From: BRYAN Martin (EXTERNAL AREVA) [Martin.Bryan.ext@areva.com]
Sent: Wednesday, September 15, 2010 5:48 PM
To: Tesfaye, Getachew
Cc: DELANO Karen (AREVA); ROMINE Judy (AREVA); BENNETT Kathy (AREVA); NOXON David (AREVA)
Subject: Response to U.S. EPR Design Certification Application RAI No. 392, FSAR Ch. 11, PHASE 4 RAI, Supplement 2
Attachments: RAI 392 Supplement 2 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 392 on July 8, 2010. Supplement 1 response to RAI No. 392 was sent on August 12, 2010, to provide a revised schedule for the one question. The attached file, “RAI 392 Supplement 2 Response US EPR DC.pdf” provides a technically correct and complete final response to the one question.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which supports the response to RAI 392 Question 11.05-21.

The following table indicates the respective pages in the response document, “RAI 392 Supplement 2 Response US EPR DC.pdf,” that contain AREVA NP’s response to the subject question.

Question #	Start Page	End Page
RAI 392 — 11.05-21	2	7

This concludes the formal AREVA NP response to RAI 392, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, August 12, 2010 7:11 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen (RS/NB); ROMINE Judy (RS/NB); BENNETT Kathy (RS/NB); NOXON David (RS/NB); WILLIFORD Dennis (RS/NB)
Subject: Response to U.S. EPR Design Certification Application RAI No. 392, FSAR Ch. 11, PHASE 4 RAI, Supplement 1

Getachew,

AREVA NP Inc. (AREVA NP) provided a schedule for a technically correct and complete response to RAI No. 392 on July 8, 2010.

The schedule for RAI 392 Question 11.05-21 is being revised to allow more time to interact with the NRC. The schedule for a technically correct and complete response to the one question has changed and is provided below.

Question #	Response Date
RAI 392 — 11.05-21	September 20, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: BRYAN Martin (EXT)
Sent: Thursday, July 08, 2010 3:40 PM
To: 'Tesfaye, Getachew'
Cc: DELANO Karen V (AREVA NP INC); ROMINE Judy (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); NOXON David B (AREVA NP INC); WILLIFORD Dennis C (AREVA NP INC)
Subject: Response to U.S. EPR Design Certification Application RAI No. 392, FSAR Ch. 11, PHASE 4 RAI

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 392 Response US EPR DC.pdf," provides the schedule for technically correct and complete response to the one question.

The following table indicates the respective pages in the response document, "RAI 392 Response US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 392 — 11.05-21	2	3

The schedule for technically correct and complete response to the one question is provided below.

Question #	Response Date
RAI 392 — 11.05-21	August 13, 2010

Sincerely,

Martin (Marty) C. Bryan
U.S. EPR Design Certification Licensing Manager
AREVA NP Inc.
Tel: (434) 832-3016
702 561-3528 cell
Martin.Bryan.ext@areva.com

From: Tesfaye, Getachew [mailto:Getachew.Tesfaye@nrc.gov]
Sent: Wednesday, June 09, 2010 8:13 AM
To: ZZ-DL-A-USEPR-DL
Cc: Dehmel, Jean-Claude; Roach, Edward; Jennings, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 392 (4650), FSAR Ch. 11, PHASE 4 RAI

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on April 28, 2010, and on June 7, 2010, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
Getachew Tesfaye
Sr. Project Manager
NRO/DNRL/NARP
(301) 415-3361

Hearing Identifier: AREVA_EPR_DC_RAIs
Email Number: 2005

Mail Envelope Properties (BC417D9255991046A37DD56CF597DB71079308E9)

Subject: Response to U.S. EPR Design Certification Application RAI No. 392, FSAR Ch. 11, PHASE 4 RAI, Supplement 2
Sent Date: 9/15/2010 5:47:54 PM
Received Date: 9/15/2010 5:48:36 PM
From: BRYAN Martin (EXTERNAL AREVA)

Created By: Martin.Bryan.ext@areva.com

Recipients:
"DELANO Karen (AREVA)" <Karen.Delano@areva.com>
Tracking Status: None
"ROMINE Judy (AREVA)" <Judy.Romine@areva.com>
Tracking Status: None
"BENNETT Kathy (AREVA)" <Kathy.Bennett@areva.com>
Tracking Status: None
"NOXON David (AREVA)" <David.Noxon@areva.com>
Tracking Status: None
"Tesfaye, Getachew" <Getachew.Tesfaye@nrc.gov>
Tracking Status: None

Post Office: AUSLYNCMX02.adom.ad.corp

Files	**Size**	**Date & Time**
MESSAGE	4739	9/15/2010 5:48:36 PM
RAI 392 Supplement 2 Response US EPR DC.pdf		151162

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Response to

Request for Additional Information No. 392(4650), Supplement 2

6/9/2010

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 11.05 - Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems
Application Section: FSAR 11.5

QUESTIONS for Health Physics Branch (CHPB)

Question 11.05-21:

Phase 4 RAI

Follow-up to Open Item 276, Question 11-05-13, Supplement 2 Response

In the response dated Nov. 12, 2009, the applicant provides information addressing the staff's questions about the provision for instrumentation and sampling system and their performance characteristics in complying with the RCS operational leakage rate of 1 GPM under U.S. EPR TS 16.3.4.12.b. While the staff confirmed the results of a selected set of conditions, a review of the response raises the following concerns. Specifically, the applicant is requested to address the following issues and revise the response and FSAR accordingly. The issues are:

1. Figure 11.05-13-1 presented in the response should be expanded to include in the right ordinate axis, the derived dynamic response range of the instrumentation showing where the 1 GPM criterion would be met.
2. Given that the response includes information addressing the implementation and application of the methodology described in the calculations, there is a need to include for COL applicants a reference to the supporting calculation package in FSAR Section 11.5.5. This information would be valuable for the COL applicant in defining procurement specifications for the related radiation monitoring instrumentation and sampling system, and for developing operating procedures in ensuring that the instrumentation will measure containment airborne concentrations over the stated dynamic response range once installed in the plant.
3. The last sentence of the proposed text (which would support the info in FSAR Table 11.5-1) should be qualified as it is not clear if the stated dynamic response range does account for the effects of filtration of airborne radioactivity from the internal filtration system, and whether under routine operation, the internal filtration system would be in continuous operation.
4. While the response acknowledges that some design features and operating characteristics of the radiation monitoring and sampling system cannot be defined at this stage of the design certification, there is a need to alert COL applicants of these important considerations. As a result, Areva is requested to include a COL information item that places the responsibility on the COL applicant to provide plant-specific information describing how design features, installation, and implementation of operating procedures for this system will address compliance with the RCS operational leakage rate of 1 GPM under U.S. EPR TS 16.3.4.12.b. In confirming that the instrumentation and sampling system can detect and operate over the stated design certification dynamic range, the COL information item should address:
    a. the representativeness of the chosen sampling or monitoring location (ambient containment, ventilation ductwork, or process stream),
    b. consider expected particle size distributions and determine the need for isokinetic sampling when extracting aerosol samples from ductwork,
    c. design features that minimize sample line losses and correction for line losses from the sampling location to the point of collection and measurement,
    d. type of filter media and collection or retention efficiency for expected radionuclides physical and chemical properties,

e. considerations in selecting fixed or moving filter system and associated sampling flow rates, including detector to filter media geometry dependencies, fixed particulate filter replacement frequency, and equilibrium conditions of moving particulate filter system in detecting airborne radioactivity corresponding to a RCS operational leakage rate of 1 GPM,

f. radiation detection method and detection efficiencies for radionuclide distributions stated in the design certification or alternate set of surrogate radionuclides, and

g. placement of radiation monitoring instrumentation in plant areas that minimize interferences from ambient external radiation levels.

Response to Question 11.05-21:

Response to Question 11.05-21, Part 1:

The Response to RAI 276, Question 11-05-13, Supplement 2 indicated that U.S. EPR FSAR Tier 2, Figure 11.05-13-1 would be revised to include, in the right ordinate axis, the derived dynamic response range of the instrumentation showing where the gpm criterion would be met. However, this is not feasible. The dynamic response of the monitor is relative to the pre-existing airborne activity and the associated background radiation level. The alarm setpoint will be established as a multiple of the background radiation (at least a factor of two). Therefore, the dynamic response is characterized as a multiple of the pre-existing activity. For example, if the pre-failure leakage rate is 0.1 gpm, which implies that the post-failure leakage rate would be 1 + 0.1 = 1.1 gpm, the increase of airborne concentration within 50 minutes occurs by a factor of 4.14 (see Table 11.05-21-1).

A new figure (Figure 11.05-21-1) was developed to show the pre- and post-failure total airborne particulate concentration at the radiation monitor sampling location as a function of pre-failure reactor coolant system (RCS) leakage rate assuming a realistic reactor coolant activity concentration. The post-failure RCS leakage rate is 1 gpm higher than the pre-failure value (see U.S. EPR FSAR Tier 2, Section 5.2.5). The ratio of these two plots is shown in U.S. EPR FSAR Tier 2, Figure 11.05-13-1 as a result of the response to RAI-276, Question 11.05-13. This figure is also shown as Figure 11.05-21-2. Tabulation of the plotted results in these two figures is shown in Table 11.05-21-1.

Response to Question 11.05-21, Part 2:

This question is addressed in the response to Part 4.

Response to Question 11.05-21, Part 3:

The dynamic response of the radiation monitor requires the continuous removal of airborne radioactivity from the containment building equipment area by the internal filtration system (KLA-5), as designed. The filtered recirculation flow rate is equivalent to about 0.5 air changes per hour. U.S. EPR FSAR Tier 2 Section 11.5.4 will be revised to include this statement.

Response to Question 11.05-21, Part 4:

U.S. EPR Technical Specification (TS) 3.4.14 states that the containment particulate radiation monitor is required to be operable. To demonstrate operability, the applicant has an obligation to carry out a setpoint calculation to demonstrate the monitor's capability of performing its intended function (i.e., to detect a 1 gpm leak in 1 hr based on realistic RCS concentrations as defined in U.S. EPR FSAR Tier 2, Section 5.2.5). Therefore, no COL item is required.

There are a number of factors that have the potential of impacting the ability of the monitor to perform its function. U.S. EPR FSAR Tier 2, Section 11.5.4 will be revised to include a new section (U.S. EPR FSAR Tier 2, Section 11.5.4.8), which will list these factors and their potential impacts. This new section will provide sufficient information for the COL applicants to develop procurement specifications for the related radiation monitoring instrumentation and sampling system, and for its placement, shielding, and operational requirements. Operating procedures will verify that the given particulate radiation monitor sensitivity is sufficient to satisfy the reactor coolant system (RCS) leakage rate technical basis.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 11.5.4.8 will be added as described in the response and indicated on the enclosed markup.

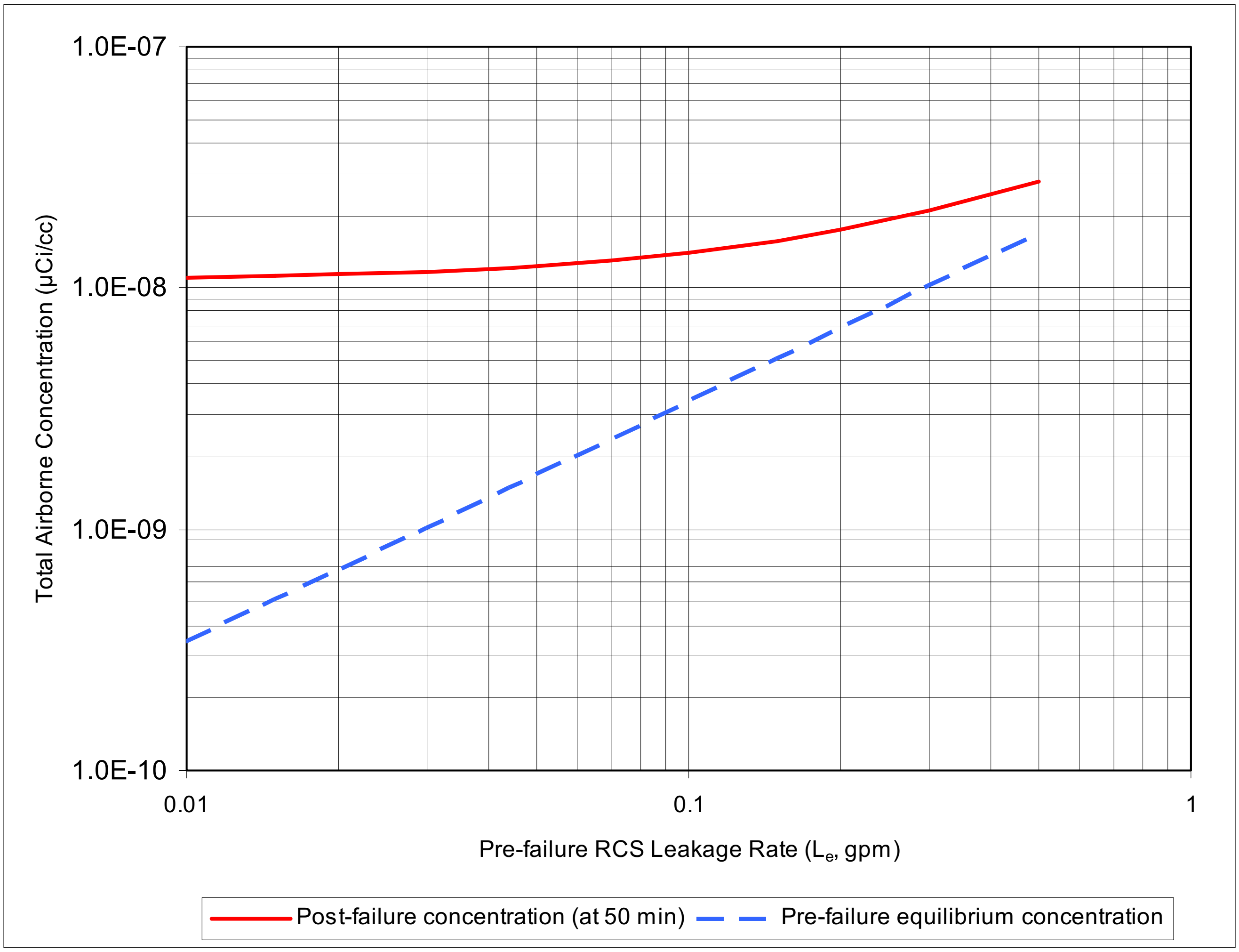
Table 11.05-21-1—Pre- and Post-Failure Total Airborne Particulate Concentrations at the Radiation Monitor Sampling Location[1]

Initial RCS Leakage Rate (gpm)	Pre-Failure Equilibrium Concentration[2] (Total μCi/cc)	Post-Failure Concentration, at 50 min[2] (Total μCi/cc)	Increase in Airborne Concentration in 50 minutes[3]
0.01	3.396E-10	1.100E-08	32.40
0.015	5.093E-10	1.117E-08	21.93
0.02	6.791E-10	1.134E-08	16.70
0.03	1.019E-09	1.168E-08	11.46
0.0442	1.501E-09	1.216E-08	8.10
0.05	1.698E-09	1.236E-08	7.28
0.07	2.377E-09	1.304E-08	5.49
0.1	3.396E-09	1.406E-08	4.14
0.15	5.093E-09	1.576E-08	3.09
0.2	6.791E-09	1.745E-08	2.57
0.3	1.019E-08	2.085E-08	2.05
0.5	1.698E-08	2.764E-08	1.63

Notes:

1) Based on a 1 gpm increase in the RCS leakage rate and on the particulate radionuclide mix in the ANSI/ANS 18.1 source term for the U.S. EPR NPP.
2) See Figure 11.05-21-1 for graphical presentation.
3) See Figure 11.05-21-2 for graphical presentation.

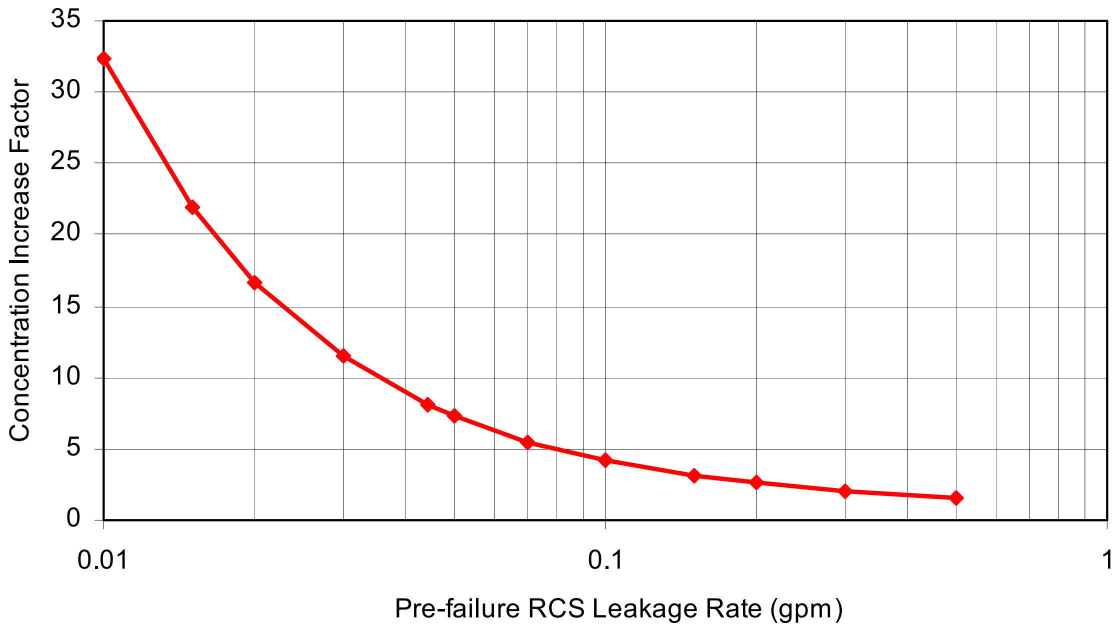
Figure 11.05-21-1—Pre- and Post-Failure Total Airborne Particulate Concentration at the Radiation Monitor Sampling Location[1]



Note:

1) Based on a 1 gpm increase in the RCS leakage rate and on the particulate radionuclide mix in the ANSI/ANS 18.1 source term for the U.S. EPR NPP.

Figure 11.05-21-2—Increase in Airborne Particulate Concentration at the Radiation Monitor Sampling Location at 50 min after Increase in RCS Leakage Rate by 1 gpm



Note:

1) Based on the particulate radionuclide mix in the ANSI/ANS 18.1 source term for the U.S. EPR NPP.

U.S. EPR Final Safety Analysis Report Markups

from this system for radiochemistry laboratory evaluation is provided in the return manifold of the chilled water system.

11.5.4.8 Radiation Monitoring System for RCS Leakage Detection

11.05-21

Containment atmosphere particulate radioactivity monitoring is one of the systems used in the U.S. EPR design for RCS leakage detection described in Section 5.2.5. The particulate radiation monitoring system continuously monitors airborne radioactivity in the containment equipment area. Radiation levels are indicated in the MCR. Alarms alert the operators of elevated levels of radioactivity to allow for prompt identification of RCS leakage into the equipment area. The monitor is located in the service area of the containment, which is accessible during normal operation. The system draws air from the containment building ventilation system which filters airborne radioactivity within the equipment area. The sampled flow is returned to the equipment area.

The particulate monitor is a low-range monitor capable of detecting 3E-10 to 1E-6 μCi/cc (Radiation Monitoring Point R-10 in Table 11.5-1). The monitor sensitivity requirement is to be able to detect a leakage increase of one gpm within one hour based on a realistic RCS source term (Table 11.1-7) consistent with RG 1.45 (Reference 10) and RIS-2009-02 (Reference 11). Typical radionuclides of interest are as follows:

1-member decay chains:	Na-24	Y-93
	Te-129	
2-member decay chains:	Kr-88 / Rb-88	Ru-106 / Rh-106
	Xe-138 / Cs-138	Ba-140 / La-140

The stated dynamic response of the radiation monitor requires the continuous removal of airborne radioactivity from the containment building equipment area by the internal filtration system (KLA-5), as designed. The filtered-recirculation flow rate is equivalent to 0.5 air changes per hour.

The dynamic response of the monitor is relative to the pre-existing airborne activity and the associated background radiation level. The alarm setpoint will be established as a multiple of the background radiation (at least a factor of two). Therefore, the dynamic response is characterized as a multiple of the pre-existing activity.

Quantification of the leakage is based on correlations which predict the time-dependent buildup of radioactivity within the equipment area, making use of both the pre-existing concentration of airborne radioactivity therein and of the RCS radioactivity level at the onset of increased leakage. The leakage rate is quantified by correlating the measured airborne concentrations with analytical predictions. A similar approach is used under equilibrium conditions (with constant airborne radioactivity and radiation monitor reading) to determine the alarm setpoint.

11.05-21

A number of items impact the ability of the containment atmosphere particulate monitoring instrumentation and sampling system to detect and operate over the stated dynamic range. These items are listed below, along with clarifying comments:

- Representativeness of Chosen Sampling Location

  During normal operation (i.e., without containment purge), the equipment area atmosphere is conditioned by the normal ventilation system (KLA-6) with a mixing flow of 130,000 cfm. Airborne radioactivity is removed by the internal filtration system (KLA-5) at a flow rate of 4120 cfm through HEPA and charcoal filters. KLA-5 draws air from the upper portion of the area housing the Reactor Coolant Pump #3, and discharges it to the return duct of the compartment with the KLA-6 main supply fans.

  The particulate radiation monitoring system for RCS leakage detection within the equipment area is located in the service area of the containment (in Room UJA 29-022). The system draws air from the KLA-5 ventilation system just upstream of the filtration unit (also located therein), and discharges it back to the same airduct. The radionuclide concentration at the monitoring sampling location is the same as at the intake to KLA-5.

  In view of the mixing provided by KLA-6, equivalent to 16.4 volumes per hour, the selected sampling location for RCS leakage detection is representative. Analysis has shown that the buildup of airborne concentrations at the monitor sampling location for the actual multi-compartment configuration of the equipment area will require no more than an additional five minutes to arrive at the concentration predicted by a single-compartment model with instantaneous mixing, no matter where within the equipment area the RCS leakage occurs. This five minute delay has been included in the required one hour response time for leakage identification.

- Need for Isokinetic Sampling

  The expected particle size, as well as the configuration of KLA-5 ductwork and installed particulate monitor can have an impact on obtaining a representative aerosol sample.

- Minimization of Sampling Line Losses and Associated Corrections

  The sample line losses can have an impact on obtaining a representative aerosol sample. These losses are minimized by optimizing air flow to verify high efficiency sampling and applying appropriate correction factors to account for sample line losses.

11.05-21

- Sample Collection Media

  The filter media retention properties have an impact on the collection and retention of specific radionuclides. This impact is addressed by applying appropriate correction factors to account for the specific properties of the filter media selected and the radionuclides of interest.

- Sample Collection System

  The sample collection system is a moving-filter type, where airborne particulate radioactivity is continuously drawn from the containment atmosphere and accumulated on a filter medium, and the emitted radiation is measured. Features that impact the monitor response for this type of collection system are sample flow rate and sample collection interval, as dictated by the detector view window and the speed of the traversing filter tape. These variables are adjusted as required to achieve a sufficient normal background reading (i.e., with minimal unidentified RCS leakage into containment) close to and above the monitor lower limit of detection (LLD), while at the same time minimize the filter roll replacement frequency and associated entries to the containment service area.

- Radiation Detection Methods and Detection Efficiencies

  The containment particulate monitor measures airborne particulate beta activity, with active gamma compensation (coincidence counting of beta/gamma radiation emitted by the same decaying radionuclide to reduce background radiation). The detector uses gross beta detection and as such does not identify airborne concentration for any specific radionuclide; radioanalytical and/or empirical correlations are, therefore, required to convert the measurements to RCS leakage. The monitor response is impacted by the source/receptor geometry and detection efficiencies for given isotopes. The range is selected to meet the technical specification requirements.

- Placement of Radiation Monitoring Instrumentation

  The radiation level in the area housing the monitoring instrumentation is less than 25 mrem/hr (refer to Figure 12.3-13—Reactor Building Cross-Section Radiation Zones). Shielding is used to minimize the interferences from ambient external radiation levels, including shine from the potential accumulation of radioactivity on the KLA-5 filtration system.

RCS leakage quantification can also be based on the detection of activation products, such as F-18, which is generated by the O^{18} (proton, neutron) F^{18} reaction as the RCS coolant passes through the core. This particular isotope is of particular interest for RCS leakage detection because it is not a fission product (and, therefore, not dependent on fuel clad defects), has a reasonable half life (about 110 min), decays by positron emission (followed by annihilation radiation, which is readily detectable), and combines with lithium in the water to form LiF (a particulate). It is not addressed in the U.S. EPR design for RCS leakage detection due to the unavailability of analytical values for its equilibrium concentration within the RCS as LiF, and the loss

11.05-21 mechanisms it is subjected to when released to the containment atmosphere as a result of leakage.

11.5.5 References

1. ANSI/HPS N13.1-1999, "Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities," American National Standards Institute/Health Physics Society, 1999.

2. ANSI N42.18-2004, "Specifications and Performance of On-site Instrumentation for Continuously Monitoring Radioactivity in Effluents," American National Standards Institute, 2004.

3. NUREG-0800, BTP 7-10, "Guidance on Application of Regulatory Guide 1.97," Revision 5, U.S. Nuclear Regulatory Commission, March 2007.

4. NUREG-0737, "Clarification of TMI Action Plan Requirements," U.S. Nuclear Regulatory Commission, November 1980.

5. NUREG-0718, "Licensing Requirements for Pending Applications for Construction Permits and Manufacturing Licenses," U.S. Nuclear Regulatory Commission, March 1981.

6. Generic Letter 89-01, "Implementation of Programmatic Controls for Radiological Effluent Technical Specifications in the Administrative Controls Section of the Technical Specifications and the Relocation of Procedural Details of RETS to the Offsite Dose Calculation Manual or to the Process Control Program," U.S. Nuclear Regulatory Commission, January 1989.

7. NUREG-0800, "U.S. NRC Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, March 2007.

8. NUREG-1301, "Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors," U.S. Nuclear Regulatory Commission, April 1991.

9. NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," U.S. Nuclear Regulatory Commission, October 1978.

10. NEI 07-09A, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description," Nuclear Energy Institute, March 2009.