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.:	**277-8227**
SRP Section:	**14.02 – Initial Plant Test Program – Design Certification and New License Applicants**
Application Section:	**14.2**
Date of RAI Issue:	**10/30/2015**

Question No. 14.02-38

The staff determined that the additional information is needed about the preoperational testing plan for the Steam Generator Blowdown System (FSAR Tier 2, Subsection 14.2.12.1.66) for the staff to complete its review in accordance with 10 CFR 52.79(a)(28) and 52.79(d). The additional information is based on following the guidance in RG 1.68. Appendix A-1 of RG 1.68 identifies system and component operability tests, including the components for the secondary coolant and radioactive waste handling systems (A-1.m.).

a. Provide a more detailed description of the objective. Section 1.1 of the test plan states that the objective is, “To verify the proper operation of the steam generator blowdown system (SGBDS).” This system has several functions, including containment isolation, water purification, interface with the sampling system, determination of the appropriate flow path (condenser or liquid radioactive waste), etc. The test objective should identify the functions that need to be tested to verify proper operation of the system.

b. The staff notes that the Steam Generator Blowdown System is abbreviated “SGBDS” in this test plan, but “SGBS” in FSAR Tier 2 Section 10.4.8, "Steam Generator Blowdown System." Please justify this difference or change the FSAR for consistency.

c. Add a “Test Method” requirement to verify that the blowdown water can be sampled in accordance with the system design. If that requirement is included in another preoperational test plan, provide that information in the response.

d. Section 3.6 of the test plan is intended to verify the ability to regenerate resin, but this is not listed as a function of the SGBS in Subsection 10.4.8 of the FSAR. Conversely, the SGBS does have a secondary water chemistry function that is not addressed in the SGBS test plan. Explain how the test plan addresses the SGBS secondary water chemistry function and in which section(s) of the test plan. In addition, describe the basis for including the resin regeneration requirement.

e. Revise Section 5.0 of the test plan, “Acceptance Criteria,” to provide a complete description of the criteria needed to demonstrate that the system will operate in accordance with the design. The criterion that the system “operates as described in Subsection 10.4.8” is not sufficient because not all of the information in Section 4.0, “Data Required,” can be found in FSAR Subsection 10.4.8. For example, FSAR Section 10.4.8 does not provide information such as valve opening and closing times, or how to assess operation of the demineralizers.

Response

KHNP has reviewed the subject question and understands the staff’s request. KHNP is in the process of upgrading the test plans presented in Section 14.2 of the DCD. This effort is focused on adding additional SSCs that are important to safety and risk significant as well as increasing the level of detail described in the DCD for test prerequisites, test methods and acceptance criteria for the various tests. It has been determined that the actions to be taken as a result of this question is within the scope of the upgrade effort. Therefore, KHNP will address the noted items in the upgrade effort, which is scheduled to be completed by February 1, 2016. A revised response to this question that incorporates the results of the upgrade effort will be submitted to the NRC after completion.

Response – (Rev. 1)

a. The revised DCD Tier 2, Section 14.2 submitted by KHNP in letter MKD/NW-16-0156L, dated February 24, 2016, ML16056A003, provides more detailed objectives to identify the functions that need to be tested for the steam generator blowdown system (SGBS). Demonstration of the flow paths and the flow rates will be added to the objectives and acceptance criteria in DCD Tier 2, Subsection 14.2.12.1.66, (see Attachment 1).

b. The correct abbreviation for the steam generator blowdown system is “SGBS.” The pertinent subsections in DCD Tier 1 and 2 have been reviewed and changes to the correct abbreviation will be made accordingly, (see Attachments 1 and 2).

c. The verification that the blowdown water can be sampled in accordance with the system design is contained in the test plan for Process and Primary Sampling Test detailed in DCD Tier 2, Subsection 14.2.12.1.83.

d. The test plan that addresses the SGBS secondary water chemistry function is discussed in DCD Tier 2, Subsection 14.2.12.1.83. The resin regeneration requirement specified in the Section 3.6 will be removed since the resin regeneration is not a function of the system and, therefore, is not part of pre-operational test scope (see Attachment 1).

e. The revised DCD Tier 2, Section 14.2.12.1.66 submitted by KHNP letter MKD/NW-16-0156L, dated February 24, 2016 provides more detailed acceptance criteria to demonstrate that the SGBS will operate in accordance with the specific design attributes.

Impact on DCD

DCD Tier 2, Subsection 14.2.12.1.66 will be revised as shown in Attachment 1. DCD Tier 2, Chapter 01 (Acronym and Abbreviation List and Subsection 1.2.13.3), Chapter 03 (Acronym and Abbreviation List and Subsection 3.2.2), Chapter 09 (Acronym and Abbreviation), Chapter 10 (Acronym and Abbreviation List, Subsection 10.1, and Table 10.1-1), Chapter 11 (Acronym and Abbreviation List, Subsection 11.4.1.1, 11.4.1.5, 11.4.2, and 11.4.2.2.1), and Chapter 12 (Acronym and Abbreviation List, Subsection 12.2.1.1.5.2) will be revised as shown in Attachment 2.

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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RSR	remote shutdown room
RTD	resistance temperature detector
RTP	rated thermal power
RTSS	reactor trip switchgear system
RV	reactor vessel
SAM	shape annealing matrix
SAT	Standby auxiliary transformer
SBCS	steam bypass control system
SBO	station blackout
SC	shutdown cooling
SCP	shutdown cooling pump
SCS	shutdown cooling system
SDCHX	shutdown cooling heat exchanger
SFPCCS	spent fuel pool cooling and cleanup system
SG	steam generator
~~SGBDS~~ SGBS	steam generator blowdown system
SI	safety injection
SIAS	safety injection actuation signal
SIS	safety injection system
SIT	1) safety injection tank 2) structural integrity test
SKN	Shin-Kori nuclear power plant
SOE	sequence of event
SRO	senior reactor operator
SRP	Standard Review Plan
SSC	structures, systems, and components
SSE	safe shutdown earthquake
SWGR	switchgear
SWMS	solid waste management system
TBV	turbine bypass valve
TCS	turbine control system

5.4 Drain valves in the main steam supply line to a feedwater pump turbine shall be opened and closed upon a level signal from their respective level switches.

14.2.12.1.66 Steam Generator Blowdown System Test

1.0 OBJECTIVEOBJECTIVES

1.1 To verifydemonstrate the proper operation of the steam generator blowdownSGBDS SGBS remote operated valves

1.2 To demonstrate the operation of the SGBDS SGBS pressure, level, and temperature control valves

1.3 To demonstrate the operation of the SGBDS SGBS pressure, level, radiation level and temperature valve interlocks

1.4 To demonstrate system (SGBDS)alarms and status lights

1.5 To demonstrate system responses to ESFAS and DPS signals

1.6 To demonstrate the failed position of system

1.7 To demonstrate that the SGBS accepts water from each SG blowdown line, processes the blowdown as required, and delivers the processed water to the condensate system.

2.0 PREREQUISITES

2.1 Construction activities on the SGBDS SGBS have been completed.

2.2 SGBDS SGBS instrumentation has been calibrated.

2.3 Support systems required for operation of the SGBDS SGBS are complete and operational.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify the availability of flow paths for generator blowdown and subsequent condensate recycle (HFT).

3.2 Verify blowdown flow path flow rates during HFT.

3.3 Operate control valves from all appropriate control positions. Observe valve operation and position indication and, where required, measure opening and closing times.

3.4 Verify power-operated valves fail to the position specified in Subsection 10.4.8 upon loss of motive power.

3.5 Verify the proper operation of pump, motors, and heat exchanger in all operation modes and flow paths.

~~3.6 Verify the ability to regenerate resin.~~

3.6 ~~3.7~~ Verify the proper operation of all protective devices, controls, interlocks, and alarms, using actual or simulated inputs.

3.7 ~~3.8~~ Verify the proper system response to ~~containment isolation actuation signal (~~CIAS~~), main steam isolation signal (~~, MSIS~~)~~, and ~~auxiliary feedwater actuation signal (~~AFAS~~)~~.

3.8 ~~3.9~~ Verify steam generator wet layup system operation.

4.0 DATA REQUIRED

4.1 Valve opening and closing times, where required

4.2 Valve position indication

4.3 Position response of valves to loss of motive power

4.4 Setpoints at which alarms and interlocks occur

4.5 Wet layup pump running data

4.6 Response to MSIS, CIAS, and AFAS

4.7 SG blowdown flow path flow rates

5.0 ACCEPTANCE CRITERIA

The SGBS should receive water from each SG blowdown line, processes the blowdown as required, and delivers the processed water to the condensate system.

5.1 ~~The SGBDS operates as described in Subsection 10.4.8.~~

5.2 Valves should be operated upon related signals and their status indicated at the MCR.

5.3 The Valves in parallel paths should be operated in accordance with interlock provisions.

5.4 The status of blow down flash tank should be annunciated at the MCR.

5.5 The SOVs should be closed on loss of control power and re-opened when control power is restored.

5.6 The blowdown valves should be closed in less than specified time upon receipt of a CIAS, MSIS, AFAS and DPS-AFAS signal.

14.2.12.1.67 Main Condenser and Condenser Vacuum Systems Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the ~~ability of the main condenser~~automatic and manual operation of condenser vacuum ~~systems~~pumps and their associated recirculation pumps.

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SDN	safety system data network
SDS	safety depressurization system
SDVS	safety depressurization and vent system
SECY	Secretary of the Commission, Office of the NRC
SER	safety evaluation report
SF	1) stratified flow 2) single failure
SFD	spent fuel damage
SFG	structural fill granular
SFHM	spent fuel handling machine
SFP	spent fuel pool
SFPCCS	spent fuel pool cooling and cleanup system
SFPCL	SFP cleanup loop
SFR	spent fuel rack
SG	steam generator
~~SGBDS~~ SGBS	steam generator blowdown system
SGI	safeguard information
SGMSR	steam generator maximum steaming rate
SGTR	steam generator tube rupture
SI	safety injection
SI units	International System of Units
SIAS	safety injection actuation signal
SIF	stress intensification factor
SIFT	safety injection filling tank
SIP	safety injection pump
SIRCP	startup of an inactive reactor coolant pump
SIS	safety injection system
SIT	1) safety injection tank 2) structural integrity test
SIT-FD	safety injection tank with fluidic device
SKN	Shin-Kori nuclear power plant

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The SWMS meets the following design requirements:

a. Collect, segregate, treat, package, and store various solid radioactive wastes generated from the normal operation, maintenance, refueling, and AOOs.

b. Store, treat, and package the radioactive spent resin transported from the LWMS, CVCS, SFPCCS, and steam generator blowdown system (~~SGBDS~~ SGBS).

c. Temporarily store the high- and low-activity waste, and to retrieve and ship wastes.

d. Treat and package wastes into drums or high-integrity containers (HICs) that satisfy the required regulations of the U.S. Department of Transportation (DOT) and the disposal facility.

e. Satisfy federal regulations, and protect the workers and the general public from radiation exposures ALARA.

The SWMS is subdivided into a spent resin transfer subsystem, packaging and storage subsystem, filter handling subsystem, dry active waste subsystem, concentrate treatment subsystem, and waste storage subsystem.

In order to reduce occupational radiation exposure, operations for processing and transfer of low- and intermediate-level radioactive waste are conducted remotely. Operator access is required for work related to low-level radioactive waste such as DAW.

A description of this system is presented in Section 11.4.

1.2.14 Plant Arrangement Summary

The APR1400 plant is composed of the following buildings:

a. Reactor containment building

b. Auxiliary building including two emergency diesel generator rooms

SFP	spent fuel pool
SG	steam generator
SGBS ~~SGBDS~~	steam generator blowdown system
SGTR	steam generator tube rupture
SI	safety injection
SIF	stress intensification factor
SIP	safety injection pump
SIS	safety injection system
SIT	1) safety injection tank 2) structural integrity test
SLB	steam line break
SMAW	shielded metal arc weld
SOV	solenoid-operated valve
SQSDS	seismic qualification summary data sheet
SRI	Stanford Research Institute
SRP	Standard Review Plan
SRSS	square root of the sum of the squares
SRV	safety relief valve
SS	outside secondary shield
SSC	structures, systems, and components
SSE	safe shutdown earthquake
SSI	soil structure interaction
SSW	secondary shield wall
T/C	reactor inlet temperature, T(cold)
T/H	reactor outlet temperature, T(hot)
TEDE	total effective dose equivalent
TGB	turbine generator building
TIV	temperature isolation valve
TLOFW	total loss of feedwater
UGS	upper guide structure
UHS	ultimate heat sink

criteria or other codes and standards listed in Table 1 of NRC RG 1.26. Quality Group D may include parts or portions of systems that contain or may contain radioactive material.

SGBS

The radwaste management system and steam generator blowdown system (~~SGBDS~~), which contain or may contain radioactive materials, are designed in accordance with applicable codes and standards, QA requirements, and guidance provided in NRC RG 1.143.

Quality Group E

Quality Group E pertains to non-safety-related fluid systems and components that are designed to codes other than ASME B31.1 code criteria and codes and standards listed in NRC RG 1.26.

Quality Group G

Quality Group G pertains to safety-related fluid systems and components that are designed to codes other than ASME Section III.

3.2.3 Safety Class

Fluid system components important to safety are classified in accordance with ANSI/ANS-51.1-1983 (Reference 9). Safety Class 1, 2, 3, and non-nuclear safety (NNS) of ANSI/ANS-51.1-1983 are equivalent, on a functional basis, to Quality Groups A, B, C, D of NRC RG 1.26. The criteria establish safety classes that are used as a guide to the selection of codes, standards, and quality assurance provisions for the design and construction of the components. The safety class designations are also used as a guide to the fluid system components that are classified as seismic Category I and II (see Subsection 3.2.1).

The safety classification in ANSI/ANS-51.1-1983 is summarized as follows:

a. Safety Class 1

Safety Class 1 (SC-1) applies to pressure-retaining portions and supports of mechanical equipment that form part of the RCPB whose failure could cause a

RCFC	reactor containment fan cooler
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RDS	radioactive drainage system
RDT	reactor drain tank
RFI	radio frequency interference
RG	Regulatory Guide
RLS	radioactive laundry subsystem
RMWT	reactor makeup water tank
RSR	remote shutdown room
RSSH	resin sluice supply header
RV	reactor vessel
SAS	service air system
SBO	station blackout
SC	shutdown cooling
SCS	shutdown cooling system
SFHM	spent fuel handling machine
SFP	spent fuel pool
SFPCCS	spent fuel pool cooling and cleanup system
SFPCL	sfp cleanup loop
SFR	spent fuel rack
SG	steam generator
~~SGBDS~~	~~steam generator blowdown systems~~
SI	safety injection
SIAS	safety injection actuation signal
SIS	safety injection system
SIT	safety injection tank
SRP	Standard Review Plan
SSC	structure, system, and component
SSE	safe shutdown earthquake

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NRV	non-return check valve
NSSS	nuclear steam supply system
POSRV	pilot-operated safety relief valve
QA	quality assurance
RCS	reactor coolant system
RG	Regulatory Guide
RPCS	reactor power cutback system
RRS	reactor regulating system
RSR	remote shutdown room
SBCS	steam bypass control system
SBLOCA	small-break loss-of-coolant accident
SBO	station blackout
SG	steam generator
~~SGBDS~~ SGBS	steam generator blowdown system
SGMSR	steam generator's maximum steaming rate
SGTR	steam generator tube rupture
SSC	structure, system, or component
SSE	safe shutdown earthquake
TB	turbine building
TBS	turbine bypass system
TBV	turbine bypass valve
T/G	turbine generator
TGBCCW	turbine generator building closed cooling water
TGBOCWS	turbine generator building open cooling water system
TGCS	turbine generator control system
TGSS	turbine gland sealing system
VWO	valve wide open
WLS	wet lay-up subsystem
WWTS	wastewater treatment system

CHAPTER 10 – STEAM AND POWER CONVERSION SYSTEM

10.1 Summary Description

The function of the steam and power conversion system is to convert the heat energy generated by the nuclear reactor into electrical energy. The heat energy produces steam in two steam generators (SGs) capable of driving a turbine generator unit. The steam and power conversion system uses a condensing cycle with regenerative feedwater heating. Turbine exhaust steam is condensed in a surface-type condenser. The condensate from the steam is returned to the SGs through the condensate and feedwater system.

The steam and power conversion system comprises the following major process systems:

a. Turbine generator (T/G)

b. Main steam system (MSS)

c. Condensate and feedwater systems

d. Turbine bypass system (TBS)

e. Circulating water system (CWS)

f. Steam generator blowdown system (~~SGBDS~~ SGBS)

g. Auxiliary feedwater system (AFWS)

The following figures and tables describe the steam and power conversion system:

a. Table 10.1-1: Steam and Power Conversion System Major Design Data

b. Figure 10.1-1: Heat Balance Diagram

c. Figure 10.1-2: Overall System Flow Diagram

Table 10.1-1

Steam and Power Conversion System Major Design Data

Data	Value
Major Steam System Design Data	
Rated NSSS power	4,000 MWt
MSS design pressure/temperature	84.37 kg/cm^{2}A (1,200 psia) / 298.9 °C (570 °F)
MSS operating pressure/temperature (at SG steam nozzle outlets)	69.74 kg/cm^{2}A (992 psia) / 284.2 °C (543.6 °F)
Main steam flow (maximum guaranteed rate [MGR] condition)	8.14 × 10^6 kg/hr (17.95 × 10^6 lb/hr)
Main feedwater temperature (MGR condition)	232.2 °C (450 °F)
Main feedwater flow (MGR condition, with 0.2 % ~~SGBDS~~ SGBS flow)	8.16 × 10^6 kg/hr (17.99 × 10^6 lb/hr)
Downcomer flow (MGR condition, with 0.2 % ~~SGBDS~~ SGBS flow)	8.16 × 10^5 kg/hr (17.99 × 10^5 lb/hr)
Economizer flow (MGR condition, with 0.2 % ~~SGBDS~~ SGBS flow)	7.34 × 10^6 kg/hr (16.19 × 10^6 lb/hr)
~~SGBDS~~ SGBS flow rate, normal/abnormal/high	0.2 % / 1 % / 13.9 % of main flow rate
Turbine Generator Design Data	
Generator output	1,425 MWe at 0.090 kg/cm^{2}A(2.6 in HgA)
Operating speed	1,800 rpm
Turbine type	Tandem-compound
Frequency	60 Hz, three phase
Power factor	0.90
Voltage	24 kV nominal

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SGBS

~~SGBDS~~	steam generator blowdown system
SGTR	steam generator tube rupture
SRLST	spent resin long-term storage tank
SRP	Standard Review Plan
SRS	solid radwaste system
SRST	spent resin storage tank
SSC	structure, system, or component
SWMS	solid waste management system
TEDE	total effective dose equivalent
TEMA	Tubular Exchanger Manufacturers Association
TID	total integrated dose
TMI	Three Mile Island
VCT	volume control tank
WCT	waste collection tank

b. To store, process, and package the radioactive spent resins transferred from the liquid waste management system (LWMS), the chemical and volume control system (CVCS), the spent fuel pool cooling and cleanup system (SFPCCS), and the steam generator blowdown system (~~SGBDS~~ SGBS).

c. To temporarily store the high- and low-activity waste, and to retrieve and ship wastes.

d. To process and package wastes into drums, high-integrity containers (HICs), or other containers that satisfy the regulations of the U.S. Department of Transportation (DOT) and the requirements from the disposal facility.

e. To satisfy federal regulations and protect the workers and the general public by maintaining radiation exposures ALARA.

11.4.1.2 Design Criteria

The SWMS design criteria are as follows:

a. The SWMS is designed to meet the requirements of 10 CFR 50, Appendix A, GDC 61 (Reference 4), to provide reasonable assurance of adequate safety under normal and postulated accident conditions by providing adequate shielding and appropriate containment and confinement features, and GDC 63 (Reference 5), such that the SWMS has the ability to detect conditions that may result in excessive radiation levels and to initiate appropriate safety actions. The radiation monitoring system is described in Section 12.3.

   Spent resin is sampled for analysis, and the volume to be transferred into the HIC is predetermined. After the filling operation, the radiation level of the container is monitored prior to offsite shipment, providing reasonable assurance that the containers meet regulatory radiation limit and waste acceptance criteria, achieving conformance with 10 CFR 50, Appendix A, GDC 64 (Reference 6).

b. Liquid and gaseous effluents arising from the operation of the SWMS are within the effluent concentration limits of 10 CFR 20, Appendix B (Reference 7). To

d. R/O concentrates are dried to reduce the volume and converted to a granular or bead form. The dried concentrates are packaged in a 200 L (55 gal) drum or HIC.

The generation of mixed waste is minimized by prohibiting the use of hazardous materials. However, if mixed waste cannot be avoided, the mixed wastes are collected separately in a 200 L (55 gal) drums and stored prior to shipment to an appropriately licensed processor.

The SWMS is designed to provide 30-day storage of packaged wastes in accordance with the guidance of ANSI/ANS 55.1 (Reference 14). The storage facility is designed with adequate shielding to minimize the radiation dose to the operators, as described in Sections 12.3 and 12.4.

11.4.1.5 Radioactive Source Terms in SWMS

Source terms for solid radwaste are calculated for high-activity spent resin, low-activity spent resin, spent filter, and R/O concentrate. Tables 11.4-2 and 11.4-3 present the expected and design basis (1 percent fuel defect) radionuclide quantities in various solid radioactive wastes.

The spent resin long-term storage tank (SRLST) in the SWMS is designed to accumulate and contain high-activity spent resins from the purification, deborating, pre-holdup, and boric acid condensate ion exchangers of the CVCS for 10 years. The source terms for the SRLST are calculated by summing the source terms for each CVCS ion exchanger resin bed considering decay of up to 10 years.

The low-activity spent resin tank (LASRT) contains spent resins from the LWMS, SFPCCS, and ~~SGBDS~~ SGBS. The source term in the LASRT is determined based on spent resin generation assuming a one-time replacement of each ion exchanger bed. Because the buildup activities of SGBD and SFPCC spent resins are low, it is conservatively assumed that the LASRT is filled only with spent resins generated from the LWMS.

The high-activity spent filters generated from the CVCS, SFPCCS, and ~~SGBDS~~ SGBS are removed by means of a shielded plug and a shielded cask and transferred to the filter capping area in the compound building via the filter transporter and capped in a 200 L (55

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shipment to the onsite interim storage facility or offsite disposal facility. The boundaries and descriptions for SWMS subsystems are presented as follows:

Spent Resin Transfer and Packaging Subsystem

The boundary of the spent resin transfer and packaging subsystem starts at the spent resin discharge isolation valve from each of the demineralizers and terminates at the temporary waste storage area for packaged spent resins.

The spent resin transfer and packaging subsystem is designed to transfer spent radioactive resins from the demineralizer vessels to the spent resin tanks where the resin is held up prior to being processed. The major components of this subsystem are the low-activity spent resin tank and the spent resin long-term storage tank. The process flow diagram for the spent resin transfer and storage subsystem is shown in Figure 11.4-1. The COL applicant is to provide piping and instrumentation diagrams (P&IDs) (COL 11.4(4)).

The spent resin tanks provide a settling capacity for radioactive resins transferred from various demineralizers. The spent resin long-term storage tank and low-activity spent resin tank are provided to hold up the spent resin for decay prior to processing. The spent resins in the CVCS demineralizers are transferred to the spent resin long-term storage tank hydraulically using demineralized water for sluicing. The sluice water in the SRST is then removed and routed to the LWMS for processing and release. The relatively low-activity spent resins from the LWMS, SFPCCS, and ~~SGBDS~~ SGBS are transferred to the low-activity spent resin tank via a similar method. Each spent resin tank has a connection for the transfer of spent resin to the mobile dewatering system.

Spent Filter Handling Subsystem

The boundary of the spent filter handling subsystem starts at the point of removal of the filter media from the filter housing and terminates at the temporary waste storage area.

The filter handling subsystem provides the capability to replace normally radioactive filters with a minimum of personnel radiation exposure. Following the detection of a pressure drop across the filter at a predetermined level, spent filters are removed from the filter vessel through a shield plug and a shielded transfer cask. Spent filters are transferred to moved to the low-level temporary waste storage area for shipment. The overhead crane with a capacity of 15 tons is provided to move the containers to and from the temporary waste storage area. The containers are surveyed prior to shipment. Table 11.4-1 provides an estimate of annual dry solid wastes generated. The dry active waste handling and storage operation is outlined in Figure 11.4-1.

11.4.2.1.2 HVAC Filters Handling

The HVAC filters are placed directly into the drums without disassembly to reduce personnel exposure. Filter hoods are also provided for handling filters where airborne contamination may occur.

11.4.2.2 Wet Solid Waste

11.4.2.2.1 Spent Resin Storage and Handling

The various spent resins generated from demineralizers or ion exchangers are sluiced to spent resin tanks in the compound building where they are allowed to settle prior to processing. Spent resins are segregated based on level of activity. High-activity spent resins from demineralizers used to process the reactor coolant, such as the purification and pre-holdup ion exchangers in the CVCS, are sluiced to the spent resin long-term storage tank located in the compound building. Low-activity spent resins from the demineralizers in the LWMS and the SFPCCS are sluiced to the low-activity spent resin tank. Figure 11.4-1 is a process flow diagram of the spent resin handling subsystem.

The spent resin of demineralizers in the ~~SGBDS~~ SGBS is sluiced to the low-activity spent resin tank only if the resin is radioactively contaminated. Otherwise, the resin is directly transferred to HICs for transport to an offsite facility for treatment and disposal.

Service air or water injected through the resin outlet line at the bottom of each demineralizer vessel is used to agitate the resins prior to transfer to the spent resin tank. The spent resins are transferred to the spent resin tank by opening the resin discharge valve on the resin outlet line after pressurization by demineralized water or the reactor makeup pump.

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HVAC	heating, ventilating, and air conditioning
ICRP	International Commission on Radiological Protection
IRWST	in-containment refueling water storage tank
LOCA	loss-of-coolant accident
MCR	main control room
MSIV	main steam isolation valve
NRC	United States Nuclear Regulatory Commission
PA	postulated accident
POSRV	pilot operated safety and relief valve
PTS	primary-to-secondary
PWR	pressurized water reactor
RADTRAD	radionuclide transport, removal, and dose
RCFC	reactor containment fan cooler
RCGVS	reactor coolant gas vent system
RCP	reactor coolant pump
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system
RMS	radiation monitoring system
RV	reactor vessel
SCS	shutdown cooling system
SFP	spent fuel pool
SG	steam generator
SI	safety injection
SIS	safety injection system
TEDE	total effective dose equivalent
TSC	technical support center

SGBS steam generator blowdown system

e. Boric acid concentrator

The maximum values for BAC radionuclide inventories are presented in Table 12.2-14.

The total radioactivity inventories in the BAC package are based on a concentration factor of 100.

12.2.1.1.5.2 Steam Generator Blowdown System

SGBS

Radiation sources in the steam generator blowdown system (~~SGBDS~~) are shown in Table 12.2-18. The sources are based on the assumed design basis primary-to-secondary (PTS) leakage rate and the assumed fuel defect percentage described in Subsection 12.2.1.1.3. The blowdown rate is assumed to be 0.2 percent of the maximum steaming rate.

12.2.1.1.5.3 Condensate Polishing System

Radiation sources in the condensate polishing system (CPS) are shown in Table 12.2-18. The sources are based on the design basis PTS leakage and the assumed fuel defect percentage described in Subsection 12.2.1.1.3. It is assumed that 65 percent of the condensate flows through the CPS and that one out of six CPS demineralizers is used to process the condensate during normal operation.

12.2.1.1.6 Gamma Sources of Irradiated Components

The components in the reactor vessel are irradiated by the fission neutrons during the core power operation and are activated. The in-core instrument (ICI) assembly, which consists of five rhodium detectors, one background detector, one core-exit thermocouple, and a central member assembly, is enclosed in a protective sheath. Activated gamma sources of the irradiated ICI assembly are estimated assuming 6 years of irradiation. The activated gamma sources of the irradiated control element assembly (CEA) and the irradiated neutron source assembly (NSA) are estimated assuming 10 years of irradiation. In CEA, the neutron absorbing material is B_4C and the cladding material is Inconel 625. The NSA contains the primary neutron source of Cf^{252} and the secondary neutron source of Sb-Be. The activated gamma source of the irradiated surveillance capsule assembly (SCA) is