
REVISED 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

Question No. 12.03-13

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 20.1101(b) requires that the licensee use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).

Regulatory Guide 8.8 indicates that appropriate station layout and design features should be provided to reduce the potential doses to personnel who must operate, service, or inspect station instrumentation and controls.

The gaseous radwaste management system contains four delay beds in two cubicles. The areas are listed as potential very high radiation areas using the design basis failed fuel source term. The design also includes two guard beds to reduce moisture to the delay beds which are also listed as significant radiation areas. In addition, FSAR Chapter 11 discusses the possibility of replacing the delay beds if necessary. However, the FSAR does not provide any information on accessing requirements for the delay bed or guard bed area.

1. Please update the FSAR to specify the need and frequency for access the delay bed and guard bed areas, such as to check temperature or humidity levels or to perform other activities or inspections. In the FSAR discussion indicate how the design features limit worker exposure, consistent with RG 8.8 and 10 CFR 20.1101(b).
2. Also update the FSAR to discuss the process for replacing the beds, if they need to be replaced. In the FSAR discussion indicate how the design is commensurate with limiting worker exposure consistent with RG 8.8 and 10 CFR 20.1101(b).

Response – (Rev. 2)

1. The temperature and humidity instrumentation are installed at wall mounted piping racks that include valves. This instrumentation is located in relatively low radiation areas outside charcoal guard bed and charcoal delay bed rooms, and remotely monitored in the radwaste control room located at Compound Building El. 120' in order to minimize the radiological exposure to the plant operator as described in the DCD Tier 2, subsection 12.3.1.1.a, General Arrangement Design Feature.

There are also temperature instrumentations at each guard bed and inlet of each delay bed to monitor the abnormal condition such as exothermic reaction caused by excessive inflow of moisture or fire in the bed. Plant operator can also remotely monitor the temperature in the radwaste control room located at Compound Building El. 120'.

Therefore, except for the temperature instrumentations at each guard bed and inlet of each delay bed, the components such as valves and instrumentations are not installed in the guard bed and delay bed rooms. Plant operator may need to access the bed rooms only if the repair work or inspection of the temperature instrumentation at the bed is required. In order to minimize the radiological exposure to the plant operator, the radioactive gases in the bed are purged with nitrogen gas and are isolated before such works. If the work for a charcoal delay bed is required, two charcoal delay beds located at the same room are purged and isolated to allow plant operator access the room at lower dose rates. During this work, other charcoal delay beds located at the other room will be in operation. DCD Figure 11.3-1 shows the functional arrangement for the purge operation and isolation of the beds.

According to COL 12.1(2), the COL applicants is to describe the operational radiation protection program to provide reasonable assurance that occupational radiation exposures are ALARA, if necessary.

DCD Tier 2, Section 11.3.2 will be updated to add the above description.

2. Although it is not expected to replace the charcoal in the charcoal delay bed during the life of the plant, the gaseous radwaste system includes provisions for charcoal replacement in the event of an unexpected condition such as the wetting of the delay bed. If wetting occurs, the leading delay bed is isolated and bypassed and the charcoal delay beds are rearranged in series for continued operation and to allow for the regeneration or replacement of charcoal in the isolated delay bed. As described in DCD Tier 2 Section 11.3.2, the charcoal in the beds is regenerated by drying the beds with nitrogen gas. The charcoal is regenerated in case of the wetting of the delay bed in order to minimize the potential for charcoal replacement. When the replacement of charcoal would be required, the spent charcoal is then quickly removed through the charcoal removal port at the bottom of the bed using temporary vacuum charcoal removal system at the top of the bed and the fresh charcoal is uniformly loaded into the beds. The radioactive gases in the bed are purged with nitrogen gas before the replacement in order to minimize the radiological exposure to plant workers. According to COL 12.1(2), the COL applicant is to describe the operational radiation protection

program to provide reasonable assurance that occupational radiation exposures are ALARA, if necessary.

DCD Tier 2, Section 11.3.2 will be updated to add the above description.

Impact on DCD

DCD Tier 2, Section 11.3.2 will be revised as indicated in the attached markup.

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.

APR1400 DCD TIER 2

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The GRS uses charcoal at ambient temperature to delay the passage of radioactive gases. When operating at design conditions, the mass of charcoal in the absorber beds is sufficient to provide a delay of 45 days for xenon and a delay of 3.5 days for krypton. The waste gas dryer controls the inlet gas moisture and temperature to achieve the desired performance of the charcoal delay beds.

The condensed liquid in the gas surge header in the auxiliary building and in the GRS inlet piping in the compound building is collected in the GRS header drain tank. The tank is also used to collect condensate from the waste gas dryer.

Downstream of the gas surge header, two 100 percent capacity trains, each comprising one waste gas dryer and one charcoal guard bed, are used to reduce the gas moisture to protect the charcoal in the main delay beds as the performance of the charcoal delay beds can be degraded by moisture.

The waste gas dryer cools the waste gases to below 7.8 °C (46 °F) and removes the condensate before the gas enters the guard beds. The GRS chiller provides the cooling water when the plant chilled water system is unavailable. Humidity sensors downstream of the waste gas dryer and charcoal guard beds are provided to monitor the moisture content and alarm for operator actions if the moisture content is at an unacceptable level.

Two charcoal guard beds are provided upstream of the charcoal delay beds. Only one is normally operating; the other one is in the standby mode or regeneration mode. The guard bed further protects the main charcoal delay bed from moisture. ~~Humidity sensors are installed upstream and downstream of the charcoal guard bed to monitor the charcoal wetting condition. Temperature sensors are installed at the guard beds and delay beds.~~ Iodine is held up for decay in the charcoal guard beds.

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The four delay beds are normally operating in series. Although it is not expected to replace the charcoal in the charcoal delay bed, the gaseous radwaste system includes provisions for charcoal replacement in the event of an unexpected condition such as the wetting of the delay bed. If wetting occurs, the leading delay bed is isolated and bypassed and the charcoal delay beds are rearranged in series for continued operation and to allow for the regeneration or replacement of charcoal in the isolated delay bed. When the replacement of charcoal would be required, the spent charcoal is then quickly removed through the charcoal removal port at the bottom of the bed using the temporary vacuum charcoal removal system at the top of the bed and the fresh charcoal is uniformly loaded

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The temperature and humidity instrumentation are installed at wall mounted piping racks that include valves. This instrumentation is located in relatively low radiation areas outside charcoal guard bed and charcoal delay bed rooms, and remotely monitored in the radwaste control room. There are also temperature instrumentations at each guard bed and inlet of each delay bed to monitor the abnormal condition such as exothermic reaction caused by excessive inflow of moisture or fire in the bed. Plant operator can remotely monitor the temperature in the radwaste control room and may need to access the bed rooms if the repair work or inspection of the temperature instrumentation at the bed is required. ~~In order to minimize the radiological exposure to the plant worker, the radioactive gases in the bed are purged with nitrogen gas before such works.~~

In order to minimize the radiological exposure to the plant operator, the radioactive gases in the bed are purged with nitrogen gas and are isolated before such works. If the work for the charcoal delay bed is required, all charcoal delay beds located at the same room are purged and isolated to allow plant operator access the room at lower dose rates. During this work, other charcoal delay beds located at the other room will be in operation. DCD Figure 11.3-1 shows the functional arrangement for the purge operation and isolation of the beds.