RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**368-8470**
SRP Section:	**14.03.08 – Radiation Protection Inspections, Tests, Analyses, and Acceptance Criteria**
Application Section:	**Tier 1**
Date of RAI Issue:	**01/19/2016**

Question No. 14.03.08-14

This is a follow-up to the response to RAI 8054, Questions 14.03.08-4 and 14-03.08-5.

BASIS

10 CFR 52.47(a)(5) requires that the FSAR contain the kinds and quantities of radioactive materials expected to be produced in the operation and the means for controlling and limiting radioactive effluents and radiation exposures within the limits set forth in 10 CFR 20.

10 CFR 50, GDC 61, requires that the fuel storage and handling, radioactive waste, and other systems which may contain radioactivity shall be designed to assure adequate safety under normal and postulated accident conditions. These systems shall be designed (1) with a capability to permit appropriate periodic inspection and testing of components important to safety, (2) with suitable shielding for radiation protection, (3) with appropriate containment, confinement, and filtering systems, (4) with a residual heat removal capability having reliability and testability that reflects the importance to safety of decay heat and other residual heat removal, and (5) to prevent significant reduction in fuel storage coolant inventory under accident conditions.

SRP 12.3-12.4 indicates that, the applicant’s area radiation monitoring system is designed to monitor the radiation levels in areas where radiation levels could become significant and where personnel may be present.

ANSI/ANS-HPSSC-6.8.1-1981, which the applicant references and which is referenced in the SRP indicates that, “Detectors shall be located in those areas which require entry or exit, or both, to be monitored or controlled for purposes of occupational radiation protection which are normally accessible, and where changes in plant conditions can cause significant increases in personnel exposure rate above that expected for the area. Detectors shall be located to best measure the representative exposure rates within the specific area so as to assist in minimizing exposure to personnel.”

SRP Section 14.3 indicates that the purpose of inspections, tests, analysis, and acceptance criteria (ITAAC), is to verify that a facility referencing the design certification is built and operates in accordance with the design certification and applicable regulations.

In addition, SRP Section 14.3.8 indicates that the reviewer should ensure that Tier 1 identifies and describes, commensurate with their safety significance, those SSCs that provide radiation shielding, confinement or containment of radioactivity, ventilation of airborne contamination, or radiation (or radioactivity concentration) monitoring for normal operations and during accidents.

ISSUES

1. In the response to Question 14.03.08-4, the applicant removed the instrument calibration facility area radiation monitor (referred to as RE-286) from Tier 1, Table 2.7.6.5-1 and Tier 2, Table 12.3-6, although the monitor is still shown in Tier 2, Figure 11.5-2R. However, no information was provided in the response regarding why this monitor was being removed from the design.

   The instrument calibration facility is identified as a potential very high radiation area (exceeding 500 Rad/hour) when unshielded radiation sources are present. Since the area is normally a low radiation area when unshielded sources are not present, monitor RE-286 was in place to alert plant personnel of high radiation levels in the area to ensure that appropriate actions are being taken. Therefore, it would appear that monitor RE-286 is necessary in accordance with the aforementioned regulations and guidance documents.

   As a result, please;

   a) Retain monitor RE-286 in Tier 1, Table 2.7.6.5-1 and Tier 2, Table 12.3-6; or

   b) Provide an explanation for why monitor RE-286 is being removed from the design and justify why monitor RE-286 is not necessary to comply with the aforementioned regulations and to conform to the aforementioned guidance. If this option is chosen, please remove monitor RE-286 from FSAR Figure 11.5-2R, for consistency.

2. With the changes made in the response to Question 14.03.08-4, the application now includes two truck bay monitors (RE-288 and RE-289), however, only one truck bay monitor (RE-289) is shown in FSAR Figure 11.5-2T. Please update the figure to include RE-288, as appropriate.

3. 10 CFR 50.34(f)(xvii) requires that instrumentation be provided that measure containment high level radiation intensity and NUREG-0737 specifies that the monitors be widely separated and view a large fraction of the containment volume. In response to item 5 in Question 14.03.08-4, the applicant proposed adding ITAAC 7 to Tier 1, Table 2.7.6.5-3, to indicate that the containment radiation monitors will be located in an unimpeded location. However, the acceptance criteria for this ITAAC is subjective, which could lead to disagreement to if the criteria is met or not. Please revise this ITAAC so that it specifies the minimum percent unimpeded exposure path of the containment atmosphere free volume for each high range radiation monitor, sufficient to access post LOCA containment radiation conditions, consistent with 10 CFR

50.34(f)(xvii) and the guidance of NUREG-0737 II.F.1, or to reference a figure which clearly shows the vertical and horizontal locations of the monitors and ensures that it has an unimpeded view.

4. In response to item 4 in Question 14.03.08-4, the applicant indicated which ITAAC are used to ensure that when the monitors with emergency safety features (ESF) detect high radiation levels that the appropriate ESF are actuated. Regarding this response, please resolve the following;

    a. During the pre-application review, the applicant indicated that these monitors would be tested with an actual radiation check source and not some type of artificial signal. In order to remove any ambiguity, please include the word “radiation” in front of “check source” in ITAAC 3 and 6 in Table 2.7.6.5-3 and ITAAC 4 and 5 in Table 2.7.6.4-3.

    b. The applicant indicates that the tests from detection of the radiation signal to actuation of the ESF functions are overlap tests, however, this does not appear to be the case. As an example, ITAAC 6 in Table 2.7.6.5-3 states that the ESF initiation signals are sent to the ESF-CCS group control cabinet. If the test was an overlap test, it would also ensure that the ESF-CCS group control cabinet receives the signal appropriately. Then, ITAAC 5 in Table 2.5.4-4 would overlap with ITAAC 6 in Table 2.7.6.5-3, because ITAAC 5 in Table 2.5.4-4 begins with the signal being received by the ESF-CCS group control cabinet. Therefore, please update all ITAAC associated with testing from sensor to actuator to ensure that the tests for radiation monitors with ESF functions are performed with appropriate overlap testing. In lieu of revising multiple ITAAC, the applicant may elect to include a new or separate ITAAC that appropriately tests the monitors with ESF functions from sensor (with a radiation source) to ESF function actuation, in one ITAAC.

    c. The purpose of the ITAAC is to ensure the facility is constructed and operates as referenced in the design certification. In ITAAC Table 2.7.3.2-3, it is unclear why ITAAC 10 would have an acceptance criteria indicating that it is met based on the conclusions reached in a report. It would appear that the isolation of dampers and the start of emergency ventilation would be something that should be physically tested to ensure that everything functions properly. Please revise the acceptance criteria for this ITAAC and other ITAAC associated with actuation functions from radiation monitors so that they ensure that the proper dampers physically close and that the emergency exhaust ventilation physically starts properly (or other action is appropriately performed) or explain and provide justification for why it is appropriate to rely on the conclusions reached in a report for these ITAAC.

    d. In addition, ITAAC 10 in Table 2.7.3.2-3 does not provide any minimum timeframe for damper closure or the start of the emergency ventilation. Please update ITAAC 10 in Table 2.7.3.2-3 or provide a new ITAAC to include this information.

5. In the response to item 1 of Question 14.03.08-5, the applicant proposed adding new information to Tier 1, Table 2.7.6.4-1. The following questions are a result of the proposed changes:

   a. Staff notes that the seismic category of monitors PR-RE-111 and PR-RE-104 is listed as “A.” Since there is no definition for seismic category A in the design, please correct this apparent error.

   b. For the CVCS Letdown Line monitor (CV-RE-036), the class and range information is blank. In addition, staff cannot find any information in Tier 2 Chapters 11 and 12 regarding this monitor. Please provide additional information regarding this monitor and its purpose and resolve these issues.

   c. The proposed addition of Note (4) to the table states, “Q = Quality Class: Q, A, S” however, there is no relevant information provided in Table 2.7.6.4-1 corresponding to this note. In addition, Tier 2 Tables 11.5-1 and 12.3-6 include the same note and the tables include a quality class column with each monitor listed as either Q, A, S, or T. Please provide information defining quality class and describing what the different designations mean and either remove the designation from Tier 1 or provide the column listing the information. Provide FSAR updates to describe quality class, delete unnecessary information or resolve inconsistencies, as appropriate.

6. In item 4 of Question 14.03.08-5, staff requested that the applicant provide information on the overlap testing ITAAC in place for the main control room air intake monitors to ensure that the appropriate ESF function of isolating normal ventilation and starting emergency ventilation occurs (beginning with Tier 1 Table 2.7.6.4-3). Instead of providing this information the applicant provided information on the testing provided for the radiation monitors associated with containment purge isolation and fuel handling emergency ventilation. However, staff believes the correct set of ITAAC for testing the main control room radiation monitors for emergency actuation are ITAAC 5 in Table 2.7.6.4-3, ITAAC 5 in Table 2.5.4-4, and several ITAAC in Table 2.7.3.1-3 (including items 10 and 12).

   a. Similar to item “4.b” above, (this time for main control room air intake monitors associated with Table 2.7.6.4-3), please ensure that sufficient overlap testing is provided to test the monitors from sensor to the completion of the ESF functions or provide a separate individual ITAAC testing the function from the detection of high radiation levels (with a radiation check source) to completion of actuation of the ESF function (e.g. altering appropriate dampers and activating emergency ventilation).

   b. ITAAC 9 in Table 2.7.3.1-3 indicates that upon detection of radiation in the outside air intakes, the air intake isolation dampers in the air intake having the higher radiation level close automatically. When one air intake is closed, the radiation readings on the associated radiation monitor will likely greatly decrease because there is no longer air being drawn in the intake. During an accident, please indicate if the intake that initially has the higher radiation is closed and will remain closed regardless of radiation levels, or if the closed intake will automatically open if higher radiation levels are detected in the open intake. If the design is such that the open intake could continually change automatically based on radiation levels, please discuss why this design is appropriate.

Response

Subquestion 1

The reference plant Shin-Kori 3&4 deleted the Instrument Calibration Facility Area Radiation Detector (RE-286) to reflect the client’s preference to have potentially radioactive sources, including radioactive calibration sources, handled at a designated offsite facility. This change was similarly incorporated into APR1400 DCD without due consideration that the reference plant’s decision was a client specific feature. Therefore, RE-286 will be reinstated in Tier 1, Table 2.7.6.5-1 and Tier 2, Table 12.3-6.

Subquestion 2

Truck bay monitor RE-288 will be added to Figure 11.5-2T. In this figure, the location of RE-284 and RE-289 has been changed to the correct location.

Subquestion 3

It is difficult to present spatial location information using 2D design drawings. Therefore, an attempt is made for the ITAAC to reflect the description that the locations of the monitors are located to provide unimpeded communication of the entire containment representative free volume, as follows:

> The containment area monitors consist of four total. The upper monitors (RE-233A and 234B) are designed and comply with NUREG-0737.II.F.1 and NRC RG 1.97 Type C requirements.
>
> In accordance with RG 1.97 Type C, these two monitors are designed to meet Category I requirements, which means that they are Electrical Class 1E, Seismic Category I and environmentally qualified to withstand and the post-accident LOCA environment. The measurement range is commensurate with the range given in RG 1.97.
>
> The two monitors are azimuthally 180° apart and located just below the containment polar crane rail support girder (near El.230’). Thus, the two monitors have a wide open, unobstructed communication with the entire containment free air volume. An access ladder and platform provide for maintenance, but presents minimal interference.
>
> The lower monitors (RE-231A and 232B) are located at El. 160’ directly above the refueling pool. These two monitors serve a different function than those of the upper monitors. These lower ones monitor the refueling operation to detect a fuel handling accident condition. Therefore, these monitors are not intended to serve the functions specified by NUREG-0737 or RG 1.97. These monitors generate a Containment Purge Isolation Actuation Signal (CPIAS) should a fuel handling accident occur. The measurement range reflects the purpose and intended function.
>
> Since these lower monitors perform balance of plant (BOP) ESFAS function, they are Class 1E, seismic Category I and environment qualified to maintain functional integrity in a fuel handling accident environment. These two lower monitors utilize a one-out-of-two coincident logic and comply with the single failure criteria of IEEE Std.603. Even though not required, the two upper monitors can be used in a redundant capacity to the lower monitors. Therefore, the signals from the upper monitors are fed into the CPIAS coincidence logic to take advantage of

this capability and the one-out-of-two coincident logic is taken twice to improve the overall functional reliability and to increase the availability.

ITAAC Item 7 of Table 2.7.6.5-3 will be revised to be more specific on the verification of the unimpeded location to ensure that the as-built monitors' intended functions will be as designed.

Subquestion 4.a

Use of a radiation check source will replace the integral activated check source in described in Subsection 11.5.2.1 of DCD Tier 2.

The integral activated check source is an uncalibrated radioactive source or equivalent that is used to confirm the continuing satisfactory operation of the radiation monitoring assembly, when exposed to the detector. A check source is exposed to the detector on demand with an upscale measurement indication being a pass/fail criterion. The radioactive check source consists of a small amount of radioactive material chosen to provide a signal in the lower range of detection for verification of detector function. For this reason, the integral activated check source cannot be used to verify the setpoint for the alarm and radiation level. Verification of the setpoint for the alarm and radiation level will normally be carried out periodically using the appropriate calibration source.

Therefore, a simulated radiation signal will be used where necessary to produce the radiation level required to test the BOP ESFAS signals and RMS alarm functionality discussed in ITAAC items 3 and 6 of Table 2.7.6.5-3 and ITAAC items 4 and 5 of Table 2.7.6.4-3.

Subquestion 4.b

The use of the term “overlap testing” in the response to RAI 8054, Questions 14.03.08-4 item 4 was a misnomer and not accurate per the definition given in IEEE Std. 338. The segmented subsystems described in the response were to outline the signal path from the sensor to the actuated component and was not intended to indicate that each segmented section could be separately tested. In actuality, each of the three BOF ESFAS loops is tested by injecting a simulated test signal at the detector end and making an observation that the associated component (e.g. fan, damper, etc.) is actuated in one continuous sequence. The BOP ESFAS is a test type equivalent to a “GO” test defined in IEEE Std. 338; which means the system can be tested during normal plant operation and would not lead to a plant upset condition.

The response RAI 8054, Questions 14.03.08-4 item 4 should have stated that BOP ESFAS-FHEVAS and CPIAS initiation from the actuation signal generation to physical activation of the engineered safety feature (ESF) components is tested using a simulated signal in one continuous actuation through the segmented sections detailed in ITAAC Table 2.7.6.5-3 Item 6, 2.5.4-4 Item 5, 2.7.3.2-3 Item 10, and 2.11.3-2 Item 7.a.

The segmented sections delineated in the ITAAC tables are to merely outline the signal path from the sensor to the actuated components and it is not intended to indicate that each section would be separately tested requiring overlap testing between sections. The verification testing of BOP ESFAS-FHEVAS and CPIAS is done continuously from the actuation signal generation to physical actuation of the ESF components.

Table 2.7.6.5-3, Item 6 is to verify that an ESFAS signal is sent through the ESF-CCS group control cabinet to the final actuated component if the simulated radiation signal exceeds predetermined setpoints for the FHEVAS and CPIAS.

Table 2.5.4-4, Item 5 is to verify that the ESF-CCS group control cabinet receives the ESFAS initiation signal from safety-related divisionalized cabinet (SRDC) of the RMS and performs a 1-out-of-2 logic to perform the BOP ESF actuation functions identified in Table 2.5.4-2, Item 7 and 8. The control signals are then sent to the ESF components.

Table 2.7.3.2-3, Items 10.a and 10.b are to verify that the fuel handling area emergency exhaust ACU starts and the air intake isolation dampers and the normal exhaust ACU isolation dampers close in response to BOP ESFAS-FHEVAS signal.

Table 2.11.3-2, Item 7.a is to verify that the containment purge isolation valves (VQ-0011 ~ VQ-0014 and VQ-0031 ~ VQ-0034) close in response to BOP ESFAS-CPIAS signal.

ITAAC Tables 2.7.6.5-3 Item 6 and Table 2.5.4-4, Item 5 will be revised to make it clear that the testing is done continuously rather than giving a misleading impression of segmented sectionalized testing requiring overlap between sections.

Subquestion 4.c

The ITAAC items 9 and 10 in Table 2.7.3.1-3, ITAAC item 10 in Table 2.7.3.2-3 and ITAAC item 10 in Table 2.7.3.5-3 which are associated with actuation functions from radiation monitors will be revised to have acceptance criteria to ensure that the associated isolation dampers physically close and the emergency exhaust ACU physically starts properly.

Subquestion 4.d

The air intake isolation dampers and the normal exhaust isolation dampers of the fuel handling area HVAC system are designed to be closed within 8.4 seconds after receiving an engineered safety features-fuel handling area emergency ventilation actuation signal (ESF-FHEVAS). The applicant will divide ITAAC 10 in Table 2.7.3.2-3 into ITAAC 10.a for the fuel handling area emergency exhaust ACU and ITAAC 10.b for the isolation dampers. ITAAC 10.b will include the 8.4 seconds for the isolation damper closure time.

Subquestion 5.a

The seismic category for PR-RE-111 and PR-RE-104 will be corrected to II in Tier 1, Table 2.7.6.4-1.

Subquestion 5.b

Monitor CV-RE-036 has been deleted from the Table 2.7.6.4-1 as provided in the mark up for response to RAI 116-8054, Question 14.03.08-5 (ref. KHNP submittal MKD/NW-0204L dated October 30, 2016; ML15303A426).

Subquestion 5.c

Monitor classification using Quality Class designation is not applicable to APR1400 and is a classification only used for Korean nuclear power plants. Reference to Quality Class will be deleted from Tables 11.5-1, 11.5-2, and 12.3.6 in DCD Tier 2 and Table 2.7.6.4-1 in DCD Tier 1.

Subquestion 6.a

The response provided to Item 4 of Question 14.03.08-5 for RAI 116-8054 erroneously repeated the same response given for BOP ESFAS-FHEVAS and CPIAS; although the contents of the response are similar. The previous response to Item 4 of Question 14.03.08-5 should have stated that similar to the verification testing of BOP ESFAS-FHEVAS and CPIAS, BOP ESFAS-CREVAS initiation from the actuation signal generation to physical activation of the engineered safety feature (ESF) components is tested using a simulated signal in one continuous actuation through the segmented sections detailed in ITAAC Table 2.7.6.4-3 Item 5, 2.5.4-4 Item 5 and 2.7.3.1-3 Item 10.

The segmented sections delineated in the ITAAC Tables are to merely outline the signal path from the sensor to the actuated components and it is not intended to indicate that each section would be separately tested requiring overlap testing between sections. The verification testing of BOP ESFAS-CREVAS is done continuously from the actuation signal generation to physical actuation of the ESF components.

Table 2.7.6.4-3, Item 5 is to verify that an ESFAS signal is sent through the ESF-CCS group control cabinet to the final actuated component if the simulated radiation signal exceeds predetermined setpoints for the CREVAS.

Table 2.5.4-4, Item 5 is to verify that the ESF-CCS group control cabinet receives the ESFAS initiation signal from SRDC of the RMS and performs a 1-out-of-2 logic to perform the BOP ESF actuation functions identified in Table 2.5.4-2, Item 9. The control signals are then sent to the ESF components.

Table 2.7.3.1-3, Item 10 is to verify that in response to a NSSS ESFAS-SIAS and BOP ESFAS-CREVAS signal, the control room emergency makeup ACU starts and the ACU inlet isolation damper, the ACU discharge flow control damper, and the ACU return air isolation dampers open.

ITAAC Tables 2.7.6.4-3 Item 5 and Table 2.5.4-4, Item 5 will be revised to make them consistent with other BOP ESFAS actuation verification testing and to make it clear that the testing is done continuously rather than giving a false impression of segmented sectionalized testing requiring overlap between sections.

Subquestion 6.b

Upon detection of a high radiation in the outside air intakes, the outside air intake isolation dampers in the outside air intake having the higher radiation level close automatically. When one outside air intake is closed, the radiation monitors in the closed outside air intake will no longer read radiation levels because there is no longer air being drawn in the outside air intake. As a result, the circuitry for the radiation monitors can no longer compare the radiation levels in both outside air intakes, and the initially closed outside air intake will remain closed.

However, the control room HVAC system has a control logic that automatically reopens the closed isolation dampers at a preset interval by automatically resetting the closed isolation dampers to ensure that the operators are only exposed to the lowest dose possible. After reopening, the outside air is drawn through both outside air intakes again and the control room HVAC system automatically closes the outside air intake isolation dampers in the intake having the higher radiation level by comparing radiation levels.

The control room HVAC system automatically repeats reopening the closed isolation dampers at the preset interval of the control logic in order to automatically change to the intake that has the lowest radiation levels. The interval time will be determined by considering the durability of the isolation damper and the site-specific meteorological data from radiological aspects defined by the COL applicant. ITAAC Table 2.7.3.1-3 and Tier 2 Subsection 9.4.1.2 will be revised to indicate that the closed outside air intake isolation dampers are automatically reset and reopened at an interval after they are initially closed upon receipt of a high radiation signal. DCD Tier 2 Table 1.8-2 and Subsection 9.4.9 will also be revised to add a COL Item 9.4(5) which indicates that the COL applicant is to provide the interval.

Impact on DCD

The following Subsections, Tables, and Figure will be revised.

DCD Tier 1

Subsections 2.5.4.1, 2.7.3.1.1, 2.7.3.2.1, 2.7.3.5.1.3, and 2.7.6.4.1

Tables 2.5.4-4, 2.7.3.1-3, 2.7.3.2-3, 2.7.3.5-3, 2.7.6.4-1, 2.7.6.4-3, 2.7.6.5-1, and 2.7.6.5-3

DCD Tier 2

Subsections 9.4.1.2, 9.4.9, and 11.5.2.1

Tables 1.8-2, 11.5-1, 11.5-2, and 12.3-6

Figure 11.5-2T

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

1. The seismic Category I equipment and components identified in Table 2.5.4-1 withstand seismic design basis loads without loss of the safety function.

2. Redundant Class 1E divisions listed in Table 2.5.4-1 and associated field equipment are physically separated and electrically isolated from each other and physically separated and electrically isolated from non-Class 1E equipment.

3. The Class 1E equipment and components identified in Table 2.5.4-1 are powered from its respective Class 1E train.

4. Each ESF-CCS division receives ESFAS initiation signals from four divisions of the PPS and performs selective 2-out-of-4 coincidence logic to perform NSSS ESF actuation functions identified in Table 2.5.4-2.

5. Each BOP ESFAS actuation signal passes through ESF-CCS division ~~receives ESFAS initiation signals~~ from two divisions of the RMS as shown in Tables 2.7.6.4-2 and 2.7.6.5-2 and performs 1-out-of-2 logic taken twice except the fuel handling area emergency ventilation actuation signal which has one 1-out-of-2 logic to perform the BOP ESF actuation functions identified in Table 2.5.4-2.

6. Upon receipt of a SIAS, CSAS, or AFAS, the ESF-CCS initiates an automatic start of the EDGs and automatic EDG loading sequencer of ESF loads identified in Table 2.5.4-2.

7. Upon detecting loss of power to Class 1E buses, the ESF-CCS initiates startup of the EDGs, shedding of electrical loads, transfer of Class 1E bus connections to the EDGs, and EDG loading sequencer to the reloading of safety-related loads to the Class 1E buses.

8. Each ESF-CCS division is controlled from either the MCR or RSR, as selected from MCR/RSR master transfer switches.

9. Once a BOP ESF actuation has been actuated (automatically or manually), the ESF actuation logic is latched in the actuated state and is not reset automatically

BOP ESFAS actuation signal passes through

Table 2.5.4-4 (3 of 7)

BOP ESFAS initiation signal passes through

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. Each ESF-CCS division ~~receives ESFAS initiation signals~~ from two divisions of the RMS as shown in Tables 2.7.6.4-2 and 2.7.6.5-2 and performs 1-out-of-2 logic taken twice except the fuel handling area emergency ventilation actuation signal which has one 1-out-of-2 logic to perform the BOP ESF actuation functions identified in Table 2.5.4-2.	5. A test will be performed using simulated input signals for initiation input to each division of the as-built ESF-CCS~~.~~ to verify that the final actuated component functions as required.	5. Each ESF-CCS division ~~receives ESFAS initiation signals~~ from two divisions of the RMS, performs 1-out-of-2 logic taken twice except the fuel handling area emergency ventilation actuation signal which has one 1-out-of-2 logic for each BOP ESF actuation function identified in Table 2.5.4-2 and sends the control signals to the ESF components.
6. Upon receipt of a SIAS, CSAS, or AFAS, the ESF-CCS initiates an automatic start of the EDGs and automatic EDG loading sequencer of ESF loads identified in Table 2.5.4-2.	6. A test will be performed using simulated input signals for initiation input to each division of the as-built ESF-CCS.	6. Each ESF-CCS division receives a SIAS, CSAS, or AFAS and initiate an automatic start of the EDGs and automatic loading sequencer of ESF loads identified in Table 2.5.4-2.
7. Upon detecting loss of power to Class 1E buses, the ESF-CCS initiates startup of the EDGs, shedding of electrical loads, transfer of Class 1E bus connections to the EDGs, and EDG loading sequencer to the reloading of safety-related loads to the Class 1E buses.	7. A test will be performed using simulated input signals for initiation input to each division of the as-built ESF-CCS.	7. Each ESF-CCS division receives loss of power to Class 1E buses, and initiate an automatic start of the EDGs, shedding of electrical loads, transfer of Class 1E bus connections to the EDGs, and sequencing to the reloading of safety-related loads to the Class 1E buses.
8. Each ESF-CCS division is controlled from either the MCR or RSR, as selected from MCR/RSR master transfer switches.	8. A test of the as-built system for one control within each ESF-CCS division will be performed to demonstrate the transfer of control capability between the MCR and RSR.	8. The as-built master transfer switches transfer controls between the MCR and RSR separately for each as-built ESF-CCS division, as follows: a. Controls in the RSR are disabled when controls are active in the MCR. b. Controls in the MCR are disabled when controls are active in the RSR.

4.a ESR dampers, PSR dampers, check dampers and tornado dampers identified in Table 2.7.3.1-1 perform an active safety function to change position as indicated in the table.

4.b After loss of motive power, ESR dampers and PSR dampers identified in Table 2.7.3.1-1 assume the indicated loss of motive power position.

5.a All controls required by the design exist in the MCR to start and stop the ACUs and AHUs, and to open and close ESR dampers and PSR dampers identified in Table 2.7.3.1-1.

5.b All controls required by the design exist in the RSR to start and stop the ACUs and AHUs, and to open and close ESR dampers and PSR dampers identified in Table 2.7.3.1-1.

5.c All displays and alarms required by the design exist in the MCR as defined in Tables 2.7.3.1-1 and 2.7.3.1-2.

5.d All displays and alarms required by the design exist in the RSR as defined in Tables 2.7.3.1-1 and 2.7.3.1-2.

6. The two mechanical divisions of the control room HVAC system are physically separated.

7. The control room HVAC system provides the conditioned air that is required to maintain the room temperature within the design limits for the CRE during plant normal, abnormal and accident conditions.

8. The control room HVAC system removes particulate matter and iodine, and provides system flow as required in the safety analysis.

~~9. Upon detection of radiation in the outside air intakes, the outside air intake isolation dampers in the air intake having the higher radiation level close automatically.~~

9.a The outside air intake isolation dampers in the outside air intake having the higher radiation level close upon receipt of a high radiation signal.
9.b After the outside air intake isolation dampers are initially closed upon receipt of a high radiation signal, the closed outside air intake isolation dampers are automatically reset and reopened at an interval.

10. ~~In response to ESFAS-SIAS or ESFAS-CREVAS, the emergency makeup ACU starts and associated isolation dampers open to direct flow to the ACU.~~

The control room emergency makeup ACU starts and the ACU inlet isolation damper, the ACU discharge flow control damper, and the ACU return air isolation dampers open upon receipt of ESFAS-SIAS or ESFAS-CREVAS.

11. The unfiltered inleakage is within the performance value limit as specified in the safety analysis.

12. The AHU inlet isolation dampers (PSR) listed in Table 2.7.3.1-1 close within their closure time before the airborne radioactive material passes through the isolation dampers.

13.a The fire dampers are installed in the fire rated barriers and have the same fire resistance rating as the barrier.

13.b The fire dampers which are required to protect safety shutdown capability close under design air flow condition.

13.c HVAC ducts that penetrate fire barriers have fire dampers in the HVAC ducts.

14. HVAC duct is installed and routed within the CRE boundary.

2.7.3.1.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.3.1-3 specifies the inspections, tests, analyses, and associated acceptance criteria for the control room HVAC system.

Replaced with "A" in next page.

Table 2.7.3.1-3 (4 of 5)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
~~9. Upon detection of radiation in the outside air intakes, the air intake isolation dampers in the air intake having the higher radiation level close automatically.~~	~~9. Testing will be performed on the isolation dampers using signals that simulate radiation levels in the outside air intakes.~~	~~9. A report exists and concludes that the outside air intake isolation dampers having a higher radiation level in the outside air intakes are closed upon detection of radiation, as a result of having used a signal which simulates radiation levels.~~
~~10. In response to ESFAS-SIAS or ESFAS-CREVAS the emergency makeup ACU starts and associated isolation dampers open to direct flow to the ACU.~~	~~10. Testing will be performed on the ACU using a simulated ESFAS-SIAS or ESFAS-CREVAS.~~	~~10. A report exists and concludes that in response to a simulated ESFAS-SIAS or ESFAS-CREVAS, the ACU starts and ACU inlet isolation dampers and return isolation dampers open.~~
11. The unfilterd inleakage is within the performance value limit as specified in the safety analysis.	11. Tests and analyses will be performed to verify that as-built unfiltered inleakage is within limits.	11. A report exists and concludes that the as-built unfiltered inleakage is less than 510 cmh (300 cfm) in the emergency mode. The 510 cmh (300 cfm) unfiltered inleakage value includes an assumed value of 17 cmh (10 cfm) for CRE ingress/egress.
12. The AHU inlet isolation dampers (PSR) listed in Table 2.7.3.1-1 close within their closure time before the airborne radioactive material passes through the isolation dampers.	12. Test of the as-built AHU inlet isolation dampers (PSR) will be performed using a simulated isolation signal.	12. The AHU inlet isolation dampers (PSR) listed in Table 2.7.3.1-1 close within the 8.4 seconds after receiving a simulated isolation signal.
13.a The fire dampers are installed in the fire rated barriers and have the same fire resistance rating as the barrier.	13.a Type tests, tests, a combination of type tests and analyses, or a combination of tests and analyses of fire damper rating will be performed.	13.a A report exists and concludes that the fire dampers that penetrate the fire barriers have the same fire resistance rating as the barrier.

A

9.a The outside air intake isolation dampers in the outside air intake having the higher radiation close upon receipt of a high radiation signal.	9.a Tests of the as-built outside air intake isolation dampers will be performed using a simulated high radiation signal.	9.a The as-built outside air intake isolation dampers in the outside air intake having the higher radiation level close upon receipt of a simulated high radiation signal.
9.b After the outside air intake isolation dampers are initially closed upon receipt of a high radiation signal, the closed outside air intake isolation dampers are automatically reset and reopened at an interval.	9.b Tests of the as-built outside air intake isolation dampers will be performed under the condition that they are initially closed after receiving a simulated high radiation signal.	9.b The as-built outside air intake isolation dampers are automatically reset and reopened at an interval after they are initially closed upon receipt of a simulated high radiation signal.
10. The control room emergency makeup ACU starts and the ACU inlet isolation damper, the ACU discharge flow control damper, and the ACU return air isolation dampers open upon receipt of ESFAS-SIAS or ESFAS-CREVAS.	10. Tests of the as-built control room emergency makeup ACU, the ACU inlet isolation damper, the ACU discharge flow control damper, and the ACU return air isolation damper will be performed using a simulated ESFAS-SIAS or ESFAS-CREVAS.	10. The as-built control room emergency makeup ACU starts and the as-built ACU inlet isolation damper, the ACU discharge flow control damper, and the ACU return air isolation damper open upon receipt of a simulated high radiation signal.

9. The emergency exhaust ACU in each division removes particulate matter and iodine.

~~10. In response to ESFAS-FHEVAS or high radiation signal, the normal exhaust ACU stops and isolation dampers close to direct flow to the emergency exhaust ACUs.~~

11.a The fire dampers are installed in the fire rated barriers and have the same fire resistance rating as the barrier.

11.b The fire dampers which are required to protect safety shutdown capability close under design air flow condition.

11.c HVAC ducts that penetrate fire barriers have fire dampers in the HVAC ducts.

12. The fuel handling area HVAC system has exhaust airflow rate greater than supply airflow rate to control the release of potential airborne radioactive materials from the fuel handling area during plant normal condition.

2.7.3.2.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.3.2-3 specifies the inspections, tests, analyses, and associated acceptance criteria for the fuel handling area HVAC.

10.a The fuel handling area emergency exhaust ACU starts upon receipt of an ESFAS-FHEVAS or high radiation signal.

10.b The air intake isolation dampers and the normal exhaust ACU isolation dampers close within their design basis closure time upon receipt of an ESFAS-FHEVAS or high radiation signal.

Table 2.7.3.2-3 (5 of 5)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
~~10. In response ESFAS-FHEVAS or high radiation signal, the normal exhaust ACU stops and isolation dampers close to direct flow to the emergency exhaust ACUs.~~ 10.a The fuel handling area emergency exhaust ACU starts upon receipt of an ESFAS-FHEVAS or high radiation signal. 10.b The air intake isolation dampers and the normal exhaust ACU isolation dampers close within their design basis closure time after receiving an ESFAS-FHEVAS or high radiation signal.	~~10. Testing will be performed on the ACUs using a simulated ESFAS-FHEVAS or high radiation signal.~~ 10.a Tests of the as-built fuel handling area emergency exhaust ACUs will be performed using a simulated ESFAS-FHEVAS or high radiation signal. 10.b Tests of the as-built air intake isolation dampers and the normal exhaust ACU isolation dampers will be performed using a simulated ESFAS-FHEVAS or high radiation signal.	10. ~~A report exists and concludes that in response to a simulated ESFAS-FHEVAS or high radiation, the isolation dampers in the air inlet and exhaust ductwork close and the emergency exhaust ACU start.~~ 10.a The as-built fuel handling area emergency exhaust ACU starts upon receipt of a simulated ESFAS -FHEVAS or high radiation signal. 10.b The as-built air intake isolation dampers and the normal exhaust ACU isolation dampers close within 8.4 seconds after receiving a simulated ESFAS-FHEVAS or high radiation signal.
11.a The fire dampers are installed in the fire rated barriers and have the same fire resistance rating as the barrier.	11.a Type tests, tests, a combination of type tests and analyses, or a combination of tests and analyses of fire damper rating will be performed.	11.a A report exists and concludes that the fire dampers that penetrate the fire barriers have the same fire resistance rating as the barrier.
11.b The fire dampers which are required to protect safety shutdown capability close under design air flow condition.	11.b Type tests, tests, a combination of type tests and analyses, or a combination of tests and analyses of fire damper closing will be performed under design air flow condition.	11.b A report exists and concludes that the fire dampers which are required to protect safety shutdown capability close under the design air flow condition.
11.c HVAC ducts that penetrate fire barriers have fire dampers in the HVAC ducts.	11.c An inspection will be performed to verify that fire dampers are installed in the as-built HVAC ducts that penetrate the fire barriers.	11.c Fire dampers are installed in the as-built HVAC ducts that penetrate the fire barriers.
12. The fuel handling area HVAC system has exhaust airflow rate greater than supply airflow rate to control the release of potential airborne radioactive materials from the fuel handling area during plant normal condition.	12. Tests of the as-built fuel handling area HVAC system will be performed.	12. A report exists and concludes that the as-built fuel handling area HVAC system provides design exhaust airflow rate that is greater than design supply airflow rate during plant normal condition.

6.c The two mechanical divisions of the auxiliary building controlled area HVAC system (A/C & B/D) are physically separated.

7.a The emergency diesel generator area HVAC system provides conditioned air that is required to maintain the room temperature within the design limits for the emergency diesel generator area during plant normal, abnormal and accident conditions.

7.b The electrical and I&C equipment areas HVAC system provides conditioned air that is required to maintain the room temperature within the design limits for the electrical and I&C equipment areas except non safety-related equipment rooms during plant normal, abnormal and accident conditions.

7.c The auxiliary building controlled area HVAC system provides conditioned air that is required to maintain the room temperature within the design limits for the auxiliary building controlled area during plant normal, abnormal and accident conditions.

8. The emergency diesel generator area HVAC system, the electrical and I&C equipment areas HVAC system and the auxiliary building controlled area HVAC system cubicle cooler fans identified in Table 2.7.3.5-1 operate automatically according to room temperature signal.

9. The auxiliary building controlled area emergency exhaust ACU removes particulate matter and iodine and provides a negative pressure..

10. ~~In response to ESFAS-SIAS, the auxiliary building controlled area emergency exhaust ACU starts and isolation dampers on the auxiliary building controlled area supply AHU outlet and normal exhaust ACU inlet are closed automatically.~~

11. The electrical and I&C equipment areas HVAC system provides battery room ventilation that is required to maintain hydrogen concentration within the design limit during plant normal, abnormal and accident conditions.

The auxiliary building controlled area emergency exhaust ACUs start and the auxiliary building controlled area supply AHU outlet isolation dampers and the auxiliary building controlled area normal exhaust ACU inlet isolation dampers close upon receipt of an ESFAS-SIAS.

Table 2.7.3.5-3 (7 of 8)

	Design Commitment		Inspections, Tests, Analyses		Acceptance Criteria
10.	~~In response to ESFAS-SIAS, the auxiliary building controlled area emergency exhaust ACU starts and isolation dampers on the auxiliary building controlled area supply AHU outlet and normal exhaust ACU inlet are closed automatically.~~ The auxiliary building controlled area emergency exhaust ACUs start and the auxiliary building controlled area supply AHU outlet isolation dampers and the auxiliary building controlled area normal exhaust ACU inlet isolation dampers close upon receipt of an ESFAS-SIAS.	10.	~~Testing will be performed on the ACUs and the isolation damper using a simulated ESFAS-SIAS.~~ Tests of the as-built auxiliary building controlled area emergency exhaust ACUs, the auxiliary building controlled area supply AHU outlet isolation dampers, and the auxiliary building controlled area normal exhaust ACU inlet isolation dampers will be performed using a simulated ESFAS-SIAS.	10.	~~The ACU starts and the isolation dampers are closed in response to a simulated ESFAS-SIAS.~~ The as-built auxiliary building controlled area emergency exhaust ACUs start and the as-built auxiliary building controlled area supply AHU outlet isolation dampers and the auxiliary building controlled area normal exhaust ACU inlet isolation dampers close upon receipt of a simulated ESFAS-SIAS.
11.	The electrical and I&C equipment areas HVAC system provides battery room ventilation that is required to maintain hydrogen concentration within the design limit during plant normal, abnormal and accident conditions.	11.	Tests and analyses of the as-built electrical and I&C equipment areas HVAC system will be performed.	11.	A report exists and concludes that the as-built electrical and I&C equipment areas HVAC system is capable of providing battery room ventilation in order to maintain hydrogen concentration below 1 % by battery room volume during plant normal operations, abnormal and accident conditions.
12.a	The fire dampers are installed in the fire rated barriers and have the same fire resistance rating as the barrier.	12.a	Type tests, tests, a combination of type tests and analyses, or a combination of tests and analyses of fire damper rating will be performed.	12.a	A report exists and concludes that the fire dampers that penetrate the fire barriers have the same fire resistance rating as the barrier.
12.b	The fire dampers which are required to protect safety shutdown capability close under design air flow condition.	12.b	Type tests, tests, a combination of type tests and analyses, or a combination of tests and analyses of fire damper closing will be performed under design air flow condition.	12.b	A report exists and concludes that the fire dampers which are required to protect safety shutdown capability close under the design air flow condition.
12.c	HVAC ducts that penetrate fire barriers have fire dampers in the HVAC ducts.	12.c	An inspection will be performed to verify that fire dampers are installed in the as-built HVAC ducts that penetrate the fire barriers.	12.c	Fire dampers are installed in the as-built HVAC ducts that penetrate the fire barriers.

Format changed and safety class information added

Range information added

Display & Alarm at MCR/RSR/Local

No/No/No

Table 2.7.6.4-1 (3 of 5)

Description	Tag No (1)	Monitor Type (3)	Location	Class (4)			Range (µCi/cc) (5)				~~Display/ Alarm at MCR/RSR~~
				S	SE	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	
Gaseous Radwaste System Exhaust	PR-RE-080	Gas	Compound Building	N	III	N	N/A	N/A	1.0×10^{-3} to 1.0×10^{2}	N/A	Yes/Yes/Yes
Comp. BLDG HVAC Effluent	PR-RE-082	Sampler (P,I)	Compound Building	N	III	N	Sampler	Sampler	N/A	N/A	~~Yes/Yes/Yes~~
Comp. BLDG Exhaust ACU Inlet	PR-RE-083	P, I, G	Compound Building	N	III	N	1.0×10^{-11} to 1.0×10^{-5}	1.0×10^{-11} to 1.0×10^{-5}	1.0×10^{-6} to 1.0×10^{2}	N/A	Yes/Yes/Yes
Comp. BLDG Hot Machine Shop ACU outlet	PR-RE-084	P, I, G	Compound Building	N	III	N	1.0×10^{-11} to 1.0×10^{-5}	1.0×10^{-11} to 1.0×10^{-5}	1.0×10^{-6} to 1.0×10^{-1}	N/A	Yes/Yes/Yes
Condensate Receiver Tank	PR-RE-103	Liquid	Auxiliary Building	N	III	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
CCW Supply Header (TRN A)	PR-RE-111	Liquid	Auxiliary Building	N	~~A~~	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
CCW Supply Header (TRN B)	PR-RE-112	Liquid	Auxiliary Building	N	II	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
ESW PUMP Discharge Header (TRN A)	PR-RE-113	Liquid	CCW HX Building	N	II	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
ESW PUMP Discharge Header (TRN B)	PR-RE-114	Liquid	CCW HX Building	N	II	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes

II

II

Format changed and safety class information added

Range information added

Display & Alarm
at MCR/RSR/Local

Monitor deleted

Table 2.7.6.4-1 (4 of 5)

Description	Tag No $^{(1)}$	Monitor Type $^{(3)}$	Location	Class $^{(4)}$			Range (µC/cc) $^{(5)}$				~~Display/ Alarm at MCR/RSR~~
				S	SE	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	
Condensate Polishing Area Sump Water	PR-RE-164	Liquid	Turbine Building	N	III	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
Liquid Radwaste System Effluent	PR-RE-183	Liquid	Compound Building	N	III	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
Liquid Radwaste System Effluent	PR-RE-184	Liquid	Compound Building	N	III	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
Steam Generator Blowdown Line	PR-RE-104	Liquid	Auxiliary Building	N	~~A~~	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
CVCS Letdown Line	CV-RE-036	Liquid	Auxiliary Building								Yes/Yes/Yes
CVCS letdown	CV-RE-204	Liquid	Auxiliary Building	N	II	N	N/A	N/A	N/A	1.0×10^{-4} to 1.0×10^{2}	Yes/Yes/Yes
CVCS gas stripper effluent	CV-RE-265	Liquid	Auxiliary Building	N	II	N	N/A	N/A	N/A	1.0×10^{-4} to 1.0×10^{1}	Yes/Yes/Yes
~~Process Sample Panel~~	PR-RE-185	Liquid	Compound Building	N	III	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
~~Process Sample Panel~~	PR-RE-186	Liquid	Compound Building	N	III	N	N/A	N/A	N/A	1.0×10^{-6} to 1.0×10^{-1}	Yes/Yes/Yes
~~FP & Water /Waster Water Treatment BLDG~~	PR-RE-190	Liquid	Waste Water Treatment Building	N	III	N	N/A	N/A	N/A	1.0×10^{-7} to 1.0×10^{-1}	Yes/Yes/Yes

Collective sewage treatment sump

Steam Generator 1 Downcomer

Monitor added

Steam Generator 2 Downcomer

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Format changed and safety class information added

Table 2.7.6.4-1 (5 of 5)

Range information added

Display & Alarm at MCR/RSR/Local

Description	Tag No (1)	Monitor Type (3)	Location	Class (4)			Range (µCi/cc) (5)				~~Display/ Alarm at MCR/RSR~~
				S	SE	E	Particulate Gross β	I-131 γ	Gas Gross β	Area	
Main Steam Line	PR-RE-217	Gas(2)	Auxiliary Building	N	II	N	N/A	N/A	N/A	2.7×10^{-9} to 2.7×10^{-3}	Yes/Yes/Yes
Main Steam Line	PR-RE-218	Gas(2)	Auxiliary Building	N	II	N	N/A	N/A	N/A	2.7×10^{-9} to 2.7×10^{-3}	Yes/Yes/Yes
Main Steam Line	PR-RE-219	Gas(2)	Auxiliary Building	N	II	N	N/A	N/A	N/A	2.7×10^{-9} to 2.7×10^{-3}	Yes/Yes/Yes
Main Steam Line	PR-RE-220	Gas(2)	Auxiliary Building	N	II	N	N/A	N/A	N/A	2.7×10^{-9} to 2.7×10^{-3}	Yes/Yes/Yes

(1) The column “Tag No” is information only (not part of certified design).

(2) N-16 monitoring function is embedded in the Main Steam Line Area Radiation Monitor.

(3) Monitor Type

P : Particulate, I : Iodine, G : Noble gas, Liquid

Notes added

(4) S = Safety Class per ANSI/ANS 51.1 (Reference 32): 1 = SC-1, 2 = SC-2, 3 = SC-3, N = NNS

SE = Seismic Category: I, II, III

E = Electrical Class: A, B, C, D = Class 1E Separation Division, N = Non-Class 1E

~~Q = Quality Class: Q, A, S~~

Delete

(5) Detector type and calibration nuclide for each measurement:

Particulate Gross β = β scintillator with Cs-137

Gas Gross β = β scintillator with Kr-85

Liquid Gross γ = γ scintillator with Cs-137

Iodine γ = γ scintillator with Ba-133

for the entire actuated loop including the final component

5. The safety-related divisional cabinet (SRDC) of the PERMSS provides an automatic ESF initiation signals, as shown on Table 2.7.6.4-2.

6. The seismic category I monitors identified in Table 2.7.6.4-1 can withstand seismic design basis loads without loss of safety function.

7. Separation is provided between Class 1E divisions, and between Class 1E division and non-Class 1E division.

2.7.6.4.2 Inspections, Tests, Analyses, and Acceptance Criteria

Table 2.7.6.4-3 specifies the inspections, tests, analyses, and associated acceptance criteria for the process and effluent radiation monitoring and sampling system.

Table 2.7.6.4-3 (1 of 2)

Process and Effluent Radiation Monitoring and Sampling System ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the PERMSS is as described in the Design Description of Subsection 2.7.6.4.1 and in Table 2.7.6.4-1.	1. Inspection of the as-built PERMSS will be conducted.	1. The as-built PERMSS conforms with the functional arrangement as described in the Design Description of Subsection 2.7.6.4.1 and in Table 2.7.6.4-1.
2. The PERMSS has components that provide radiation monitoring of gaseous and liquid processing systems.	2. Inspections will be performed to verify that the as-built gaseous and liquid processing systems are provided with radiation monitoring.	2. The components of radiation monitoring exist in gaseous and liquid processing systems of the as-built PERMSS.
3. All displays and alarms required by the design exist in the MCR and RSR as defined in Table 2.7.6.4-1.	3. Tests will be performed on the displays and alarms in the MCR and RSR. simulated input signals.	3. All displays and alarms exist and can be retrieved in the as-built MCR and RSR as defined in Table 2.7.6.4-1. simulated
ESFAS 4. Each safety-related radiation monitor channel monitors the radiation level in its assigned area, and indicates its respective MCR alarm and local audible and visual alarm when the radiation level reaches a preset level.	4. Testing of each channel of the safety-related radiation monitors will be conducted using ~~an integral activated check source.~~ entire as-built loop including the	4. MCR and local alarms are initiated when the radiation level ~~of integral activated check source~~ reaches a preset limit. ESFAS through
5. The safety-related divisional cabinet (SRDC) of the PERMSS provides an automatic ~~ESF initiation~~ signals, as shown on Table 2.7.6.4-2. for the entire actuated loop including the final component	5. A testing of the ~~as-built~~ SRDC will be performed using ~~an integral activated check source~~ a simulated signal by observing the final actuated component to verify that the SRDC and the system function as required.	5. Each as-built ~~ESF initiation~~ signals are sent ~~to~~ ESF-CCS group control cabinet upon detection of high radiation of the MCR intake defined in Table 2.7.6.4-2, if plant's radiation monitors exceed predetermined setpoints for control room emergency ventilation actuation signal (CREVAS). to the final actuated component

(mSv/hr)

Display & Alarm at MCR/RSR/Local

Table 2.7.6.5-1

Radiochemistry Lab

Area Radiation Monitoring System Components List

Description	Tag No (1)	Class (2)			Range	Display/ Alarm at MCR/RSR
		S	SE	E		
Post Accident Primary Sample Room	RE-205	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Normal Primary Sample Room	RE-285	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Main Steam & FW Containment Piping Penetration Area	RE-237 RE-238	N	II	N	10^{0}~10^{5}	Yes/Yes/Yes
Fuel Handling ACC & POST-ACC High Range Monitor In Containment	RE-231A RE-232B	3	I	A B A B	10^{-3}~10^{2}	Yes/Yes/Yes
	RE-233A RE-234B				10^{1}~10^{8}	Yes/Yes/Yes
Incore Instrument	RE-235	N	II	N	10^{-3}~10^{2}	Yes/Yes/Yes
Containment Personnel Access Hatch Area	RE-236	3	I	A B	10^{-3}~10^{2}	Yes/Yes/Yes
Spent Fuel Pool Area	RE-241A RE-242B	N	II	N	10^{-3}~10^{2}	Yes/Yes/Yes
New Fuel Storage Area	RE-245	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Hot Machine Shop	RE-293	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Low Level Lab	RE-257	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Instrument Calibration Facility	RE-286	N	II	N	10^{-3}~10^{2}	Yes/Yes/Yes
Main Control Room Area	RE-275	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
TSC Area	RE-279	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Truck Bay	RE-289	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Waste Drum Storage Area	RE-292	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes
Compound Building Dry Active Waste Storage Area	RE-284	N	III	N	10^{-3}~10^{2}	Yes/Yes/Yes

II

II

Retain

~~Deleted~~

N	II	N
3	I	A B

(1) The column “Tag No” is information only (not part of certified design).

(2) S : Safety Class per ANSI/ANS-51.1; 1=SC-1, 2=SC-2, 3=SC-3, N=NNS
SE : Seismic Category; I, II, III
E : Electrical Class ; A, B, C, D=Class 1E Separation Division, N=Non-Class 1E

RE-288
RE-289

Truck Bay Area

Containment Operating Area	RE-231A RE-232B	3	I	A B	10^{-3} ~ 10^{2}	Yes/Yes/Yes
Containment Upper Operating Area	RE-233A RE-234B	3	I	A B	10^{1} ~ 10^{8}	Yes/Yes/Yes

Table 2.7.6.5-3 (1 of 2)

Area Radiation Monitoring System ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the ARMS is as described in the Design Description of Subsection 2.7.6.5.1 and in Table 2.7.6.5-1.	1. Inspection of the as-built ARMS will be conducted.	1. The as-built ARMS conforms with the functional arrangement as described in the Design Description of Subsection 2.7.6.5.1 and in Table 2.7.6.5-1.
2. The ARMS provides operating personnel with an indication and record of radiation levels in the MCR.	2. Inspection of the ARMS components will be performed.	2. It provides operating personnel with an indication and record of radiation levels at selected locations within the various plant buildings to warn of excessive gamma radiation levels in areas where nuclear fuel is stored or handled.
3. The monitors provide local readout and alarm units at the detector locations.	3. Testing of local readout and alarm units at the detectors will be conducted.	3. Local alarms are initiated when the simulated radiation level ~~radiation level of integral activated check source~~ reaches a preset limit. Both audible and visual alarms are included for each local readout/alarm unit.
4. Separation is provided between Class 1E division, and between Class 1E division and non-Class 1E division.	4. Inspection of the as-built Class 1E divisions will be performed.	4. Physical separation or electrical isolation exists in accordance with NRC RG 1.75 between these Class 1E divisions, and also between Class 1E division and non-Class 1E division.

2.7.6.5 Area Radiation Monitoring System

2.7.6.5.1 Design Description

The area radiation monitoring system (ARMS) monitors the radiation levels in selected areas throughout the plant. The area monitors warn operators and station personnel of the visible and audible alarm when unusual radiological events occur.

Components of the ARMS are located in the containment building, the auxiliary building, and the compound building.

1. The functional arrangement of the ARMS is described in the Design Description of Subsection 2.7.6.5.1 and in Table 2.7.6.5-1.

2. The ARMS provides operating personnel with an indication and record of radiation levels in the MCR.

3. The monitors provide local readout and alarm units at the detector locations.

4. Separation is provided between Class 1E channels, and between Class 1E division and non-Class 1E division.

for the entire actuated loop
including the final component

5. The seismic Category I monitors of the ARMS identified in Table 2.7.6.5-1 can withstand seismic design basis loads without loss of safety function.

6. The safety-related divisional cabinet (SRDC) of the ARMS provides an automatic ESF initiation signals, as shown in Table 2.7.6.5-2.

2.7.6.5.2 Inspections, Tests, Analyses, and Acceptance Criteria

The ITAAC for the area radiation monitoring system is described on Table 2.7.6.5-3.

~~7. The containment monitors are located in an unimpeded location.~~

7. The containment monitors are located in an unimpeded location for each intended function as follows:

1. Upper area monitors (RE-233A and 234B) are located just below the containment polar crane for a wide open, unobstructed communication with the entire containment free air volume.
2. Lower area monitors (RE-231A and 232B) are located directly above the refueling pool to detect a fuel handling accident condition.

Table 2.7.6.5-3 (2 of 2)

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
5. The seismic Category I monitors of the ARMS identified in Table 2.7.6.5-1 can withstand seismic design basis loads without loss of safety function.	5.a. Inspections will be performed to verify that the as-built seismic Category I monitor identified in Table 2.7.6.5-1 is located in a seismic Category I structure(s).	5.a. The as-built seismic Category I monitor identified in Table 2.7.6.5-1 is located in a seismic Category I structure(s).
	5.b. Type test, analyses, or a combination of type tests and analyses of seismic Category I monitor identified in Table 2.7.6.5-1 will be performed.	5.b. A report exists and concludes that the seismic Category I monitor identified in Table 2.7.6.5-1 withstands seismic design basis loads without loss of safety function.
	5.c. Inspections and analyses will be performed to verify that the as-built seismic Category I monitor identified in Table 2.7.6.5-1 including anchorages is seismically bounded by the tested or analyzed conditions.	5.c. A report exists and concludes that the seismic Category I monitor identified in Table 2.7.6.5-1 including anchorages is seismically bounded by the tested or analyzed conditions.
6. The safety-related divisional cabinet (SRDC) of the ARMS provides an automatic ~~ESF initiation~~ signals, as shown in Table 2.7.6.5-2.	6. A Testing of the ~~as-built~~ SRDC will be performed using ~~an integral activated check source.~~	6. Each as-built ~~ESF initiation~~ signal is sent ~~to~~ ESF-CCS group control cabinet upon detection of high radiation of containment operating area and fuel handling area defined in Table 2.7.6.5-2, if plant's radiation monitors exceed predetermined setpoints for containment purge isolation actuation signal (CPIAS) and fuel handling area emergency ventilation actuation signal (FHEVAS).

ESFAS

for the entire actuated loop including the final component

entire as-built loop including the

through

ESFAS

a simulated signal by observing the final actuated component to verify that the SRDC and the system function as required.

to the final actuated component

7.Inspections will be performed to verify that containment monitors are located in an unimpeded location for each intended function.

~~7. The containment monitors are located in an unimpeded location.~~

7. The containment monitors are located in an unimpeded location for each intended function as follows:

1. Upper area monitors (RE-233A and 234B) are located just below the containment polar crane for a wide open, unobstructed communication with the entire containment free air volume.

2. Lower area monitors (RE-231A and 232B) are located directly above the refueling pool to detect a fuel handling accident condition.

7. As-built containment monitors are located in an unimpeded location for each intended function described in the design commitment.

Table 1.8-2 (15 of 29)

Item No.	Description
COL 9.3(2)	The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.
COL 9.3(3)	The COL applicant is to prepare the site radiological environmental monitoring program.
COL 9.3(4)	The COL applicant is to provide the supply systems of the nitrogen gas subsystem, the hydrogen subsystem, the carbon dioxide subsystem, and the breathing air systems.
COL 9.4(1)	The COL applicant is to provide the capacities of heating coils in the safety-related air handling units and cooling and heating coils in the non safety-related air handling units affected by site-specific conditions.
COL 9.4(2)	The COL applicant is to provide the capacities of heating coils of electric duct heaters affected by site-specific conditions.
COL 9.4(3)	The COL applicant is to provide the system design information of ESW building and CCW heat exchanger building HVAC system including flow diagram, if the ESW building and CCW heat exchanger building require the HVAC system.
COL 9.4(4)	The COL applicant is to establish operational procedures and maintenance programs as related to leak detection and contamination control.
COL 9.5(1)	The COL applicant is to establish a fire protection program, including organization, training, and qualification of personnel, administrative controls of combustibles and ignition sources, firefighting procedures, and quality assurance.
COL 9.5(2)	The COL applicant is to address the design and fire protection aspects of the facilities, buildings and equipment, and a fire protection water supply system, which are site specific and/or are not a standard feature of the APR1400.
COL 9.5(3)	The COL applicant is to describe the provided apparatus for plant personnel and fire brigades such as portable fire extinguishers, self-contained breathing apparatus, and radio communication systems.
COL 9.5(4)	The COL applicant is to address the final FHA and FSSA based on the final plant design, including a detailed post-fire safe-shutdown circuit analysis.
COL 9.5(5)	The COL applicant is to provide a reliable starting method for the AAC GTG.
COL 9.5(6)	The COL applicant is to provide details of emergency response facilities and associated communication capabilities.

COL 9.4(5)	The COL applicant is to provide the interval of reopening the closed outside air intake isolation dampers by considering the durability of the isolation dampers and the site-specific meteorological data from radiological aspects.

e. The other AHUs (HV01B through HV01D) are kept in standby and the associated isolation dampers (Y0013C and Y0015C, Y0014B and Y0016B, and Y0014D and Y0016D) and discharge airflow control dampers (Y0021C, Y0022B, and Y0022D) are closed.

f. The kitchen and toilet exhaust fan operates continuously, and the associated isolation dampers (Y0027 and Y0028) are open.

g. Two isolation dampers (Y0029 and Y0030) for the smoke removal fan remain closed.

h. The non-safety-related humidifiers are controlled by a humidity controller located in the MCR.

i. Two computer room PACUs operate automatically when the computer room temperature rises above or drops below the setpoints of the temperature switch to maintain the room temperature within the design room temperature range.

When the other AHUs (HV01B through HV01D) operate, the normal mode operation is the same as those for above AHU (HV01A) except the equipment and component numbers are different, as shown on Figure 9.4.1-1.

Replaced with B on the next page

Emergency Mode

Upon receipt of an engineered safety feature actuation signal – safety injection actuation signal (ESFAS-SIAS) or an engineered safety feature actuation signal – control room emergency ventilation actuation signal (ESFAS-CREVAS), all AHU inlet isolation dampers in the outside normal makeup air duct to the AHUs are automatically closed. Additionally, one of the two sets of outside air intake isolation dampers closes to isolate the higher radioactivity air supply from the two available outside air intakes. ~~Then,~~ the kitchen and toilet exhaust fan stops automatically, and two isolation dampers in the exhaust duct to the outside close automatically. The emergency makeup ACU of the operating division starts automatically to filter the outside makeup air and part of the recirculated air. The ACU filters 6,286 cmh (3,700 cfm) of the outside makeup air and 7,305 cmh (4,300 cfm) of the recirculated air. The two isolation dampers in the exhaust duct to the outside of the smoke removal fan remain closed or automatically close to maintain CRE boundary integrity.

B

The closed outside air intake isolation dampers are automatically reset and reopened at an interval after the outside air intake isolation dampers are initially closed upon receipt of an ESFAS-SIAS or an ESFAS-CREVAS. After reopening, one set of outside air intake isolation dampers having higher radioactivity air automatically closes based on the radiation levels and the control room HVAC system automatically repeats reopening the closed outside air intake isolation dampers at the interval. The COL applicant is to provide the interval of reopening the closed outside air intake isolation dampers by considering the durability of the isolation dampers and the site-specific meteorological data from radiological aspects (COL 9.4(5)). And

9.4.9 Combined License Information

COL 9.4(1) The COL applicant is to provide the capacities of heating coils in the safety-related air handling units and cooling and heating coils in the non-safety-related air handling units affected by site-specific conditions.

COL 9.4(2) The COL applicant is to provide the capacities of heating coils of electric duct heaters affected by site-specific conditions.

COL 9.4(3) The COL applicant is to provide the system design information of ESW building and CCW heat exchanger building HVAC system including flow diagram, if the ESW building and CCW heat exchanger building requires the HVAC system.

COL 9.4(4) The COL applicant is to establish operational procedures and maintenance programs as related to leak detection and contamination control.

COL 9.4(5) The COL applicant is to provide the interval of reopening the closed outside air intake isolation dampers by considering the durability of the isolation dampers and the site-specific meteorological data from radiological aspects.

9.4.10 References

1. ASME AG-1-2009, “Code on Nuclear Air and Gas Treatment,” The American Society of Mechanical Engineers, 2009.

2. ASME N509-2002, "Nuclear Power Plant Air-Cleaning Units and Components," The American Society of Mechanical Engineers, 2002.

3. ASME N511-2007, “In-Service Testing of Nuclear Air Treatment, Heating, Ventilation, and Air Conditioning System,” The American Society of Mechanical Engineers, 2007.

4. ASTM D 3803-1991, “Standard Test Method for Nuclear-Grade Activated Carbon,” American Society for Testing and Materials, 1991.

5. ASME Boiler and Pressure Vessel Code, Section III, “Rules for Construction of Nuclear Facility Components,” The American Society of Mechanical Engineers, the 2007 Edition with the 2008 Addenda.

11.5.2 System Description

11.5.2.1 Monitor Design and Configuration

Process, effluent, and airborne radiation monitors typically consist of components such as a microprocessor, one or more detectors, a shielded detection chamber, a sample pump, flow instrumentation, and associated tubing and cabling.

Each process, effluent, and airborne radiation monitor is located in an easily accessible area and has sufficient shielding to provide reasonable assurance that the required sensitivity is achieved at the design background radiation level for the area. This approach is consistent with NRC RG 8.8 (Reference 28) and NRC RG 8.10 (Reference 29). Instrumentation and sensors are provided to detect component failures such as loss of power, loss of sample flow, check source response failure, and loss of detector signal.

Radiation level signals, alarms, and operation status alarms are generated by each monitor microprocessor and are transmitted to IPS, QIAS, and other interfacing systems. Alarm relay contacts are provided for alert-radiation, high-radiation, and operation status alarms.

For some monitors, the high-radiation alarm contacts are used to initiate control functions to terminate batch releases or to divert flow from one location to another. The operation status alarm is initiated by the microprocessor if conditions indicate that the monitor is not operating properly.

Radiation monitoring equipment is designed for service based on expected environmental conditions during normal operation and AOOs. These conditions include temperature, pressure, humidity, chemical spray (where applicable), and radiation exposure. Post-accident radiation monitors conform with NRC RG 1.97 including equipment qualification, redundancy, power source, channel availability, quality assurance, display and recording, range, interfaces, testing, calibration, and human factors engineering recommendations. Further description of conformance with NRC RG 1.97 is contained in Subsections 7.1.2.44 and 7.5.2.1.

The RMS has ~~an integral activated check source~~ a radiation check source similar to the sample isotope to be detected to monitor ~~proper system response automatically.~~ system availability automatically.

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Function and Remarks (4)

Display & Alarm at MCR/RSR/Local

Table 11.5-1 (1 of 3)

1.0×10^{-11} to 1.0×10^{-5}

µCi/cc

Gaseous Process and Effluent Radiation Monitors

Location	Tag No.	Class[1]				Range (~~Bq/cc~~)[2]					~~Function and Remarks~~
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	
High-energy line break area HVAC effluent (offline)	RE-006	N	III	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
High-energy line break area exhaust ACU inlet (offline)	RE-007	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-7} to 3.7×10^{-1}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~
Auxiliary building controlled area (I, II) HVAC normal/emergency exhaust ACU inlet (offline)	RE-013 RE-014 RE-017 RE-018	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-2} to 3.7×10^{7}~~	N/A	N/A	~~Alarm (MCR)~~
Auxiliary building controlled area (I, II) HVAC normal/emergency exhaust ACU effluent (offline)	RE-015 RE-016 RE-019 RE-020	N	II	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis
Containment purge effluent (offline)	RE-037	N	II	A	N	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-7} to 3.7×10^{6}~~	~~3.7×10^{-2} to 3.7×10^{9}~~	N/A	N/A	~~Alarm (MCR),~~ containment building purge stop

No/No/No

Yes/Yes/Yes

1.0×10^{-6} to 1.0×10^{3}

No/No/No

1.0×10^{-11} to 1.0×10^{2}

Yes/Yes/Yes

1.0×10^{-6} to 1.0×10^{5}

Delete from the table

Table 11.5-1 (2 of 3)

Location	Tag No.	Class(1)				Range (~~Bq/cc~~ µCi/cc)(2)					~~Function and Remarks~~ Function and Remarks (4)	Display & Alarm at MCR/RSR/Local
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area		
Containment air (offline)	RE-039A RE-040B	3	I	Q	~~B~~ A B	~~3.7 × 10^{-5} to 3.7 × 10^{1}~~ 1.0 x 10^{-9} to 1.0 x 10^{-3}	~~3.7 × 10^{-5} to 3.7 × 10^{1}~~ 1.0 x 10^{-9} to 1.0 x 10^{-3}	~~3.7 × 10^{-2} to 3.7 × 10^{5}~~ 1.0 x 10^{-6} to 1.0 x 10^{1}	N/A	N/A	~~Alarm (MCR),~~ leak detection	Yes/Yes/Yes
Fuel handling area HVAC effluent (offline)	RE-043	N	II	A	N	~~3.7 × 10^{-7} to 3.7 × 10^{-1}~~ 1.0 x 10^{-11} to 1.0 x 10^{-5}	~~3.7 × 10^{-7} to 3.7 × 10^{-1}~~ 1.0 x 10^{-11} to 1.0 x 10^{-5}	~~3.7 × 10^{-2} to 3.7 × 10^{7}~~ 1.0 x 10^{-6} to 1.0 x 10^{3}	N/A	N/A	~~Alarm (MCR)~~ isolation interlock diversion interlock	Yes/Yes/Yes
Condenser vacuum pump vent effluent (offline)	RE-063	N	III	A	N	Sampler	Sampler	~~3.7 × 10^{-2} to 3.7 × 10^{3}~~ 1.0 x 10^{-6} to 1.0 x 10^{-1}	N/A	N/A	~~Alarm (MCR),~~ Isolation interlock diversion interlock analysis	Yes/Yes/Yes
MCR air intake (inline)	RE-071A RE-072B RE-073A RE-074B	3	I	Q	A B A B	N/A	N/A	~~3.7 × 10^{-2} to 3.7 × 10^{3}~~ 1.0 x 10^{-6} to 1.0 x 10^{-1}	N/A	N/A	~~Alarm (MCR),~~ CREVAS	Yes/Yes/Yes
Gaseous radwaste system exhaust (offline)	RE-080	N	III	A	N	N/A	N/A	~~3.7 × 10^{1} to 3.7 × 10^{6}~~ 1.0 x 10^{-3} to 1.0 x 10^{2}	N/A	N/A	~~Alarm (MCR)~~ isolation interlock	Yes/Yes/Yes
Compound building HVAC effluent (offline)	RE-082	N	III	A	N	Sampler	Sampler	N/A	N/A	N/A	Analysis	No/No/No
Main steam line	RE-217 RE-218 RE-219 RE-220	N	II	~~T~~ ~~A~~	N	N/A	N/A	N/A	N/A	~~10^{-4} ~ 10^{2}~~ (Note 3) 2.7 x 10^{-9} to 2.7 x 10^{-3}	~~Alarm (MCR, Local)~~ Leak detection Primary to secondary	Yes/Yes/Yes

Delete from the table

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Table 11.5-1 (3 of 3)

Location	Tag No.	Class(1)				Range ~~(Bq/cc)~~ µCi/cc (2)					~~Function and Remarks~~ Function and Remarks (4)	Display & Alarm at MCR/RSR/Local
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area		
Compound building exhaust ACU inlet (offline)	RE-083	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~ 1.0 x 10^{-11} to 1.0 x 10^{-5}	~~3.7×10^{-7} to 3.7×10^{-1}~~ 1.0 x 10^{-11} to 1.0 x 10^{-5}	~~3.7×10^{-2} to 3.7×10^{6}~~ 1.0 x 10^{-6} to 1.0 x 10^{2}	N/A	N/A	~~Alarm (MCR),~~ isolation interlock, diversion interlock from normal to emergency ventilation	Yes/Yes/Yes
Compound building hot machine shop	RE-084	N	III	A	N	~~3.7×10^{-7} to 3.7×10^{-1}~~ 1.0 x 10^{-11} to 1.0 x 10^{-5}	~~3.7×10^{-7} to 3.7×10^{-1}~~ 1.0 x 10^{-11} to 1.0 x 10^{-5}	~~3.7×10^{-2} to 3.7×10^{3}~~ 1.0 x 10^{-6} to 1.0 x 10^{-1}	N/A	N/A	~~Alarm (MCR)~~	Yes/Yes/Yes

Delete from the table

(1) S = Safety Class per ANSI/ANS 51.1 (Reference 32): 1 = SC-1, 2 = SC-2, 3 = SC-3, N = NNS
SE = Seismic Category: I, II, III
E = Electrical Class: A, B, C, D=Class 1E Separation Division, N = Non-Class 1E
Delete ~~Q = Quality Class: Q, A, S~~

(2) Detector type and calibration nuclide for each measurement:
Particulate Gross β = β scintillator with Cs-137
Gas Gross β = β scintillator with Kr-85
Liquid Gross γ = γ scintillator with Cs-137
Iodine γ = γ scintillator with Ba-133

(3) Detector type for area radiation monitor is GM tube or ionization chamber.

(4) The detector with the isolation function isolates the effluent discharge function when the discharge reaches a preset setpoint value, thus terminating the discharge. The detector with the diversion interlock function diverts the effluent discharge to a safe hold-up storage or further processing for decontamination when a setpoint is reached. Certain detectors could have both isolation and diversion interlock function depending on the application.

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Table 11.5-2 (1 of 2)

Liquid Process and Effluent Radiation Monitors

Function and Remarks (3)

Display & Alarm at MCR/RSR/Local

1.0 x 10^{-4} to 1.0 x 10^{2}

μCi/cc

1.0 x 10^{-4} to 1.0 x 10^{1}

		Class (1)				Range (~~Bq/cc~~) (2)					
Location	Tag No.	S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	~~Function and Remarks~~
CVCS letdown	CV-RE-204	N	II	A	N	N/A	N/A	N/A	~~3.7×10^{0} to 3.7×10^{6}~~	N/A	~~Alarm (MCR)~~
CVCS gas stripper effluent	CV-RE-265	N	II	A	N	N/A	N/A	N/A	~~3.7×10^{0} to 3.7×10^{5}~~	N/A	~~Alarm (MCR)~~
Condensate receiver tank	RE-103	N	III	S	N	N/A	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	~~Alarm (MCR),~~ diversion interlock
~~Steam generator blowdown and downcomer~~	~~RE-104~~ ~~RE-185~~ ~~RE-186~~	~~N~~	~~II~~ ~~III~~ ~~III~~	A	N	N/A	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	~~Alarm (MCR),~~ leak detection isolation interlock
CCW supply header	RE-111 RE-112	N	II	A	N	N/A	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	~~Alarm (MCR),~~ leak detection isolation of inlet/outlet valve of heat exchanger
Essential service water (ESW) pump discharge headers	RE-113 RE-114	N	II	A	N	N/A	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	~~Alarm (MCR),~~ leak detection

Yes/Yes/Yes

Yes/Yes/Yes

1.0 x 10^{-6} to 1.0 x 10^{-1}

Delete from the table

Steam Generator blowdown	RE-104	N	II
Steam Generator 1 and 2 downcomer	RE-185 RE-186	N	III

Table 11.5-2 (2 of 2)

µCi/cc

1.0 x 10^{-6} to 1.0 x 10^{-1}

Function and Remarks (3)

Display & Alarm at MCR/RSR/Local

Location	Tag No.	Class(1)				Range (~~Bq/cc~~)(2)					~~Function and Remarks~~
		S	SE	Q	E	Particulate Gross β	I-131 γ	Gas Gross β	Liquid Gross γ	Area	
CPP area sump water	RE-164	N	III	S	N	N/A	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	~~Alarm (MCR),~~ pump stop signal
Liquid radwaste system effluent	RE-183 RE-184	N	III	A	N	N/A	N/A	N/A	~~3.7×10^{-2} to 3.7×10^{3}~~	N/A	~~Alarm (MCR),~~ isolation interlock
[Collective sewage treatment sump]	RE-190	N	III	A	N	N/A	N/A	N/A	~~3.7×10^{-3} to 3.7×10^{3}~~	N/A	~~Alarm,~~ pump stop signal

Yes/Yes/Yes

1.0 x 10^{-7} to 1.0 x 10^{-1}

Delete from the table

(1) S = Safety Class per ANSI/ANS 51.1 (Reference 32): 1 = SC-1, 2 = SC-2, 3 = SC-3, N = NNS

SE = Seismic Category: I, II, III

E = Electrical Class: A, B, C, D = Class 1E Separation Division, N = Non-Class 1E

Delete

~~Q = Quality Class: Q, A, S~~

(2) Detector type and calibration nuclide for each measurement:

Particulate Gross β = β scintillator with Cs-137

Gas Gross β = β scintillator with Kr-85

Liquid Gross γ = γ scintillator with Cs-137

Iodine γ = γ scintillator with Ba-133

(3) The detector with the isolation function isolates the effluent discharge function when the discharge reaches a preset setpoint value, thus terminating the discharge. The detector with the diversion interlock function diverts the effluent discharge to a safe hold-up storage or further processing for decontamination when a setpoint is reached. Certain detectors could have both isolation and diversion interlock function depending on the application.

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Function and Remarks

Display & Alarm
at MCR/RSR/Local

Yes/Yes/Yes

Table 12.3-6 (1 of 3)

Area Radiation Monitors

Description	Tag No.	Class[(1)]				Range					Function and Remarks
		S	SE	Q	E	Airborne Particulate	Iodine	Gas	Liquid	Area[(2)] (mSv/hr)	
Post-accident primary sample room	RE-205	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3}~10^{2}	Alarm (MCR, local)
Normal primary sample room	RE-285	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3}~10^{2}	Alarm (MCR, local)
Main steam and FW containment piping penetration area	RE-237 RE-238	N	II	A	N	N/A	N/A	N/A	N/A	10^{0}~10^{5}	Alarm (MCR, local)
Containment operating area	RE-231A RE-232B	3	I	Q	A B	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	• Alarm (MCR, local) CPIAS
Containment upper operating area	RE-233A RE-234B	3	I	Q	A B	N/A	N/A	N/A	N/A	10^{1} ~ 10^{8}	• Alarm (MCR, local) CPIAS
In-core instrument	RE-235	N	II	A	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)

Delete from the table

RAI 116-8054 - Question 14.03.08-4

Function and Remarks

Display & Alarm
at MCR/RSR/Local

Yes/Yes/Yes

Radiochemistry lab

Table 12.3-6 (2 of 3)

Description	Tag No.	Class(1)				Range					Function and Remarks
		S	SE	Q	E	Airborne Particulate	Iodine	Gas	Liquid	Area(2) (mSv/hr)	
Containment personnel access hatch area	RE-236	N	II	A	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Spent fuel pool area	RE-241A RE-242B	3	I	Q	A B	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	• Alarm (MCR, local) • FHEVAS
New fuel storage area	RE-245	N	II	A	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Hot machine shop	C-RE-293	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Low-level lab	RE-257	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Instrument calibration facility	C-RE-286	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	~~Alarm (MCR, local)~~
Main control room area	RE-275	N	II	A	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
TSC area	RE-279	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Truck bay	C-RE-289	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Waste drum storage area	C-RE-292	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)
Compound building dry active waste storage area	C-RE-284	N	III	S	N	N/A	N/A	N/A	N/A	10^{-3} ~ 10^{2}	Alarm (MCR, local)

Retain

~~Deleted~~

Truck bay area

C-RE-288
C-RE-289

Delete from the table

Deleted

Table 12.3-6 (3 of 3)

Description	Tag No.	Class(1)				Range					Function and Remarks
		S	SE	Q	E	Airborne Particulate	Iodine	Gas	Liquid	Area(2) (mSv/hr)	
[Low radioactive waste storage area]	RE-321	N	III	S	N	N/A	N/A	N/A	N/A	$10^{-3} \sim 10^{5}$	Alarm (MCR, local)
[Medium radioactive waste storage area]	RE-322	N	III	S	N	N/A	N/A	N/A	N/A	$10^{-3} \sim 10^{2}$	Alarm (MCR, local)
[Medium radioactive waste storage area]	RE-323	N	III	S	N	N/A	N/A	N/A	N/A	$10^{-3} \sim 10^{3}$	Alarm (MCR, local)
[Truck bay area]	RE-324	N	III	S	N	N/A	N/A	N/A	N/A	$10^{-3} \sim 10^{5}$	Alarm (MCR, local)
[Crane control room]	RE-325	N	III	S	N	N/A	N/A	N/A	N/A	$10^{-3} \sim 10^{5}$	Alarm (MCR, local)

(1) S: safety Class per ANSI/ANS-51.1; 1=SC-1, 2=SC-2, 3=SC-3, N=NNS
SE: seismic Category I, II, III
E: Electrical Class A, B, C, D=Class 1E Separation Division, N=Non-Class 1E
~~Q: Quality Class Q, A, S~~
Refer to Section 3.2 for the definition.

Delete

(2) Detector type for area radiation monitor is GM tube or ionization chamber

Security-Related Information – Withhold Under 10 CFR 2.390

Figure 11.5-2T Location of Radiation Monitors at Plant (Compound Building El. 100′-0″)