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March 31, 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-09138

Subject: MHI's Response to US-APWR DCD RAI No. 249-1978 REVISION 0

References: 1) "Request for Additional Information No. 249-1978 Revision 0, SRP Section: 11.05 – Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems, Application Section: 11.5," dated March 2, 2009

With this letter, Mitsubishi Heavy Industries, Ltd. ("MHI") transmits to the U.S. Nuclear Regulatory Commission ("NRC") documents as listed in Enclosures.

Enclosed are the responses to Questions 11.05-5, 11.05-9, 11.05-10 and 11.05-11 that are contained within References 1 and 2.

The enclosed document is being submitted in two versions. One version (Enclosure 1) includes certain information, designated pursuant to the Commission guidance as sensitive unclassified non-safeguards information, referred to as security-related information ("SRI"), that is to be withheld from public disclosure under 10 C.F.R. § 2.390. The information that is SRI is identified by brackets. The second version (Enclosure 2) omits the SRI and is suitable for public disclosure. In the public version, the SRI is replaced by the designation "[Security-Related Information - Withheld Under 10 CFR 2.390]".

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

Sincerely,



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

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NRO

Enclosures:

1. Response to Request for Additional Information No.249-1978 Revision 0
(SRI included version)
2. Response to Request for Additional Information No.249-1978 Revision 0
(SRI excluded version)

CC: J. A. Ciocco
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Docket No. 52-021
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Enclosure 2

UAP-HF-09138
Docket No. 52-021

Response to Request for Additional Information
No. 249-1978 Revision 0

March, 2009
(Security-Related Information Excluded)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/31/2009

**US-APWR Design Certification
Mitsubishi Heavy Industries
Docket No. 52-021**

RAI NO.: NO. 249-1978 REVISION 0
SRP SECTION: 11.05 – Process and Effluent Radiological Monitoring
Instrumentation and Sampling Systems
APPLICATION SECTION: 11.5
DATE OF RAI ISSUE: 3/2/2009

QUESTION NO. : 11.05-5

Staff review of DCD Tier 2 (Rev 1) Sections 11.5.2.1 and 5.2.5.4.1.2, and Technical Specifications (TS) 16.3.4.13 and TS B.16.3.4.15 indicate insufficient information is provided in regards to the containment particulate (RMS-RE-40) and gaseous (RMS-RE-41) radiation monitor sensitivities to satisfy the reactor coolant system (RCS) leakage rate technical basis. The technical basis for RCS leakage detection instrumentation and RG 1.45 (Rev 1) establish radiation monitor sensitivity requirements for a leakage detection increase of 1 gpm within 1 hour using a realistic primary coolant concentration.

Although Section 5.2.5.4.1.2 specifies containment radiation monitor sensitivities for RCS leakage detection instrumentation, Section 11.5.2.2 and Table 11.5-1 only present design information on monitor ranges and do not describe the methodology to demonstrate that containment radiation monitors selected by the COL applicant for RCS leakage detection instrumentation are capable of satisfying the technical basis using a realistic radioactive concentration in the RCS. Please address the following items and revise the DCD to include this information.

1. Revise Table 11.5-1 to reflect the minimum required radiation monitor sensitivities for the containment particulate (RMS-RE-40) and gaseous (RMS-RE-41) radiation monitors necessary to satisfy the required RCS leakage rate technical basis.
2. In Section 11.5.2.2, provide the methodology to demonstrate that radiation monitors selected by the COL applicant are capable of satisfying the technical basis for RCS leakage detection instrumentation using a realistic radioactive concentration in the RCS. Include in the methodology, model assumptions, parameters values and their basis, and references.

ANSWER:

The Containment radiation gas monitor (RMS-RE-41) will be deleted from the TS leakage detection methods since this monitor (RMS-RE-41) does not have enough leakage detection capability assuming that no failed fuel exists. The Containment radiation particulate monitor (RMS-RE-40) will remain as a diverse detection method. The DCD Chapter 16 Technical Specification will be revised to delete this monitor's description. This change was previously described to the NRC in the response to RAI No. 165-1967, Revision 1, Question 05.02.05-2, which was submitted by MHI letter UAP-HF-09064, dated February 20, 2009.

For question item 1, the Containment radiation particulate monitor (RMS-RE-40) has the range of 1×10^{-10} to 1×10^{-6} $\mu\text{Ci}/\text{cm}^3$ as described in Table 11.5-1. This range provides the capability to detect leakage of less than 0.5 gpm within one hour of detector response time. This conforms to the requirement to detect 1 gpm as stated in RG 1.45 and no specific sensitivity requirement needs to be stated in Table 11.5-1.

For question item 2, the Containment radiation gas monitor (RMS-RE-41) will be deleted from the TS leakage detection methods as stated above. The Containment radiation particulate monitor (RMS-RE-40) has the detection capability described above assuming no fuel failures. Therefore, this monitor satisfies the required RCS leakage detection capability under only corrosion and activation products existing in the RCS described DCD Subsection 5.2.5.4.1.2.

Impact on DCD

The response describes an impact to the DCD based on a previous response to RAI No. 165-1967. However, there is no additional impact on the DCD.

Impact on COLA

There is no impact on the COLA

Impact on PRA

There is no impact on the PRA

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

03/31/2009

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RAI NO.: NO. 249-1978 REVISION 0
SRP SECTION: 11.05 – Process and Effluent Radiological Monitoring
Instrumentation and Sampling Systems
APPLICATION SECTION: 11.5
DATE OF RAI ISSUE: 3/2/2009

QUESTION NO. : 11.05-9

Staff review of DCD Tier 2 (Rev 1), Section 11.5.2.2.4 indicates insufficient information is provided on the design for main steam line radiation monitors (high sensitivity monitors RMS-RE-65A/B, RMS-RE-66A/B, RMS-RE-67A/B, RMS-RE-68A/B, and main steam line accident monitors RMS-RE-87 to 90) of the process effluent radiation monitoring and sampling systems (PERMS) in regards to environmental factors for compliance with 10 CFR 50.34(a). Section 11.5.2.1 states that the PERMS is designed to meet the applicable requirements in ANSI N42.18-2004, which provides recommendations on the selection and performance of effluent radiation monitoring instrumentation from factors influencing monitor response and operability such as such as temperature, humidity, electronic, and ambient radiation effects. Please address the following items and revise the DCD to include this information.

1. Describe the design features considered to minimize high temperature and humidity effects on the response of main steam line monitors installed on main steam lines that continuously measure radioactivity concentration from the SG.
2. Describe the design features considered to minimize cross talk due to high-energy gamma radiation on the response of main steam line monitors located near one another.
3. Describe the design features considered to minimize ambient radiation effects from direct or scattered radiation during LOCA conditions on the response of main steam line monitors located near containment penetrations.

ANSWER:

A1.

The main steam line radiation monitor detectors and other instruments will be placed away from the main steam lines, detecting gamma ray from radioactive nuclides which come through the wall of the main steam line pipe and the room where the monitors will be placed is ventilated. The monitors will not be affected by high temperature and humidity of main steam.

A2.

The detectors will be shielded to minimize the effect of gamma radiation except from the steam line being monitored.

A3.

As described answer 2, detectors will be shielded to minimize ambient radiation effects.

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.

This completes MHI's response to the NRC's question.

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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SRP SECTION: 11.05 – Process and Effluent Radiological Monitoring
Instrumentation and Sampling Systems
APPLICATION SECTION: 11.5
DATE OF RAI ISSUE: 3/2/2009

QUESTION NO. : 11.05-10

Staff review of DCD Tier 2 (Rev 1), Section 11.5, Table 11.5-1 indicates that design information on the location, calibration isotopes, and check source requirements is incomplete for some process effluent radiation monitors in the PERMS for compliance with 10 CFR 50.34(a). Please address the following items and revise the DCD to include this information.

1. Four main steam line accident monitors (RMS-RE-87 to 90) are indicated in GA Drawing Number 11.5-2i (Figure 11.5-2i) of Table 11.5-1 but are not depicted in Figure 11.5-2i. Show the location of the 4 main steam line accident monitors in Figure 11.5-2i.
2. No check source requirement is identified for the 4 main steam line accident monitors (RMS-RE-87 to 90). Require a check source for the main steam line accident monitors to verify proper functioning of the detector and associated electronics in Table 11.5-1, or justify its exclusion.
3. GA drawing number 11.5-2c (Figure 11.5-2c) presents the SG blowdown return water monitor (RMS-RE-36) as depicted in Figure 11.5-2c. The SG blowdown return water monitor is actually shown in Figure 11.5-2e. Revise the GA drawing number to 11.5-2e (Figure 11.5-2e) for the SG blowdown return water monitor in Table 11.5-1.
4. Calibration isotope information on 8 high sensitivity main steam line (N-16 ch) monitors (RMS-RE-65A/B, RMS-RE-66A/B, RMS-RE-67A/B, RMS-RE-68A/B) is not provided. Provide the isotope used to calibrate the high sensitivity main steam line (N-16 ch) monitors to a known radiation source of sufficient type, energy, and strength in Table 11.5-1, or justify its exclusion.

ANSWER:

A1

MHI will add Figure 11.5-2k as section view to include the information of main steam line monitor locations.

A2

To verify the function of the monitor by a check source, a source is placed near the detector and confirm is received that the measurement value increases from the background level.

The measurement range of main steam line accident monitors is very high compared to the usual level, and it is not practical to use a sufficiently strong radiation source to achieve measurement levels near the high range. To verify the function of the main steam line accident monitors, we will use a radiation source which indicates lower than the low limit of the measurement range. The monitoring system measures the resulting signal with output for the operators, and verifies the function of the detector by detecting loss of signal. For associated electronics, the test signal generating system and electronics will be verified by that signal.

A3

MHI will revise table 11.5-2 to correct the typographical error.

A4

High sensitivity main steam line monitors limit the sensitive energy range of gamma ray energies to detect only the high energy N-16 decay. To calibrate the monitors, a radioactive isotope which emits the objective gamma ray is necessary; however, it is not practical to use that isotope because of its very short half-life. Therefore, the detectors which will be installed at the plant are examined by another isotope which emits lower energy gamma rays and associated with the response for N-16 by analysis or type test. For the reason mentioned above, calibration isotope information is not provided.

Impact on DCD

The DCD will be changed as mentioned in the A1 and A3 of the response to the question No.11.5-10.

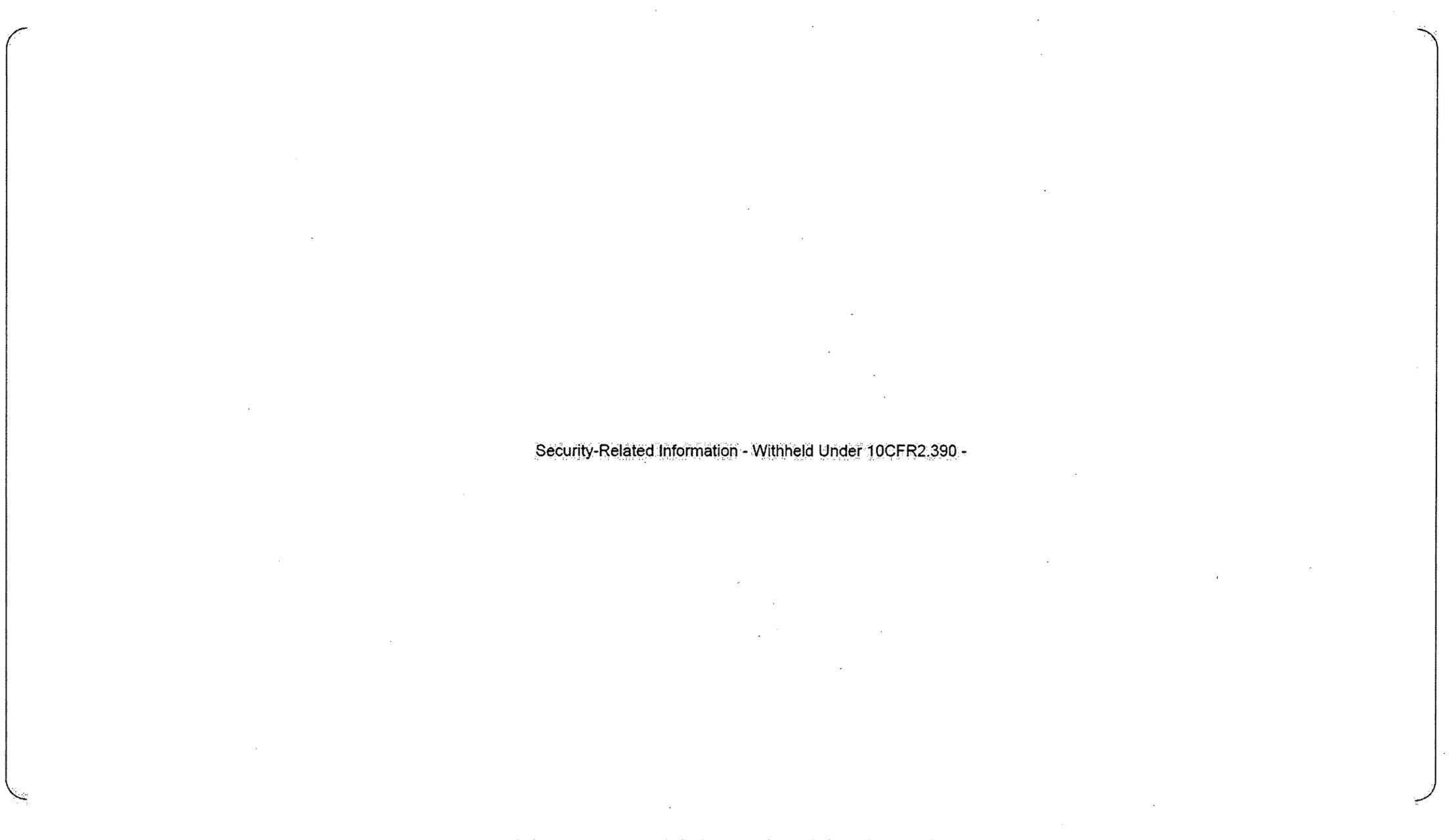
Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.



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Figure 11.5-2k Location of Radiation Monitors at Plant (Power Block Section A-A)

Table 11.5-2 Process Liquid Monitors

Item No.	Monitor Number	Service	Type	Range $\mu\text{Ci}/\text{cm}^3$	Calibration Isotopes	Check Source	Safety-Related	Control Function	Quantity	Schematic Number	GA Drawing Number
14	RMS-RE-56A RMS-RE-56B	CCW radiation <i>The concentration of radioactive material in the CCW</i>	γ	1E-6 to 1E-2	Cs-137	Yes	No	Termination	2	11.5 – 1f	11.5 – 2a
15	RMS-RE-57	Auxiliary steam condensate water radiation <i>The concentration of radioactive material in the auxiliary steam condensate water</i>	γ	1E-6 to 1E-2	Cs-137	Yes	No	Termination	1	11.5 – 1f	11.5 – 2a
16	RMS-RE-70	Primary coolant radiation <i>The concentration of radioactive material in the CVCS line</i>	γ	1E-4 R/h to 10 R/h	Cs-137	Yes	No	No	1	11.5 – 1c	11.5 – 2e
17	RMS-RE-58	Turbine building floor drain radiation <i>The concentration of radioactive material discharged from the Turbine Building</i>	γ	1E-7 to 1E-2	Cs-137	Yes	No	Diverse	1	11.5 – 1g	11.5 – 2c
18	RMS-RE-55	SG blowdown water radiation <i>The concentration of radioactive material in the SG blowdown water</i>	γ	1E-7 to 1E-3	Cs-137	Yes	No	Termination	1	11.5 – 1d	11.5 – 2h
19	RMS-RE-36	SG Blowdown return water radiation <i>The concentration of radioactive material in the SG return blowdown water</i>	γ	1E-7 to 1E-3	Cs-137	Yes	No	Diverse	1	11.5 – 1d	11.5 – 2e

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APPLICATION SECTION: 11.5
DATE OF RAI ISSUE: 3/2/2009

QUESTION NO. : 11.05-11

Staff review of DCD Tier 2 (Rev 1), Section 11.5 indicates insufficient information is presented in regards to COL information items on the PERMS. Although information items COL 11.5(1), COL 11.5(4), and COL 11.5(5) are presented in Section 11.5.5, it is unclear what information the COL applicant is to provide in the COL application and where these COL information items and actions are described. Please address the following items and revise the DCD to include this information.

1. Clarify what information the COL applicant is to provide for information items COL 11.5(1), COL 11.5(4), and COL 11.5(5).
2. Identify where information items COL 11.5(1), COL 11.5(4), and COL 11.5(5) are described in Section 11.5.
3. Include a statement for the COL applicant to perform information items COL 11.5(1), COL 11.5(4), and COL 11.5(5) in the discussion of the relevant sections.

ANSWER:

MHI will revise Subsection 11.5 to clarify the statement.

The first sentence of COL 11.5(1) presented in Section 11.5.5 refers to the information of additional site-specific PERMS beyond the standard design and is discussed in revised Section 11.5 as indicated in Impact on DCD below.

The second sentence of COL 11.5(1) presented in Section 11.5.5 refers to the methodology of fulfillment of the 10 CFR 50 Appendix I guidelines and is discussed in revised Subsection 11.5.2.9 as indicated in Impact on DCD below.

COL 11.5(4) presented in Section 11.5.5 refers to the provisions for radiological monitoring instrument inspection, decontamination, and replacement and is discussed in revised Subsection 11.5.2.6 and Subsection 11.5.2.8 as indicated in Impact on DCD below.

COL 11.5(5) presented in Section 11.5.5 refers to the information of analytical procedure and sensitivity for selected radioanalytical methods and types of sampling media and is discussed in revised Subsection 11.5.2.6 and Subsection 11.5.2.8 as indicated in Impact on DCD below.

Impact on DCD

The DCD Subsection 11.5 will be revised as described in the Attachment.

Impact on COLA

There is no impact on the COLA.

Impact on PRA

There is no impact on the PRA.

This completes MHI's response to the NRC's question.

11.5 Process Effluent Radiation Monitoring and Sampling Systems

The process effluent radiation monitoring and sampling system is designed to:

- Sample, measure, control, and record the radioactivity levels of selected process streams within the plant and effluent streams released into the environment
- Activate alarms and control releases of radioactivity
- Provide data to keep doses to workers ALARA
- Provide process data to support plant operation

The process and effluent radiological monitoring and sampling system is used to verify that releases to the environment are within the dose limit of 10 CFR 20.1301 (Ref. 11.5-1), 10 CFR 20.1302 (Ref. 11.5-2), and are within the numerical guidelines of 10 CFR 50, Appendix I (Ref. 11.5-3). The process and effluent radiological monitoring and sampling system is designed to perform its monitoring and recording functions during normal operation, AOOs, and under post-accident conditions, when and where required. Individual instruments of the process and effluent radiological monitoring and sampling system are designed to either monitor or collect samples from the gaseous and liquid streams at key process locations. All potential release points are either monitored or sampled in accordance with 10 CFR 50.34 (f)(2)(xvii) (Ref. 11.5-4). Data from these monitors is used to support the preparation of the radiological release reports required by 10 CFR 50.36a (Ref. 11.5-5).

Grab samples at key locations are taken for chemical and radiological analyses to confirm isotopic compositions and radiation levels. The grab sampling locations, methodology, analysis objectives, and frequencies are described in Chapter 9, Subsection 9.3.2.

Schematics of the monitors, including the sampling features, are presented in Figures 11.5-1a through 11.5-1j. Locations of the monitors are presented in Figures 11.5-2a through 11.5-2k.

The COL applicant is responsible for the additional site-specific aspects of the process and effluent monitoring and sampling system beyond the standard design, in accordance with RGs 1.21, 1.33 and 4.15 (Ref. 11.5-12, 11.5-17, 11.5-14).

11.5.1 Design Bases

11.5.1.1 Design Objective

The design objective of the process and effluent radiological monitoring and sampling system is to provide process data to support plant operation through monitoring, sampling, measuring, controlling, and recording of the radioactivity levels of selected

11.5.2.6 Reliability and Quality Assurance

The reliability of the process and effluent radiological monitoring and sampling system is based on providing redundant instruments, where required, and the use of manual sampling and analysis to verify the performance of the installed instruments.

To assure that quality assurance is maintained, only instruments designed and manufactured for the intended services, and instruments with industry-proven performances are used. Lessons learned regarding instrument reliability will be used in the final instrument selection. Safety-related monitoring instruments are qualified as described in Chapter 3, Section 3.11. Monitors that are not safety-related are designed in accordance with ANSI N42.18-2004 (Ref. 11.5-11), and are qualified in accordance with RG 1.143 Section IV (Ref. 11.5-16).

Calibration and inspection procedures are developed and put in place by the COL applicant in accordance with RG 1.33 (Ref. 11.5-17) and RG 4.15 (Ref. 11.5-14). Inspections are conducted daily on the process and effluent monitoring and sampling system through observance of the system channels. Periodically, the system is further checked during the course of reactor operation through the implementation of a check source. The detector response is compared to the instrument's background count rate to determine functionality. Calibration of monitors is conducted through the use of known radionuclide sources as documented by national standards. Maintenance is conducted routinely on the monitoring and sampling system, which is easily accessible, as is the accompanying power supply. Electronic and sampling components undergo a full servicing, periodically, as detailed in the operational instructions in order to maintain consistent operation.

The COL applicant is to develop procedures which are of inspection, decontamination, and replacement related to radiation monitoring instruments. The COL applicant is to provide analytical procedures and sensitivity for selected radioanalytical methods and type of sampling media for site-specific matter.

11.5.2.7 Determination of Instrumentation Alarm Setpoints for Effluents

Alarm setpoints for effluent monitors follow site-specific requirements, such as release flow rates and associated conditions, operator response preferences, and detailed design radiation monitor selection. The alarm setpoints are developed during the detailed design stage by the COL applicant in the offsite dose calculation manual. Setpoint determination will need to follow the guidance of NUREG-1301 (Ref. 11.5-21), and NUREG-0133 (Ref. 11.5-18) so that the effluent releases to unrestricted areas do not exceed those given in 10 CFR 20, Appendix B, Table 2 (Ref. 11.5-19). Setpoint determinations will also consider local meteorological conditions.

11.5.2.8 Compliance with Effluent Release Requirements

The radiological monitoring and sampling systems are designed to assure compliance with the requirements of 10 CFR 20.1301 (Ref. 11.5-1), 10 CFR 20.1302 (Ref. 11.5-2),

10 CFR 20, Appendix B (Ref. 11.5-19), and 40 CFR 190 (Ref. 11.5-20), and the numerical design guidelines stated in 10 CFR 50, Appendix I (Ref. 11.5-3). The monitoring and sampling systems are designed to collect and analyze radiation readings to generate the annual radiological effluent release report required by 10 CFR 50.36a (Ref. 11.5-5). Site-specific procedures on equipment inspection, calibration, and maintenance, and by regulated recordkeeping are developed by the COL applicant to meet the requirements of 10 CFR 20.1301 (Ref. 11.5-1) and 10 CFR 20.1302 (Ref. 11.5-2), and meet the numerical guidelines stated in 10 CFR 50, Appendix I (Ref. 11.5-3), but will also be able to comply with 10 CFR 50.34a (Ref. 11.5-6) and keep releases ALARA.

The COL applicant is to develop procedures which are of inspection, decontamination, and replacement related to radiation monitoring instruments. The COL applicant is to provide analytical procedures and sensitivity for selected radioanalytical methods and type of sampling media for site-specific matter.

11.5.2.9 Offsite Dose Calculation Manual

An offsite dose calculation manual that contains a description of the methodology and parameters used for calculation of offsite doses for the gaseous and liquid effluents will be prepared by the COL applicant. The manual will also contain the planned effluent discharge flow rates and addresses the numerical guidelines stated in 10 CFR 50, Appendix I (Ref. 11.5-3). The manual will be produced in accordance with the guidance of NUREG-1301 (Ref. 11.5-21), and NUREG-0133 (Ref. 11.5-18), and with the guidance of RG 1.109 (Ref. 11.5-22), RG 1.111 (Ref. 11.5-23), or RG 1.113 (Ref. 11.5-24). The manual will include a discussion of how the NUREGs, RGs, or alternative methods are implemented.

The COL applicant is responsible for assuring the fulfillment of the guidelines issued in 10 CFR 50, Appendix I (Ref. 11.5-3) regarding the offsite doses released through gaseous and liquid effluent streams.

11.5.2.10 Radiological Environmental Monitoring Program

The COL applicant is to develop a radiological and environmental monitoring program taking into consideration local land use census data in identifying all potential radiation dose pathways. The program will take into account associated radioactive materials present in liquid and gaseous effluents and direct external radiation from SSCs. The COL applicant is to follow the guidance outlined in NUREG-1301 (Ref. 11.5-21), and NUREG-0133 (Ref. 11.5-18) when developing the radiological environmental monitoring program.

11.5.2.11 Site –Specific Cost-Benefit Analysis

RG1.110 provides compliance with 10 CFR 50, Appendix I (Ref. 11.5-3) numerical guidelines for offsite radiation doses as a result of gaseous or airborne radioactive