RAIO-0518-59828

May 04, 2018

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Supplemental Response to NRC Request for Additional Information No. 163 (eRAI No. 8907) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 163 (eRAI No. 8907)," dated August 11, 2017
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 163 (eRAI No.8907)," dated September 26, 2017
3. NuScale Power, LLC Supplemental Response to NRC "Request for Additional Information No. 163 (eRAI No. 8907)," dated March 15, 2018

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) supplemental response to the referenced NRC Request for Additional Information (RAI).

The Enclosure to this letter contains NuScale's supplemental response to the following RAI Question from NRC eRAI No. 8907:

- 09.03.03-1

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Samuel Lee, NRC, OWFN-8G9A
Anthony Markley, NRC, OWFN-8G9A
Prosanta Chowdhury NRC, OWFN-8G9A

Enclosure 1: NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8907

Enclosure 1:

NuScale Supplemental Response to NRC Request for Additional Information eRAI No. 8907

NuScale Power, LLC
1100 NE Circle Blvd., Suite 200 Corvalis, Oregon 97330, Office: 541.360.0500, Fax: 541.207.3928
www.nuscalepower.com

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 8907
Date of RAI Issue: 08/11/2017

NRC Question No.: 09.03.03-1

GDC 60 requires, in part, a power unit design to “include means to control suitably the release of radioactive materials in liquid effluents … produced during normal reactor operation, including anticipated operating occurrences.” 10 CFR 52.6 requires, in part, that information provided to the Commission under Part 52 shall be complete and accurate in all material respects.

FSAR Tier 2, Section 9.3.3.2.1, indicates that the radioactive waste drainage system (RWDS) and balance-of-plant drainage system (BPDS) are designed to include surge capacity to support other routine activities such as runoff from firefighting activities. The FSAR shows and describes that firewater removal pumps are provided in certain sumps, but not all, to aid in removal of liquids in those sumps and prevent overflow of the sumps. FSAR Tier 2, Figure 9.3.3-2, “Balance-of-plant Drain System Diagram,” shows some sumps having a firewater removal pump while FSAR Tier 2, Figure 9.3.3.-1, "Radioactive Waste Drain System Diagram," shows none. It is not clear to the staff why some sumps, such as the Chemical Waste Collection Sump which receives drainage from floor drains, do not have this extra pump.

The applicant is requested to provide clarification on why firewater removal pumps are not required for some sumps. The FSAR is to be modified accordingly. In addition, describe the expected surge volumes, the capacity of the drain systems’ components designed to accommodate these surge volumes, and provide the basis for ensuring the sumps are sized appropriately or provide a COL information item to capture this design information.

NuScale Response:

This response supplements NuScale's response, dated September 26, 2017, to RAI 8907 (09.03.03-1), and is based on information exchanged during a public phone call on March 13, 2018. After reviewing the NuScale response to RAI 8907, the NRC had questions and comments as shown below.

Comment 1: The paragraph in Section 9.3.3.2.3 beginning with "In the BPDS, building drains are collected and routed..." is not consistent with how the system operates.

NuScale response:

Corrections have been made to the indicated paragraph and to several other areas of FSAR Section 9.3.3 to provide a more consistent description of the RWDS and BPDS design and operation.

Comment 2: In Section 9.3.3.5, in the statement beginning with "On a high-high level, signal", the comma should follow the word "signal".

NuScale response: This error has been corrected as shown in the attached markup.

Comment 3: In the same paragraph identified in Comment 2, the description does not apply to the chemical waste sumps.

NuScale response: As shown in the attached DCA markup, the indicated paragraph has been revised to indicate that the sump pumps in the chemical waste sumps do not start automatically.

In addition to these changes, the names of the pumps have been revised in several places in FSAR Section 9.3.3 to be consistent with the wording used in FSAR Section 14.2. FSAR Table 14.2-24 has been revised to provide consistent terminology with regard to pump names.

Impact on DCA:

FSAR Section 9.3.3 and Table 14.2-24 have been revised as described in the response above and as shown in the markup provided in this response.

waste from areas associated with power-related or process-related functions outside the RCA.

The RWDS serves the radiologically controlled areas (RCA), which include the Reactor Building (RXB), the Radioactive Waste Building (RWB), and potentially contaminated areas of the Annex Building (ANB). The RWDS does not provide drainage for the reactor containment of an NPM.

The RWDS liquid wastes are segregated into:

- Low-conductivity waste (LCW) - These are generally low chemical concentration wastes (e.g., equipment drains) that can have relatively high radioactivity concentrations.
- High-conductivity waste (HCW) - These are high-conductivity drain wastes (e.g., floor drains) containing various dissolved and suspended solids that can have relatively high radioactivity concentrations.

RAI 09.03.03-1S2, RAI 14.02-6S1

- Chemical waste drains

RAI 09.03.03-1S2, RAI 14.02-6S1

- RCCW waste drains

RAI 09.03.03-1S2, RAI 14.02-6S1

- Detergent waste drains

The RWDS consists of five subsystems:

- The equipment drain subsystem collects RXB and RWB equipment drainage, pool leak detection drainage, and leakage in the chemical and volume control system ion exchanger cells and transfers it to the LCW collection tanks in the LRWS.
- The floor drain subsystem collects RXB, RWB and ANB (decontamination room) floor drainage and transfers it to the HCW collection tanks in the LRWS.
- The chemical waste drain subsystem collects chemical waste from the containment evacuation system and the hot laboratory and transfers it to the HCW collection tanks in the LRWS.
- The reactor component cooling water system (RCCWS) drain subsystem collects potentially contaminated liquid and stores it for recycle back to the RCCWS. The waste is sampled upon receipt and transferred to the HCW tanks in the LRWS if it is found to be contaminated.
- The detergent waste collection subsystem collects detergent waste from personnel and small equipment decontamination activities and transfers it to the detergent waste collection tank in the LRWS via gravity flow. There are no tanks or pumps in this subsystem.

The BPDS consists of three subsystems:

- The waste water sumps receive water from auxiliary boiler system (ABS) blowdown, and floor and equipment drains within the structure housing the auxiliary AC power source (AAPS), Auxiliary Boiler Building, Turbine Generator

The RWDS piping has welded connections with the exception that flanges may be used where frequent disassembly is required for maintenance or NPM disconnection. Threaded connections are not used for piping containing radiologically contaminated fluid. The RWDS floor drain piping is routed and sealed to prevent flow of airborne radioactivity between building rooms and compartments. The RWDS drains in areas containing combustible liquids have provisions for preventing the backflow of combustible liquids into safety-related areas through the interconnected drain systems.

The BPDS uses double-walled lines with built-in leak detection capability in the piping between the TGB sumps to the LRWS, to contain radioactive material and prevent contamination spread from buried pipe. The connections and fittings for potentially contaminated BPDS tanks are welded in order to prevent leakage.

9.3.3.2.2 Major Component Description

Sumps and Tanks

The RWDS is designed to collect, accumulate, and transfer the expected amounts of radioactive liquid wastes to the LRWS, including chemical and detergent bearing wastes. The RWDS has excess capacity which supports periodic maintenance or other volume increases greater than routine operating capacities. Redundant pumps provide backup.

RAI 09.03.03-1

The internal flooding analysis for the RXB determined that pooling from fire suppression equipment does not impact safety-related or risk-significant equipment functions with no credit taken for the floor drain system, as described in Section 3.4. There are no safety-related or risk significant SSC on the lowest level of the CRB. In the event of fire suppression system activation, the excess water is allowed to pool on the impacted floor until it can drain into the floor drain sump tank. Floor drains from upper elevations are collected and routed through individual downcomers to the nearest floor drain sump, located in the lowest elevation. This feature prevents water collected on one floor from backing up to other floors. The RWDS sumps in the RXB, though not credited to prevent flooding in the respective buildings, will attenuate to some extent the flood levels from design basis fire suppression system flows. The BPDS sump in the CRB contains a fire water removal pump rated at the maximum single zone fire suppression system flow rate.

The RWDS sumps are provided with stainless steel liners to collect any leakage from the primary tank. The liners also contain leak detection which alarms in the Waste Management Control Room (WMCR). The sumps are covered to keep out debris, with an access port to facilitate inspection and cleanout operations. The RWDS tanks are vented to the RXB or RWB ventilation system which helps prevent gaseous and airborne radioactive contaminants from leaving the sump tanks by a path other than the vent piping.

RAI 09.03.03-1, RAI 09.03.03-1S1, RAI 09.03.03-1S2, RAI 14.02-6S1

The BPDS is designed to accommodate normal drainage into each of the five sumps. Sufficient storage volume and pump-out capacity is provided in the BPDS collection tanks to process normal and infrequent operational occurrences. The two TGB waste water sumps and the CRB sump are also equipped with ~~firewater~~fire water removal pumps sized to accommodate the design basis fire suppression system flows in the respective buildings without flooding. The chemical waste collection sumps are not equipped with ~~firewater~~fire water removal pumps because the capacity of the sump pumps exceeds the potential runoff from firefighting activities.~~these sumps do not receive runoff from floors.~~

The BPDS sumps are closed tanks. The BPDS design provides positive leakage containment that excludes precipitation, groundwater, and runoff. The waste water sumps associated with the BPDS are equipped with coalescing media. Oily waste collected in the BPDS waste water sumps is processed by a BPDS oil separator to permit oily waste collection and transport offsite.

RAI 09.03.03-1S2, RAI 14.02-6S1

Underground tanks in the BPDS, regardless of material, are located in concrete enclosures with leak detection for secondary containment and covers to exclude precipitation. ~~Each sump includes two pumps. The first pump turns on at high level. The second pump turns on at high-high level. All pumps turn off at low level. For the three tanks with firewater removal pumps, that pump turns on at high-high-high level.~~

RAI 09.03.03-1

The RCCWS drain tank is sized to accept the RCCWS water contained in the single largest piece of equipment in the RCCWS circuit. The chemical drain tank is sized to accept waste from the process sampling system and the 12 containment evacuation systems.

Pumps

RAI 09.03.03-1S2, RAI 14.02-6S1

Cleanable screens are installed on pump suction lines to minimize the potential for pump damage or plugging of system piping. The RWDS chemical drain tanks are provided with air diaphragm transfer pumps. The RCA drainage, with the exception of detergent waste, is collected by various RWDS drain tanks, each having two redundant pumps. Each pump is sized to accommodate the maximum anticipated flow into the sump. Thus, each sump has one pump ready for operation (the 'primary' pump) and one pump on standby (the 'alternate' pump). The pumps automatically start and stop based on level indication. The ~~first~~primary pump is activated upon the tank reaching high level and the ~~second~~alternate pump is activated upon reaching high-high level. This provides automatic backup if one pump fails or if the inflow exceeds the capacity of one pump.

RAI 09.03.03-1S2, RAI 14.02-6S1

Each BPDS sump incorporates a primary and an alternate pump. In addition, each of the two waste water sumps and the control building sump include a fire water removal pump and an oily waste pump.

9.3.3.2.3 System Operation

The RWDS and BPDS operate during normal operation, maintenance, plant shutdowns, refueling, plant startup operations, and during anticipated operational occurrences.

For RWDS normal operation, liquid wastes drain by gravity to collection tanks or sumps. Sump pumps discharge the collected radiologically contaminated liquid wastes to the LRWS for further processing.

RAI 09.03.03-1S2, RAI 14.02-6S1

The ~~RCCW drain and chemical drain subsystems~~Reactor Building RCCW drain tank and the Reactor Building chemical drain tank receive waste, but transfer to the LRWS ~~is manually initiated~~requires operator action after sampling, analysis, and adjustment if necessary. The liquids contained in the RCCW drain tank are normally not radiologically contaminated but contain various treatment chemicals, including corrosion inhibitors that are typical of closed loop cooling water systems that could react exothermically with ion exchange resins.

RAI 09.03.03-1S2, RAI 14.02-6S1

The pool leak detection ~~(PLD) system~~system (PLDS) works in cooperation with the RWDS equipment drain subsystem. The PLDS drains are not individually monitored; however, because all other drains into the equipment drain system are manually initiated, unplanned changes in sump volume can be attributed to the PLD system.

RAI 09.03.03-1S2, RAI 14.02-6S1

In the BPDS, building drains are collected and routed to the appropriate sump. Each sump has ~~one operational pump and one pump on standby~~a primary and an alternate pump. During operation, the primary waste water sump pump~~s~~ automatically starts on high level and stops on low level. Liquid waste is transferred to the two BPDS collection tanks. From there, waste is sent to the utility water system for offsite discharge. The chemical waste sump pumps do not automatically start on sump high level ~~like the waste water pumps~~. ~~A~~Instead, a sump high level alarm is sent to the plant control system. This alarm requires operator action to transfer the liquid waste to the BPDS collection tanks or make arrangements for temporary storage in the backup collection tank. This is to allow a controlled metering of chemical waste into the discharge stream. Operator action is required to pump oily waste from the waste water sumps. The BPDS non-radioactive liquid wastes are transferred from the collection tanks to the discharge basin of the utility water system (UWS). The effluent from the UWS is continuously monitored for radiation level and release rate, the UWS radiation monitors are discussed in Section 11.5. Once started, continuous availability of the RWDS and BPDS is expected for the life of the plant.

During NPM startup, a major source of drain flow to BPDS is from auxiliary boiler operation.

During plant shutdown, manual equipment draining operations and flushing of equipment to the RWDS are performed. BPDS drain flows are not expected to change much during single module refueling shutdowns. A check of tank status determines whether the tanks should be pumped down in order to be ready for the next startup. Pumping of oily waste is performed as part of the shutdown process, as necessary. The BPDS supports continuous operation.

RAI 09.03.03-1S2, RAI 14.02-6S1

Off-normal RWDS operation involves an abnormally high inflow rate into the sump tanks. The high in-flow rate can be indicative of equipment draining operations, a ruptured pipe or piece of equipment, an abnormally high reactor pool leak, or activation of the fire suppression system. ~~Equipment draining operations are planned evolutions and a~~A high-high level ~~alarm~~condition starts the standby pump ~~as described above. System response to a fire suppression system actuation is also described above.~~ A high inflow rate when no equipment draining activity or fire alarm is taking place would be investigated to determine the source.

RAI 09.03.03-1S2, RAI 14.02-6S1

Off-normal BPDS operation involves higher than normal drain flow rate (e.g., fire protection system sprinklers). ~~The~~Each of the two waste water sumps and CRB sump contain ~~firewater~~a fire water removal pump~~s~~ rated at maximum expected input. These pumps automatically start upon a high-high-high level signal and automatically stop upon falling below the high-high level set point. In the event of higher than normal drain flow rates, the waste water sump pumps cycle on and off more frequently. The two BPDS collection tank levels require monitoring of discharge tank contents as the tanks are filled.

Radiologically contaminated liquid input to BPDS is an off-normal condition mitigated by automated system functions. The BPDS process radiation monitors provide continuous indication to the main and waste management control rooms. If a high radiation condition is detected an alarm initiates in the main and waste management control rooms, the associated waste water sump pumps automatically shut down and transfer to manual control, and the discharge flow path to the BPDS collection tanks automatically isolate. The radiation monitoring for the BPDS is discussed in Section 9.3.3.5. To provide an early indication of primary to secondary leakage, the high alarm setpoint is chosen for the radiation monitor that is set sufficiently low to detect abnormal conditions without causing spurious alarms in the control room. In the event of loss of power or air the sump pump discharge valves fail in their current positions. If required, the discharge flow path of the associated waste water sump pumps can be opened to the appropriate LRWS waste tank and the sump pumps can be restored to automatic operation to facilitate processing radiologically contaminated water and system flushing.

RAI 09.03.03-1S2, RAI 14.02-6S1

The BPDS chemical waste water sump pumps require operator action to discharge tank contents. High chemical waste content may require arrangements for

temporary storage in one of the collection tanks then metering the disposal to the outfall may be required.

9.3.3.3 Safety Evaluation

The RWDS and BPDS have no safety related or risk significant functions. The design and layout of these systems include provisions that ensure that a failure of the system will not adversely affect the functional performance of safety-related systems or components.

RAI 09.03.03-1S1

General Design Criterion 2 was considered in the design of the RWDS and BPDS. Consistent with GDC 2, the RWDS and BPDS are not provided with specific provisions related to protection against natural phenomena other than those portions of the systems located in Seismic Category I structures. Based on their safety classification, the RWDS and BPDS are designed as non-seismic (Seismic Category III). However, in areas ~~of the RXB and CRB~~ where portions of these systems could interact adversely with Seismic Category I SSC during a safe shutdown earthquake, the RWDS and BPDS are designed as Seismic Category II per Section 3.2.1.2 using the guidance of Regulatory Guide (RG) 1.29. ~~Additionally, BPDS drain piping and components in the CRB that have the potential to interact adversely with Seismic Category I equipment or could result in incapacitating injury to occupants of the control room during or following an SSE meet Seismic Category II design requirements.~~ The RWDS and BPDS do not have direct connections to Seismic Category I piping systems that would invoke the seismic design requirements of Staff Regulatory Guidance C.2 of RG 1.29. The RWDS and BPDS seismic and quality group classifications are identified in Table 3.2-1.

Sump tanks located in the RXB and RWB that contain radiologically contaminated liquids (equipment drains) consist of stainless steel tanks located in equally-sized, stainless steel-lined sumps in the bottom floors of the buildings. The RXB is a Seismic Category I building and the RWB is a Seismic Category II building. Thus, even if the sump tanks were to fail as the result of an earthquake, the sumps (secondary containments) would still be intact and capable of containing the liquid waste, with no adverse interaction with safety-related or risk significant equipment.

The RWDS and BPDS do not require protection against external flooding as the plant site selection criteria places the maximum external flood level at one foot below grade.

General Design Criterion 4 was considered in the design of the RWDS and BPDS. Consistent with GDC 4, the design of the RWDS and BPDS provides protection of safety-related and risk-significant SSC from the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents. The design of the RWDS and BPDS ensures that safety-related equipment functions are not impacted by undue water accumulations within the plant. The internal flood analysis provided in Section 3.4.1 evaluates the potential flooding impact on SSC due to pipe breaks, equipment failures, and fire suppression water. The RWDS and BPDS are not safety-related, single-failure proof, or seismically designed. The flood analysis takes no credit for water removal by the RWDS or BPDS. In some areas of the RXB and CRB, the flood analysis identifies the need for implementing elevated equipment mounting details,

waterproof design features, or watertight doors to minimize impact from water accumulation as described in Section 3.4. Implementation of the measures identified by the internal flood analysis ensures that safety-related equipment functions are not impacted by water accumulations within the plant.

RAI 09.03.03-1, RAI 09.03.03-1S2, RAI 14.02-6S1

The BPDS waste water drain tanks that serve the TGBs and the CRB sump contain fire water removal pumps rated for the design basis fire suppression system flow in the respective buildings. The subsystems operate automatically without the need for operator intervention. The design of the RWDS can help mitigate the consequences of flooding from internal sources, such as pipe breaks, tank leaks, discharge from fire suppression systems, and other potential flooding sources, by providing waste collection and transfer capability. The chemical waste collection sumps do not require ~~firewater~~fire water removal pumps, as ~~these sumps do not receive runoff from floors~~the potential flow into these sumps from firefighting activities is less than the capacity of the chemical waste water sump pumps.

General Design Criterion 5 was considered in the design of the RWDS and BPDS. Consistent with GDC 5, although the RWDS and BPDS are shared by up to 12 NPMs, in the event of an accident in one NPM, the failure of these systems to perform their nonsafety-related functions does not prevent an orderly shutdown and cooldown of the remaining NPMs.

RAI 09.03.03-1S1

General Design Criterion 60 was considered in the design of the RWDS and BPDS. ~~Consistent with GDC 60, the RWDS and BPDS designs control the release of radioactive materials in gaseous and liquid effluents during normal operations including anticipated operational occurrences. RWDS and BPDS process radiation monitoring and automated functions described in Section 9.3.3.5 limit the release of radioactive materials, conforming to GDC 60~~The RWDS and BPDS design features include adequate surge capacities to support maintenance activities and runoff from firefighting and decontamination activities. These systems are designed with radiation monitoring which includes functions to automatically terminate tank discharges. These design features control the release of radioactive materials in effluents during normal operations, including anticipated operational occurrences.

The design of the RWDS and BPDS considers “as low as reasonably achievable” and minimization of contamination guidelines. Consistent with 10 CFR 20.1101(b), the design of the RWDS and BPDS supports keeping radiation exposures ALARA. To maintain the radiation exposure to operating and maintenance personnel ALARA, the RWDS and BPDS are designed to facilitate maintenance, inspection, and testing in accordance with the guidance in Regulatory Guide (RG) 8.8.

RAI 09.03.03-1S2, RAI 14.02-6S1

~~The design of the RWDS and BPDS satisfies the requirements of~~The RWDS is designed to minimize the spread of contamination. All sump tanks are fabricated from austenitic stainless steel and are located in stainless steel-lined concrete sumps. The interstitial areas between the sump tanks and the sump liners are monitored for leaks. Equipment drains provide a segregated means of collecting clean reactor coolant to prevent the

spread of contamination into floor drains. Flows into the BPDS from potentially contaminated systems are monitored for radioactivity. The capacity of BPDS sumps and tanks are sufficient to prevent overflow in the event of firefighting activities. These design features demonstrate compliance with 10 CFR 20.1406 as it relates to minimization of contamination of the facility.

The RWDS is designed to receive radiologically contaminated liquids and normally non-contaminated liquids including the RCCWS drains. Equipment, floor, chemical, and detergent drains are transferred to the LRWS for treatment, storage, and disposal. The normally non-contaminated liquid from the RCCWS drains may contain corrosion inhibitors and is segregated within the RWDS. Liquid from drains related to the RCCWS are monitored by a radiation monitor located on the RCCWS drain tank as described in Section 9.3.3.5 to alert the operators to an off-normal condition within the drain tank. In addition, the provision for Reactor Building RCCWS drain tank grab sampling is located on the Reactor Building RCCW drain tank pump minimum flow line to allow for tank recirculation to obtain a representative sample. Grab sampling provides the capability to analyze the Reactor Building RCCWS drain tank contents and ensure no radioactivity is present prior to return to the reactor component cooling system, and provides a secondary method of initial detection, if the related radiation monitor is not available. The normally non-contaminated liquid is recycled back to the RCCWS; if contamination is detected greater than pre-established thresholds, the liquid is transferred to the HCW collection tanks for treatment, storage, and disposal.

The RWDS is designed to preclude the transfer of contaminated fluids to a non-contaminated drainage system for disposal.

Potential sources of BPDS contamination include 1) a primary-to-secondary steam generator tube leak, which can arrive through the condensate polishers or leaking condensate, or 2) a leak in one of the NPM heatup heat exchangers into the high pressure auxiliary steam and into the auxiliary boiler system blowdown cooler discharge.

The BPDS inputs that could introduce radiologically contaminated liquids into the system are monitored for radiation as described in Section 9.3.3.5. If a high radiation condition is detected an alarm initiates in the main and waste management control rooms, the associated waste water sump pumps automatically shut down and transfer to manual control, and the discharge flow path to the BPDS collection tanks automatically isolate. System sampling provisions located on the discharge of the BPDS sump tank pumps allow the process fluid to be recirculated to ensure a representative sample. Process sampling permits the determination of process radionuclide content and serves as a redundant means of detecting process radioactivity in the event that radiological monitoring is unavailable. The tank is sampled to determine the proper disposition of the waste, and if required, the system can transfer the liquids to the LRWS. Upon completion of the transfer, the BPDS and the inflow lines have provisions for decontamination and can be placed back into normal service.

RAI 09.03.03-1S2, RAI 14.02-6S1

Vents of BPDS sumps with the potential to be contaminated use HEPA filters to reduce airborne particulate contamination. The BPDS uses double-walled lines with built-in

leak detection capability in the piping between the TGB sumps to the LRWS. This feature ensures containment of potentially radiologically contaminated liquids, preventing the spread of contamination from sections of piping that are buried, consistent with the requirements of 10 CFR 20.1406.

9.3.3.4 Inspection and Testing

The RWDS and BPDS are designed to permit periodic inspection and testing of important components to verify their integrity and capability. Drainage piping is hydrostatically tested. Drain system piping that conveys potentially radiologically contaminated liquids is pressure tested in accordance with ASME B31.1 (Reference 9.3.3-1). The RWDS and BPDS functionality are demonstrated by continuous use during normal plant operation.

RAI 09.03.03-1S2, RAI 14.02-6S1

Section 14.2 discusses testing to verify component installation and initial operation as well as integrated system testing. ~~The inservice testing program is described in Section 3.9.6.~~ Inspections, Tests, Analyses, and Acceptance Criteria are addressed in Section 14.3.

9.3.3.5 Instrumentation and Controls

The RWDS and BPDS can be controlled manually or automatically. Sumps and drain tanks that are part of the RWDS and BPDS are monitored for level.

Information associated with the RWDS and BPDS operation is shown in the MCR, WMCR and locally, including tank and sump levels, temperatures, and pressures. High-high RWDS level alarms and BPDS radiation alarms are actuated in the MCR, locally, and in the WMCR.

RAI 09.03.03-1S2, RAI 14.02-6S1

Dual sump pumps, a primary and an alternate, are provided for each of the RWDS and BPDS sumps. ~~These pumps automatically start and stop on high-level and low-level control, respectively.~~For all sumps but the chemical waste collection sumps, the primary pump starts on high-level and stops on low-level. On a high-high ~~level, signal~~level signal, both pumps operate and an alarm signal notifies the operator. The chemical waste water sump pumps do not start automatically.~~In addition to normal high-level and low-level operation, operation of both pumps in parallel is provided in the event of unusual flow rates.~~

The RWDS Reactor Building RCCWS drain tank radiation monitor provides continuous main control room indication and alarm capability. To provide an early indication of leakage from radiologically contaminated systems to the clean RCCWS, the high radiation alarm setpoint is set as low as possible without causing spurious alarms in the main control room. The radiation monitoring for the RWDS is discussed in Section 11.5.

The following BPDS process radiation monitoring instrumentation is provided for system inputs that have the potential to be radiologically contaminated.

- A single adjacent-to-line radiation monitor is located on the line downstream of the ABS blowdown coolers for the high and low-pressure boilers, prior to entering the north waste water sump tank.
- A single in-line radiation monitor is located on the north condensate regeneration skid drain line to the north chemical waste collection sump tank.
- A single in-line radiation monitor is located on the south condensate regeneration skid drain line to the south chemical waste collection sump tank.
- A single in-line radiation monitor is located on the north turbine generator building floor drain line to the north waste water sump tank.
- A single in-line radiation monitor is located on the south turbine generator building floor drain line to the south waste water sump tank.

The BPDS process radiation monitors provide continuous indication to the main and waste management control rooms. If a high radiation condition is detected an alarm initiates in the main and waste management control rooms, the associated waste water sump pumps automatically shut down and transfer to manual control, and the discharge flow path to the BPDS collection tanks automatically isolate. The radiation monitoring for the BPDS is discussed in Section 11.5.

RAI 09.03.03-1S2, RAI 14.02-6S1

To provide an early indication of primary to secondary leakage, the high alarm setpoint is chosen for the radiation monitor that is set as low as possible without causing spurious alarms in the MCR and WMCR. In the event of loss of power or air the sump pump discharge valves fail in their current positions.

If required, the discharge flow path of the associated BPDS waste water sump pumps can be opened to the appropriate LRWS waste tank and the sump pumps can be restored to automatic operation to facilitate processing radiologically contaminated water and system flushing.

9.3.3.6 Reference

9.3.3-1 American Society of Mechanical Engineers, Power Piping - ASME Code for Pressure Piping B31, ASME B31.1, New York, NY.

RAI 09.03.03-1S2, RAI 14.02-6, RAI 14.02-6S1

Table 14.2-24: Balance-of-Plant Drains Test # 24

Preoperational test is required to be performed to support sequence of construction turnover of the BPD system.		
BPD system is described in Section 9.3.3 and 11.5.2.2.15 and the functions verified by this test are:		
System Function	**System Function Categorization**	**Function Verified by Test #**
1. The BPDS supports the condensate polisher demineralizers, the three cooling tower chemical addition systems, and the DWS reverse osmosis units by providing a means to collect and transfer chemical wastes to either the LRWS or to the UWS.	nonsafety-related	Test #24-1
2. The BPDS supports the two TGBs, the two diesel generators, the auxiliary boiler, the combustion turbine, the Central Utility Building, and the diesel driven firewater pump by providing a means to collect, treat, and transfer the waste water to the either the LRWS or to the UWS.	nonsafety-related	Test #24-1
3. The BPDS supports the CRB floor drains by providing a means to collect, treat, and transfer the waste water to the UWS.	nonsafety-related	Test #24-1
Prerequisites Verify an instrument calibration has been completed, with approved records and within all calibration due dates, for all instruments required to perform this test.		
Component Level Tests		
Test Objective	**Test Method**	**Acceptance Criteria**
i. Verify each BPDS remotely-operated valve can be operated remotely.	Operate each valve from the MCR and local control panel (if design has local valve control).	MCR display and local, visual observation indicate each valve fully opens and fully closes.
ii. Verify each BPDS air-operated valve fails to its safe position on loss of air.	Place each valve in its non-safe position. Isolate and vent air to the valve.	MCR display and local, visual observation indicate each valve fails to its safe position.
iii. Verify each BPDS air-operated valve fails to its safe position on loss of electrical power to its solenoid.	Place each valve in its non-safe position. Isolate electrical power to each air-operated valve.	MCR display and local, visual observation indicate each valve fails to its safe position.
iv. Verify each BPDS pump can be started and stopped remotely.	Align the BPDS to allow for pump operation. Stop and start each pump from the MCR.	MCR display and local, visual observation indicate each pump starts and stops.
v. Verify the pump speed of each BPDS variable-speed pump can be manually controlled.	Vary the speed of each pump from the MCR and local control panel (if design has local pump control).	MCR display indicates the speed of each pump varies from minimum to maximum speed.

Table 14.2-24: Balance-of-Plant Drains Test # 24 (Continued)

System Level Test #24-1		
Test Objective	**Test Method**	**Acceptance Criteria**
Verify BPDS automatically controlled pumps in sumps and tanks with a fire water removal pump, start and stop automatically and transfer liquid waste to its design location.	Align each BPDS sump or tank to allow water in a selected sump or tank to be pumped to its design location. If the sump fill rate in the following test method is insufficient for automatic start of the alternate pump or fire pump, the primary pump or alternate pump may be temporarily removed from service to allow an increase in the sump level. i. Verify that Pump #1 is set to the primary pump and Pump #2 is set to alternate. Fill the selected sump or tank until a HI water level is obtained to start the ~~first (~~primary~~)~~ pump. ii. Continue filling the sump or tank until a HI-HI level starts the ~~second (~~alternate~~)~~ pump. iii. Fill the sump or tank until a HI-HI-HI level starts the fire water removal pump ~~(if applicable)~~. iv. Stop filling the sump or tank to allow the fire water removal pump to stop on HI-HI level ~~(if applicable)~~. v. Continue (or start) sump or tank dewatering to allow the primary and alternate pumps to stop on LO level. vi. Change pump controls to make ~~the alternate pump the first to start~~Pump #2 the primary pump and Pump #1 the alternate pump, and refill the sump or tank until the ~~first (alternate)~~ primary pump starts on HI level. vii. Continue filling the sump or tank until a HI-HI level starts the ~~second (primary)~~alternate pump. Note: Pump #1 and Pump #2 are not the actual names of the pumps, these names are used to differentiate between the two pumps.	MCR displays and local, visual observation verifies the following: i. The ~~first~~primary pump starts on HI level and transfers water to its design location in the LRW system. ii. The ~~second (~~alternate~~)~~ pump starts on HI-HI level. iii. The fire water removal pump starts on HI-HI-HI level. ~~(if applicable)~~ iv. The fire water removal pump stops on HI-HI level. v. Both primary and alternate pumps stop on LO level. vi. The ~~alternate~~primary pump starts on HI level. vii. The ~~primary~~alternate pump starts on HI-HI level.

Table 14.2-24: Balance-of-Plant Drains Test # 24 (Continued)

System Level Test #24-6		
Test Objective	**Test Method**	**Acceptance Criteria**
Verify the BPDS automatically responds to mitigate a release of radioactivity.	Place a north waste water sump pump in operation. Initiate a real or simulated high radiation signal in the BPDS auxiliary blowdown cooler condensate.	i. The north chemical waste water sump pump stops. ii. North chemical waste collection sump to BPDS collection tank isolation valve is closed. iii. North chemical waste collection sump to LRW high conductivity waste tank isolation valve is closed. [ITAAC 03.17.04] (i through iii)
System Level Test #24-7		
Test Objective	**Test Method**	**Acceptance Criteria**
Verify BPDS automatically controlled pumps, in sumps and tanks without a fire water removal pump, start and stop automatically and transfer liquid waste to its design location.	Align each BPDS sump or tank to allow water in a selected sump or tank to be pumped to its design location. If the sump fill rate in the following test method is insufficient for automatic start of the alternate pump, the primary pump may be temporarily removed from service to allow an increase in the sump level. i. Verify that Pump #1 is set to the primary pump and Pump #2 is set to alternate. Fill the selected sump or tank until a HI water level is obtained to start the primary pump. ii. Continue filling the sump or tank until a HI-HI level starts the alternate pump. iii. Stop filling the sump or tank to allow the primary and alternate pumps to stop on LO level. iv. Change pump controls to make Pump #2 the primary pump and Pump #1 the alternate pump, and refill the sump or tank until the primary pump starts on HI level. v. Continue filling the sump or tank until a HI-HI level starts the alternate pump. Note: Pump #1 and Pump #2 are not the actual names of the pumps; these names are used to differentiate between the two pumps.	MCR displays and local, visual observation verifies the following: i. The primary pump starts on HI level and transfers water to its design location in the LRW system. ii. The alternate pump starts on HI-HI level. iii. Both primary and alternate pumps stop on LO level. iv. The primary pump starts on HI level. v. The alternate pump starts on HI-HI level.