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## 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.: 225-8254  
SRP Section: 12.03 – 12.04 Radiation Protection Design Features  
Application Section: 12.3 – 12.4  
Date of RAI Issue: 09/24/2015

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### **Question No. 12.03-20**

SRP 12.3-12.4 indicates that, the applicant's area radiation monitoring system is designed to (1) monitor the radiation levels in areas where radiation levels could become significant and where personnel may be present, (2) alarm when the radiation levels exceed preset levels to warn of increased radiation levels, and (3) provide a continuous record of radiation levels at key locations throughout the plant.

In addition, ANSI/ANS-HPSSC-6.8.1-1981, which the applicant references and which is referenced in the SRP provides examples of locations for radiation monitors in a PWR plant in Table 2. Table 2 also provides examples of appropriate ranges for monitors.

1. The following area radiation monitors identified in ANSI-18.1 do not appear in the APR1400 design;
  - a. Radwaste and drumming station control panel areas.
  - b. Shutdown cooling system pump and heat exchanger areas
  - c. Auxiliary Building and Compound Building HVAC filter areas
  - d. Equipment decontamination areas
  - e. Safe shutdown panel areas

Please provide area monitors at these locations or justify why they are not necessary.

2. Please indicate why the low radioactive waste storage area radiation monitor (RE-321) has a range that can detect higher radiation levels than the medium radioactive waste storage area monitors (RE-322 and RE-323).

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## **Response**

### 1.a Radwaste and drumming station control panel areas

There are four radwaste drumming areas as follows:

- Spent filter drumming area at 78'-0" elevation near the filter and demineralizer area in the south-east corner of the Auxiliary Building (AB);
- R/O concentrate drumming area at 63'-0" elevation inside the Compound Building (CPB);
- DAW drumming area at 85'-0" elevation in the north-east area of CPB; and
- Spent resin dewatering area at 100'-0" at the truck bay area inside CPB.

The drumming and capping operations for spent filters, R/O concentrates, DAW, and spent resin are performed by mobile subsystems in designated areas. The operations of these systems are to be controlled remotely from the Radwaste Control Room (RWCR) or by the COL applicant as stipulated in COL 11.4(3). The COL applicant is to prepare a plan to develop and use operating procedures, including the use of portable radiation monitoring instruments for the drumming and capping operations. Hence area radiation monitors in these areas are not provided.

The COL item 11.4(3) will be revised to include the use of portable radiation monitors for drumming and capping operations in these areas.

### 1.b Shutdown cooling system pump and heat exchanger areas

There are two trains of shutdown cooling system (SC) heat exchangers and pumps. They are located at the plant north-east and south-east corners of the basemat floor (Elevation 55'-0") inside the AB. Since the cubicles for these exchangers and pumps are designated higher than Radiation Zone 6, they are equipped with locked doors and entrances to these cubicles are administratively controlled. When entrance is required, operating procedures are to be followed, including conducting radiation survey and component decontamination. Since entrance is not expected to be routine or frequent, area radiation monitors are not provided for these cubicles as indicated in DCD Subsection 12.3.4.1.3.

### 1.c Auxiliary Building (AB) and Compound Building (CPB) HVAC filter areas

The AB and CPB HVAC air cleaning units (ACUs) are equipped with inlet gaseous process radiation monitors to measure the radioactivity processed in the corresponding filters (both medium and HEPA filters, and charcoal adsorbers). The operation of the ACUs is discussed in DCD Section 9.4 for the corresponding HVAC systems, and the gaseous process radiation monitors are summarized in DCD Section 11.5 Table 11.5-1. Since the concentrations of the radioactive effluents downstream of the ACU are continuously monitored and a sudden increase of the radioactive concentrations is indicated by these monitors, area radiation monitors are not provided.

#### 1.d Equipment decontamination areas

Equipment decontamination is performed in the hot machine shop located at 100'-0" elevation inside CPB. An area radiation monitor (RE-293) is provided. Please refer to DCD Table 12.3-6.

#### 1.e Safe shutdown panel areas

The safe shutdown panels are located in the main control room and the technical support center, in which area radiation monitors are provided. An area monitor is provided for the main control room (RE-275) and another for technical support center (PR-RE-279) to measure gross gamma dose rates.

2. The area radiation monitors (RE-321, RE-322, RE-323, RE-324, and RE-325) are designated to be used in a site-specific Interim Radwaste Storage Facility that is determined by the COL Applicant, in accordance with the response provided in RAI 116-8054, Question No. 14.03.08-4. These area radiation monitors are deleted from Table 12.3-6.

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#### **Impact on DCD**

DCD Tier 2 Table 1.8-2, Subsections 11.4.1.7 and 11.4.9 will be revised as indicated in Attachment.

#### **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 Environment Report.

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Table 1.8-2 (19 of 29)

Item No.	Description
COL 11.4(1)	The COL applicant can incorporate an onsite laundry facility for processing of contaminated clothing.
COL 11.4(2)	The COL applicant is to perform a site-specific cost-benefit analysis following the guidance in NRC RG 1.110.
COL 11.4(3)	The COL applicant is to provide reasonable assurance that the provisions and requirements of ANSI/ANS-40.37-2009 are met. The COL applicant is to provide reasonable assurance that mobile and temporary solid radwaste processing and its interconnection to plant systems conform with regulatory requirements and guidance such as 10 CFR 50.34a, 10 CFR 20.1406, and NRC RG 1.143. The COL applicant is to prepare a plan to develop and use operating procedures, so the guidance and information in IE Bulletin 80-10 are followed.
COL 11.4(4)	The COL applicant is to provide P&IDs.
COL 11.4(5)	The COL applicant is to prepare the site process control program and the site radiological environmental monitoring program.
COL 11.4(6)	The COL applicant is responsible for the collection, temporary storage, and shipment of mixed waste for offsite treatment and disposal.
COL 11.4(7)	The COL applicant is responsible for the provision of a site-wide IRSF for interim storage of radioactive wastes.
COL 11.4(8)	The COL applicant is to provide a mobile crane to retrieve a waste package that becomes stuck in the lifted condition or that is dropped.
COL 11.4(9)	The COL applicant is also to provide operational procedures to properly ship low-level wastes to external sites in accordance with US NRC and US Department of Transportation (DOT) regulations.
COL 11.4(10)	The COL applicant is to prepare the operational procedures and maintenance programs for the SWMS as related to leak detection and contamination control.
COL 11.4(11)	The COL applicant is to develop plant-wide RG 4.21 life-cycle planning for minimization of contamination program following the guidance in NEI 08-08A, in which the SWMS procedures and programs are to be integrated.
COL 11.4(12)	The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations.
COL 11.5(1)	The COL applicant is to determine the WARN and ALARM setpoints of the PERMSS based on the site-specific conditions and operational requirements.
COL 11.5(2)	The COL applicant is to develop an annual report that specifies the quantity of each principal radionuclide released to unrestricted areas in liquid and gaseous effluents.
COL 11.5(3)	The COL applicant is to provide site-specific procedures that conform with the numerical guides of 10 CFR 50.34a and 10 CFR Part 50, Appendix I.

, and IE Bulletin 80-10

operations

and portable radiation monitoring instruments, so that regulator requirements and guidance

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, and IE Bulletin 80-10 (Reference 1)

The COL applicant is to provide reasonable assurance that mobile and temporary solid radwaste processing equipment and its interconnections to plant systems conform with regulatory requirements and guidance such as 10 CFR 50.34a (Reference 21), 10 CFR 20.1406 (Reference 26), ~~and~~ NRC RG 1.143 (Reference 15) (COL 11.4(3)). The COL applicant is to prepare a plan to develop and use operating procedures ~~so the guidance and information in IE Bulletin 80-10 (Reference 1) are followed~~ (COL 11.4(3)).

#### 11.4.2 System Description

and portable radiation monitoring instruments, so that regulator requirements and guidance

The primary functions of the SWMS are to process, package, and store the dry and wet solid wastes generated from the plant in accordance with regulatory guidelines, to handle and store dry and low-activity wastes prior to shipment to the offsite disposal facility, and to provide reasonable assurance that plant personnel and public radiation exposure is ALARA.

The SWMS handles wet and dry solid wastes, prepares for the waste transportation and offsite disposal as described in Subsection 11.4.1.4, and is divided into the following subsystems:

- a. Spent resin transfer and packaging subsystem
- b. Spent filter handling subsystem
- c. Dry active waste subsystem
- d. R/O concentrate treatment subsystem
- e. Temporary waste storage subsystem

The expected and maximum annual waste volumes are shown in Table 11.4-1. The expected and design basis (1 percent fuel defect) activity levels of solid waste in the SWMS are presented in Tables 11.4-2 and 11.4-3.

The SWMS boundary starts at the receipt of waste from various waste generation components and ends where the packaged and dewatered waste is loaded onto a truck for

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Instruments, including backflushing provisions, are located in low-radiation areas when possible for accessibility and fulfillment of the ALARA provisions. A list of alarm instruments and location of readouts is presented in Table 11.4-6.

#### 11.4.9 Combined License Information

COL 11.4(1) The COL applicant can incorporate an onsite laundry facility for processing of contaminated clothing.

COL 11.4(2) The COL applicant is to perform a site-specific cost-benefit analysis following the guidance in NRC RG 1.110.

COL 11.4(3) The COL applicant is to provide reasonable assurance that the provisions and requirements of ANSI/ANS-40.37-2009 are met. The COL applicant is to provide reasonable assurance that mobile and temporary solid radwaste processing and its interconnection to plant systems conform with regulatory requirements and guidance such as 10 CFR 50.34a, 10 CFR 20.1406, and NRC RG 1.143. The COL applicant is to prepare a plan to develop and use operating procedures so the guidance and information in ~~IE Bulletin 80-10~~ are followed. ~~and portable radiation monitoring instruments, so that regulator requirements and guidance~~

operations, and IE Bulletin 80-10

COL 11.4(4) The COL applicant is to provide P&IDs.

COL 11.4(5) The COL applicant is to prepare the site process control program and the site radiological environmental monitoring program.

COL 11.4(6) The COL applicant is responsible for the collection, temporary storage, and shipment of mixed waste for offsite treatment and disposal.

COL 11.4(7) The COL applicant is responsible for the provision of a site-wide IRSF for interim storage of radioactive wastes.

COL 11.4(8) The COL applicant is to provide a mobile crane to retrieve a waste package that becomes stuck in the lifted condition or that is dropped.

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## 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.: 225-8254  
SRP Section: 12.03-12.04 - Radiation Protection Design Features  
Application Section:  
Date of RAI Issue: 09/24/2015

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### **Question No. 12.03-21**

#### REGULATIONS AND GUIDANCE

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.

SRP Section 12.3-12.4, indicates that the plant structures, as well as the general plant yard should be subdivided into radiation zones, with maximum design dose rate zones and the criteria used in selecting maximum dose rates identified.

SRP Section 12.2 indicates that shielding and ventilation design fission product source terms will be acceptable if developed based on 0.25-percent fuel cladding defects for PWRs.

RG 8.8 indicates that the basis for design should be based on 0.25-percent fuel cladding defects for PWRs.

#### INFORMATION NEEDED

FSAR Section 12.2.1.6 indicates that plant areas storing radioactive wastes are shielded based on maximum stored waste volumes and average expected source strengths so that the radiation level outside the storage area is below the limit of the designated radiation zone.

Since the above guidance indicates that shielding and zoning should be based on an assumed 0.25-percent fuel failure. Please provide justification and update the FSAR to justify why it is acceptable to base shielding and zoning for radwaste storage areas on the expected average source strength, instead of design basis (0.25-percent fuel failure) source strengths or modify the FSAR as appropriate to base shielding and zoning for these areas on the design basis source strengths.

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## **Response**

KHNP performed a review of the source terms used for the determination of the radiation zones and the minimum shield wall thicknesses for the two waste storage areas: the spent filter drum storage and HIC storage area (the high activity storage area), and the waste drum storage area (the low activity storage area) in the compound building; and have confirmed that the design for the spent filter drum storage and HIC storage area (high activity storage area) is based on the assumed 0.25% fuel failure for spent filters, and spent resin. The source terms for the waste drum storage area (the low activity storage area) is based on R/O concentrate from liquid waste derived from 0.25% fuel failure. For DAW (dry activity waste), the maximum value measured in the Korean domestic nuclear power plants were used, due to the diversity of contamination levels in the DAW category of waste. DCD Subsection 12.2.1.6 is revised to correctly reflect the design basis for these two waste storage areas.

The shielding analysis for these two waste storage areas is performed using the maximum stored waste volumes. The shielding analysis for the spent filter drum storage and HIC storage area (the high activity storage area) is based on 1 year of accumulation of waste volumes (drums and HICs); and for the waste drum storage area (the low activity storage area) the analysis is based on 6 months of low activity waste accumulation, comprising of LRS R/O sludge, spent resin, and other dry active waste for a total of 161 drums. The shielding analysis results minimum shield wall thicknesses sufficient for Zone 8 and 7 criteria; and that the shield wall thicknesses for the waste drum storage area (the low activity storage area) are only slightly thinner than those for the high activity waste while satisfying Radiation Zone 7 criterion.

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### **Impact on DCD**

DCD section 12.2.1.6 will be revised as indicated in the Attachment.

### **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.

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Spent fuel is stored in the SFP until it is placed in the spent fuel shipping cask for transport to an onsite interim storage facility or to an offsite storage facility.

~~Storage space is allocated in the compound building for the storage of spent filter cartridges, dewatered spent resins, and R/O concentrates from the LWMS. Plant areas storing radioactive wastes are shielded based on maximum stored waste volumes and average expected source strengths so that the radiation level outside the storage area is below the limit of the designated radiation zone.~~

The COL applicant is to provide any additional contained radiation sources, such as instrument calibration radiation sources, that are not identified in Subsection 12.2.1 (COL 12.2(1)).

#### 12.2.1.7 Pipe Routing

Piping carrying radioactive materials is routed in pipe chases to the extent practicable when routed through low-radiation and low-contamination areas to maintain radiation exposure to plant personnel ALARA and reduce the spread of contamination.

Criteria for routing radioactive piping include:

- a. Piping containing radioactive material is routed through shielded pipe chases to the extent practicable.
- b. Systems containing radioactive liquids, gases, or slurries are physically located close to interfacing systems to reduce pipe length and minimize the need for routing radioactive piping through personnel access corridors.
- c. Stagnant runs of piping are avoided to minimize the potential for crud traps. Flushing and decontamination capabilities are provided as necessary.

Storage space is allocated in the compound building for the storage of spent filter cartridges and dewatered spent resin in the spent filter drum and HIC storage area; and solidified R/O concentrates and dry active waste (DAW) in drums in the waste drum storage area. The shielding design for the spent filter drum and HIC storage area is based on using maximum stored waste volumes, and the design basis source term (0.25% fuel failure) for the generation of wastes. The shielding design for the waste drum area is based on the use of the design basis source term for the solidified R/O concentrate, and the maximum source terms for the DAW is based on the operating experience at Korean domestic nuclear power plants so that the radiation level outside the storage area is below the limit of the designated radiation zone.