR Tier 2 chapters 1 and 12 to remove these inconsistencies.

12.03-12.04-14

10 CFR 20 requires licensees to keep occupational doses ALARA, that is to make every reasonable effort to maintain exposures as far as possible below regulatory limits, taking into account the state of technology. NUREG-0800 and RG 8.19 note that the Applicant should identify features were implemented for reducing dose, as a result of the analysis.

Question Q1

APWR FSAR Section 12.4.1 Tier 2 notes that dose reduction results from elimination of high maintenance components in waste processing equipment and the use of advanced technology in the refueling process, however, contrary to NUREG-0800 and RG-8.19, APWR FSAR Section 12.4 does not provide any detailed information regarding the ALARA initiatives adopted because of the Dose Assessment.

In accordance with NUREG-0800 and RG-8.19, please revise FSAR Section 12.4 to provide the ALARA improvements made because of the Dose Assessment, or provide the specific alternative approaches used and the associated justification.

Question Q2

APWR FSAR Section 12.4.1.5 Tier 2 notes that ASME specifies the ISI inspection frequency requirements. However, there are industry standard documents that provide information regarding the use of Risk Informed PRA processes to reduce ISI frequency for cost and dose savings.

In accordance with 10 CFR 20.1101 (b), please describe how the proposed ISI program is consistent with the ALARA requirements of 10 CFR 20.1101 (b), or provide your justification for use of the process noted in section 12.4.1.5.

Question Q3

APWR FSAR Tables 12.4-1 through 12.4-6 Tier 2, provide information regarding exposure estimates associated with routine activities during normal operation. Some of the assumptions and parameters noted in these tables do not appear to be consistent with expected plant operations, including:

- Activity frequencies are not consistent with normal operation, for instance, this table indicates daily inspections of components located in the containment building, such as Accumulators, Containment Cooling System and Pressurizer Valves.

- The dose rates associated with some components, such as Pressurizer Spray Valves, appear to differ significantly from industry norms.

- Exposure estimates associated with some potentially radiologically significant routine equipment such as the operation and maintenance of the Boric Acid Evaporator has been omitted.

- In some cases, the number of people performing the activity is inconsistent with the expected shift manning (e.g. 2 chemist or RP personnel, when there are 3 shifts/day)

- The description of some activities are unclear, such as “Decompositions of valves”.

In accordance with NUREG-0800 and RG-8.19, please revise FSAR Section 12.4 to provide exposure estimate information that is consistent with expected normal operation of the plant, or provide the specific alternative approaches used and the associated justification.

12.03-12.04-15

The following questions arise as a result of the staff review of the **US-APWR DCD Tier1 Revision 0 to Revision 1 Change List.**

QUESTION 8688-Q1

10 CFR 20.1101(b) requires licensees to control external occupational exposure, and to ensure that engineering controls are used to keep occupational doses ALARA. SRP Section 12.3-4 notes that the applicant is to describe the design measures provided to reduce time in radiation fields, and the provisions for potable shielding.

In the APWR FSAR Tier 2 section 12.1.2.1 3rd paragraph 4th bulleted item, the Applicant replaced "Provision of means and adequate space to use movable shielding" with "Provisions for movable shielding, such as adequate space for movable shielding". The explanation provided for this change was that it was an editorial change for clarity. However, the new wording implies that the only provision required for movable shielding

is for available space, and not design methods for supporting or installing the movable shielding.

Please clarify the reason for the deletion of the word “means”, and how this change remains consistent with 10 CFR 20.1101(b), ALARA requirements, and SRP Section 12.3-4 acceptance criteria, or provide the specific alternative approaches used and the associated justification.

QUESTION 8688-Q2

In the APWR FSAR Tier 2 section 12.3.4.2.2 4th paragraph, the Applicant replaced the 1st sentence "The sampling points of the airborne radioactivity monitors are shown in the Figure 12.3-10." with "The detailed sampling points of the airborne radioactivity monitors are shown in Figure 9.4.3-1." and deleted the old 2nd sentence. The explanation provided for this change was that it was an editorial change for clarity, and that it cited a more adequate figure. As part of this change the following sentence was deleted: “Details of design will be developed and, it is to be described in Combined License Information and verified it in ITAAC.”. Another related change was made to FSAR Tier 2 12.3.6, which Deleted COL 12.3(2). This was also identified as an editorial change, and it was noted that that the more detailed designs are shown in Fig. 9.4.3-1. The deleted COL 12.3(2) stated that the COL Applicant is to provide more detailed air controlling process and airborne radioactivity monitor in Figure 12.3-10. However, the detail provided in 12.3-10 is equivalent to 9.4.3-1, which is insufficient for a complete evaluation of the radiation monitors.

Please provide a description of the information that is required to be provided by the COL Applicant to allow the staff to adequately assess the compliance of the plant Continuous Air Sampling equipment with the guidance provided by RG 8.8, RG 8.25 and ANSI N13.1 as noted in the SRP section 12.3-4, or provide the specific alternative approaches used and the associated justification.

QUESTION 8688-Q3

In the APWR FSAR Tier 2 Table 12.3-1 (Sheet 4 of 4) was modified to Add the concrete thicknesses of Area for future Waste Mobile Systems and added foot note 8) for the east side. Footnote 8 states that the Removable Shield is to be used, if necessary. However, the applicant does not:

- Provide information regarding what Zone Level should be used as the basis for installing Removable Shielding.
- Does not provide any criteria to the COL Applicant, for use in determining the need for removable shielding, and the required thickness of shielding to be provided.
- Does not provide a COL Action Item requiring the COL Applicant to determine if Removable Shielding should be installed in the area.
- Does not discuss the provisions provided in the design for the installation and removal of the removable shielding for the mobile waste processing system.

Please provide information that addresses the identified questions, or provide the specific alternative approaches used and the associated justification.

QUESTION 8688-Q4

Please address the following editorial observations:

1. FSAR Tier 2 section Reference 12.1-7 Deleted the old "Reference 12.1-7, However, a reference to RG 1.206 was not added to replace the deleted reference to RG 1.70. Please add a reference to RG 1.206.

2. FSAR Tier 2 section 12.3.1.2.1.3 Access Control for Personnel and Materials, states:
   (3) Regulations to be followed in the RCA:
   d. At the exit from the RCA, contamination is checked for radioactive materials on body surfaces with a radiation monitor, and persons are required to report to radiation control personnel and follow instructions if any contamination is found.

   This should read
   d. At the exit from the RCA, ~~contamination is~~ **personnel are** checked for radioactive materials on body surfaces with a radiation monitor, and ~~persons~~ **they** are required to report to radiation control personnel and follow instructions if any contamination is found.

3. FSAR Tier 2 section 12.3.4.2.2 Criteria for Location of Airborne Radioactivity Monitors, states: If the gas is detected, the existence of Iodine or other radioactive materials are to be recognized. It should state: If the gas is detected, the existence of Iodine or other radioactive materials are to be ~~recognized~~ **determined**.

4. FSAR Tier 2 section 12.1.4 4th paragraph COL 12.1(4) is deleted for an editorial change that Integrated COL 12.1(4) into COL 12.1(2). However, COL 12.1(2) was also deleted. Please revise the Revision change list to accurately reflect the purpose of the change.

12.03-12.04-16
QUESTION 8815-Q1

NUREG-0800 12.3-3 and Regulatory Guide 1.206 C.I.12.3.5 10, CFR 50.34(f)(2)(vii) and NUREG-0737 II.B.2, note that vital areas which require access by operators aiding, mitigating or recovering from the accident, need to be identified. NUREG-0737 II.B.2 notes that this is applicable to vital areas and equipment, other than the Control Room, such as the radwaste control stations, emergency power supplies, motor control centers, and instrument areas. These criteria are applicable even if the areas are accessed on an irregular basis and not continuous occupied for the duration of the event. Some of the areas that may reasonably be expected to require access include but are not limited to:

- RHR Pumps – - Figure 12.3-2 Sheet 1
- RHR Heat Exchangers - Figure 12.3-2 Sheet 3
- Safety Injection Pumps - Figure 12.3-2 Sheet 1

- Boric Acid Transfer Pumps - Figure 12.3-2 Sheet 1
- Waste Disposal Panel - Figure 12.3-2 Sheet 3
- SFP area - Figure 12.3-2 Sheet 8
- Plant filter areas - Figure 12.3-2 Sheet 7
- Charging Pumps - Figure 12.3-2 Sheet 1

US-APWR FSAR Tier 2 section 12.3.1.2.2 “Accident Conditions”, and Figures 12.3-3 through 12.3-6 and Table 12.3-3 and Figure 12.3-2 “General Plant Arrangement with Post Accident Vital Areas” apparently only present accident exposure data for TSC, MCR and sampling activities. Insufficient information is provided to allow determination of the areas that plant operators or radiation protection personnel may need to access, as noted above, and the associated mission doses.

In accordance with 10 CFR 50 GDC-19, NUREG-0800 and RG-8.8 C.I.12.3.5, please revise section 12.3.3.1.2.2, and the associated figures and tables, to show mission paths and describe those design exposure values associated with plant operation and monitoring, for the duration of the event, or provide the specific alternative approaches used and the associated justification.

QUESTION 8815-Q2

US-APWR FSAR Tier 2 section 3.11 “Environmental Qualification of Mechanical and Electrical Equipment” notes that the equipment service times are specified in Appendix 3D. Appendix 3D, Table 3D-1 “Equipment Post-Accident Operability Times” notes that for equipment with a 2 week service requirement, that part of the evaluation criteria included consideration that the equipment is located outside containment, is accessible, and can be repaired, replaced, or recalibrated. Table 3D-2 “US-APWR Environmental Qualification Equipment List” shows a number of instruments that are located in areas exposed to radiation from system containing ESF fluids, however there is no discussion of mission doses related to these components, in chapter 12.

In accordance with 10 CFR 50 GDC-19, NUREG-0800 and RG-8.8 C.I.12.3.5, please revise section 12.3.3.1.2.2, and the associated figures and tables, to show mission paths and describe those design exposure values associated with accessing these instruments for the duration of the event, or provide the specific alternative approaches used and the associated justification.

QUESTION 8815-Q3

The US-APWR FSAR Tier 2 Section 12.3.1.2.2, “Accident Conditions” discusses vital area access for long term accident recovery. Projected dose rates and mission doses are listed in Table 12.3-3. The analysis presented is silent with respect to the assumed airborne activity concentrations, the use of respiratory protection equipment (if any), assumed protection factors (if used) to limit internal exposure, or the use of movable or temporary shielding material to limit external exposure.

Please describe in FSAR section 12.3.1.2.2 or in Table 12.3-3, the assumptions and parameters used to determine compliance with the requirements of NUREG-0737, GDC 19 and 10 CFR 50.34(f)(2)(vii) , or provide the specific alternative approaches used and the associated justification.

12.03-12.04-17

10 CFR 20.1101(b) requires licensees to control external occupational exposure, and to ensure that engineering controls are used to keep occupational doses ALARA. 10 CFR 50 GDC 61 requires licensees to ensure that there is adequate shielding under normal and postulated accident conditions. NUREG-0800 notes that all accessible portions of the fuel transfer tube are shielded so that contact radiation levels are less than 100 Rad/h. If removable shielding is used for this purpose, then controls on the shielding and radiation monitoring instrumentation should be provided.

The APWR FSAR identifies a number of areas associated with fuel storage and handling, that either cause or have the potential to cause high dose rates in areas where people could be exposed. Please address the following questions regarding the physical access barriers, shielding and other design features provided to maintain personnel exposure ALARA.

QUESTION 8816-Q1

The APWR FSAR Tier 2 section 12.3.2.2.8 discusses the Spent Fuel Transfer Canal, and tube shielding design. This section notes that there are provisions for access and inspection. Unlike Figure 12.3-7 “Isometric View of Main Control Room Shielding”, which allows the viewer to determine the arrangement of structures relative to the access points, Figure 12.3-8 “Labyrinth for radiation protection around Fuel Transfer Tube” does not clearly depict the area bounded by the shock absorber labyrinth. Insufficient information has been provided to allow the staff to determine the location of physical barriers or removable shielding provided to limit personnel radiation exposure.

Please revise FSAR chapter 12.3 to describe the design features noted in NUREG-0800, that are not apparent on Figure 12.3-8 or discussed in section 12.3.2.2.8 including, the access points, physical barriers preventing access, any shielding that is other than permanent, radiation monitor locations, or provide the specific alternative approaches used and the associated justification.

QUESTION 8816-Q2

The APWR FSAR Tier 2 section 12.3.2.2.8 discusses the Spent Fuel Transfer Canal, and tube shielding design. FSAR Figure 12.3-8 “Labyrinth for radiation protection around Fuel Transfer Tube” indicates that there is a valve operator assembly for the Fuel Transfer Tube Gate valve, running through the 52’ penetration area. FSAR Section 12.1.3.1 notes that some penetrations have been provided with an offset between the source and occupied areas. However, there is insufficient detail on FSAR Figure 12.3-8 to determine what design features ensure that no streaming can occur around or through the valve reach rod assembly. In addition, insufficient information has been provided to determine if there are any other potential streaming sources (e.g. the transfer canal drain line) in the area.

In accordance with 10 CFR 20, RG 1.206 and NUREG-0800, please revise chapter 12.3 to include information that demonstrates that potential streaming paths have been identified and the appropriate ALARA design features provided, or provide the specific alternative approaches used and the associated justification.

QUESTION 8816-Q3

The APWR FSAR Tier 2 section 12.3.2.2.8 discusses the Spent Fuel Transfer Canal and tube shielding design. A Cask Load Pit (CLP), a Fuel Inspection Pit (FIP) and the Spent Fuel Pit (SFP) are connected to the Fuel Transfer Canal (FTC). Weir Gates are installed between the FTC and the SFP, FIP and CLP. Neither chapter 9 or 12 discuss the design features provided to prevent moving an irradiated component near a weir gate connected to a drained pit. Industry experience shows that high dose rate areas result from moving irradiated material near a drained area.

In accordance with 10 CFR 20, RG 1.206 and NUREG-0800, please revise section 12.3 to describe the design features provided to prevent movement of irradiated components to areas connected to the SFP that may be empty, or provide the specific alternative approaches used and the associated justification.

QUESTION 8816-Q4

The APWR FSAR Tier 2 section 12.3.2.2.8 discusses the Spent Fuel Transfer Canal and tube shielding design. While section 9.1.2 notes that there are no drains connected to the SFP, neither chapter 9, or section 12.3.2.2.8 discuss the design features provided to prevent deliberate or inadvertent draining of the CLP or the FIP, while an irradiated fuel bundle is in the area.

In accordance with 10 CFR 20, RG 1.206 and NUREG-0800, please revise section 12.3 to describe the design features provided to prevent draining of the CLP or FIP while irradiated components are in the area or provide the specific alternative approaches used and the associated justification.

QUESTION 8816-Q5

The APWR FSAR Tier 2 section 12.3.2.2 discusses shielding designs, including shielding for fuel and irradiated material handling equipment. Industry experience shows that very high dose rate areas result from moving hollow tools or equipment over irradiated material. Insufficient information has been provided to determine if there is a possibility of very high dose rates from irradiated material located underwater.

In accordance with 10CFR 20, RG 1.206 and NUREG-0800, please revise section 12.3 to that require submersible tools to have flood ports, or provide the specific alternative approaches used and the associated justification.

QUESTION 8816-Q6

INPO SOER 85-1 “Reactor Cavity Seal Failure” notes a number of events, besides Refueling Cavity (RC) seal failure, could result in the loss of RC water level. FSAR section 9.1.4.2.2.2 “Reactor Refueling Operations” notes that the lower levels of the refueling cavity are flooded using a fill line entering through the refueling cavity floor. Unlike the Spent Fuel Pool, which does not have any drain points below the level of the fuel, the refueling cavity appears to have a potential drain path below the potential elevation of the fuel. Chapter 12 contains insufficient information to determine the safe lay down area for the fuel bundle, and the resultant dose rate to personnel in the area because of reduced water shielding, in the event an RC leak occurred while moving an irradiated fuel bundle.

Please revise chapter 12.3 to provide the design features provide preclude an inadvertent loss of water from the RC, from other than a seal leak. Provide the safe lay down location for a fuel bundle and an estimate of the dose rate to personnel in the area. Identify any COL action items required to prevent an event (i.e. restrictions on use of nozzle dams, or valves that need to be locked closed during fuel movement). If this information is not provided then provide the specific alternative approaches used and the associated justification.

QUESTION 8816-Q7

The APWR FSAR Tier 2 section 12.3.2.2.4 “Fuel Handling Area Shielding Design”, notes that the minimum depth of water above the fuel limits the dose at the water surface to less than 2.5 mrem/h for an assembly in a vertical position. FSAR Section 12.2.1.1.5 “Spent Fuel Pit Cooling and Purification System” notes that the activity of SFP water is determined assuming the presence of only Cobalt-60, present at the level specified in Table 12.2-32. The Co-60 generates a dose rate at the pit surface of up to 15 mrem/h. Table 12.4-5 only reflects the dose rate from the fuel and does not reflect the dose rate from activity entrained in the liquid, therefore the dose estimate for the refueling activity presented in table 12.4-5, is not consistent with the information provided in other sections of the FASR.

Please revise FSAR Table 12.4-5 to accurately reflect the total dose the workers will receive while engaged in fuel movement activities, or provide the specific alternative approaches used and the associated justification.

12.03-12.04-18

Question 1972-8817-Q1

10 CFR 20.1101(b) requires licensees to control external occupational exposure, and to ensure that engineering controls are used to keep occupational doses ALARA. In 10 CFR 20, the definition for ALARA includes guidance to make every reasonable effort to maintain exposures below regulatory limits, taking into account the state of technology. 10 CFR 50 GDC 61 requires licensees to ensure that there is adequate shielding for routine activities in the area of the equipment.

The APWR FSAR Tier 2 12.2.1.2 “Sources for Shutdown” notes that in the reactor shutdown condition one of the significant sources requiring permanent shielding is the incore instrumentation system (ICIS). The incore instrumentation consists of movable neutron detectors (MDs) which are inserted into the core though the in-core instrumentation system nozzles located on the closure head. Figure 7.7-1 “Basic System for Insertion of Movable Neutron Detectors” indicates that at least some portion of the transit tube between the drive mechanism and the reactor head is not shielded. Industry experience shows that detectors stick in the core, and require personnel to work at the location of the movable drive system to rectify the problem. There have been personnel over exposures due to working on in core detector systems. Insufficient information is available to determine the adequacy of the shielding and personnel protective features provided for the ICIS system between the reactor head and the ICIS area, and the in the ICIS area.

In accordance with 10 CFR 20.1101(b) and RG 1.206, please update chapter 12.3 to describe the designed shielding and personnel protective features provided for work on the ICIS during an AOO, or provide the specific alternative approaches used and the associated justification.

12.03-12.04-19

RG-1.206, Part C.I.12.3.4, Area Radiation and Airborne Radioactivity Monitoring Instrumentation, states that the applicant should describe the criteria for selection and placement of the fixed radiation monitors in accordance with ANSI/ANS-HPSSC-6.8.1-1981, “Location and Design Criteria for Area Radiation monitoring Systems for Light-Water Nuclear Reactors.”

APWR FSAR Tier 2 section 12.3.4 “Area Radiation and Airborne Radioactivity Monitoring Instrumentation” discusses the plant Area Radiation Monitoring system (ARM). In this section, it states that the ARMS are in conformance with ANSI/ANS

HPSSC-6.8.1. The information provided in this subsection of the FSAR appears to be inconsistent with the stated commitment.

Question 8818-Q1

ANSI /ANS-6.8.1 section 4.3 “Monitoring Range” notes that the selection criteria for the range should ensure that upper end of the scale is high enough to ensure that the reading remains on scale for dose rates approaching 10 times the maximum expected dose rate for Anticipated Operational Occurrences. Some of the radiation monitors listed in FSAR Table 12.3-4 “Area Radiation Monitors” may not meet these range criteria. Examples include RMS-RE-2, which is located in a Zone VII (> 1R/h & $\leq$ 10 R/h) and RMS-RE-7, which is located in a Zone VI area (> 0.1R/h & $\leq$ 1 R/h) but is also subjected to elevated dose rates from ICIS detectors. Another example is the MCR monitor, RMS-RE-1 located in a Zone I area ($\leq$ 0.25 mrem/h), but based on the accident analysis information presented in Chapter 15, may be exposed to dose rates greater than the upper range of the instrument.

In accordance with RG 1.206, please revise section 12.3 to provide radiation monitors that meet the applicable range requirement, or provide the specific alternative approaches used and the associated justification.

Question 8818-Q2

APWR FSAR Tier 2 9A.3.1 FA1-101 “Containment Vessel” (CV) notes that there are two personnel air locks and one equipment hatch provided to access the CV. FSAR section 12.3.4.1.8 states that there is an area radiation monitor (ARM) at the containment air lock. FSAR Figure 12.3-1 “Radiation Zones for Normal Operation/Shutdown“ shows an ARM at the at the Elevation 25’-3 personnel air lock but this figure does not show an ARM at the other personnel air lock or the Equipment Hatch.

ANSI/ANS-6.8.1, Section 4.2, Detector Locations, has the following criteria for locating instrumentation: “… 4.2.2 Special consideration should be given to those normally accessible and occasionally accessible areas which can experience significantly greater exposure rates resulting from operational transients or maintenance activities.”

In accordance with NUREG-0800 Section 12.3, please modify Table 12.3-4 to include area monitors at these locations or discuss how workers will be alerted of increasing radiation levels in these and other areas where radiation levels could increase significantly due to accidents, transients or maintenance, and where personnel may be present.

Question 8818-Q3

The incore instrumentation consists of movable neutron detectors (MDs) which are inserted into the core though the in-core instrumentation system nozzles located on the closure head. US-APWR FSAR tier 2 Figure 7.7-1 indicates that

at least some portion of the transit tube between the drive mechanism and the reactor head is not shielded. Table 12.3-4 “Area Radiation Monitors” indicates that there is one ICIS Area Radiation Monitor located in the area, but due to the detector location, it is not capable of responding to a source of radiation present in the unshielded portion of the transit tube depicted in figure 7.7-1. Industry Operating Experience indicates that movable incore detectors occasionally become stuck during transit from the core to the storage location. If these detectors stick during withdrawal, would present a high dose rate on the elevation of the containment by the unshielded portion of the MD transit tube.

ANSI/ANS-6.8.1, Section 4.2, Detector Locations, has the following criteria for locating instrumentation: “… 4.2.2 Special consideration should be given to those normally accessible and occasionally accessible areas which can experience significantly greater exposure rates resulting from operational transients or maintenance activities.”

In accordance with NUREG-0800 Section 12.3, and RG-8.8 C.2.g, please modify Table 12.3-4 to include area monitors at these locations or discuss how workers will be alerted of increasing radiation levels in an area where radiation levels could increase significantly due to an Anticipated Operational Occurrence (equipment malfunction), and where personnel may be present.

12.03-12.04-20

Question 8819-Q1

10 CFR 20.1101(b), 1201and 1202 require licensees to control internal and external occupational exposure, and to ensure that engineering controls are used to keep occupational doses ALARA.

APWR FSAR Tier 2 section 12.3.3 “Ventilation” discusses the how the plant HVAC system is designed to meet the requirements of 10 CFR 20, however, section 12.3.3.2 does not describe the design features provided to control airborne particulate and iodine contamination during refueling activities, resulting from evaporation of the Refueling Cavity water volume, or evaporation from exposed reactor components.

Please revise FSAR Tier 2 section 12.3.3.2 to include the design features for minimizing airborne contamination around the Refueling Cavity during refueling operations, or provide the specific alternative approaches used and the associated justification.