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.:	**244-8326**
SRP Section:	**09.03.03 – Equipment and Floor Drainage Systems**
Application Section:	**9.3.3**
Date of RAI Issue:	**10/14/2015**

Question No. 09.03.03-4

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."

DCD Tier 2, Section 9.3.3.2.2, states that the turbine generating building sump radiation monitors are interlocked with the sump discharge valves to provide proper routing of contaminated fluid. However, the staff is unable to fully determine the operation and circumstances of sump discharge valve operation and thus cannot determine whether the design meets GDC 60 to control suitable releases of radioactive effluents.

The applicant is requested to provide additional information as to how these valves change the flow path in order to conclude whether this is an automatic function or operator action is required.

Response – (Rev. 1)

The turbine generator building drain system consists of condenser pit sumps (north/south) and a condensate polishing area sump. The below figure shows the interconnection of the turbine generator building drain system between the liquid waste management system (LWMS) and the waste water treatment facility (WWTF).

All sump pumps discharge into the WWTF as long as no contamination fluid is present. The discharge from the condensate polishing area sump is monitored for process radiation. Upon detection of radioactivity, the operating sump pump is stopped automatically by the RMS signal. The discharge valve to WWTF is closed, and the discharge valve to LWMS is opened simultaneously. Then, the sump pump is manually started. The flow is then diverted to the LWMS.

The discharges from the condenser pit sumps are monitored for process radiation. Upon detection of radioactivity, the operating sump pumps are stopped automatically by the RMS signal. The discharge valve to the WWTF is closed, and the discharge valve to condensate polishing area sump is opened simultaneously. Then, the sump pump is manually started. The flow is then diverted to the LWMS.

At the upstream of the condensate return pump of the auxiliary steam system, the condensate is monitored continuously for radioactivity. The auxiliary boiler blowdown and drains are routed to the auxiliary boiler building sump and then are routed to the turbine generator building sump for radiation monitoring. When contamination level of the drains is detected and exceeds a predetermined setpoint, they are routed to the LWMS for processing and release via the condensate polishing area sump.

Therefore, DCD Section 10.4.10.2.1 and 10.4.10.2.3 will be revised in accordance with the above description. DCD Tier 2, Figure 10.4.10-1 (Sheet 3 of 3) will include the auxiliary boiler building sump and lines.

The DCD will be revised to state that the COL applicant is to provide the flow diagram of turbine generator building drain system and the interconnection from the auxiliary boiler building sump, and the flow diagram of CCW heat exchanger building drain system to LWMS or turbine generator building (TGB) sump.

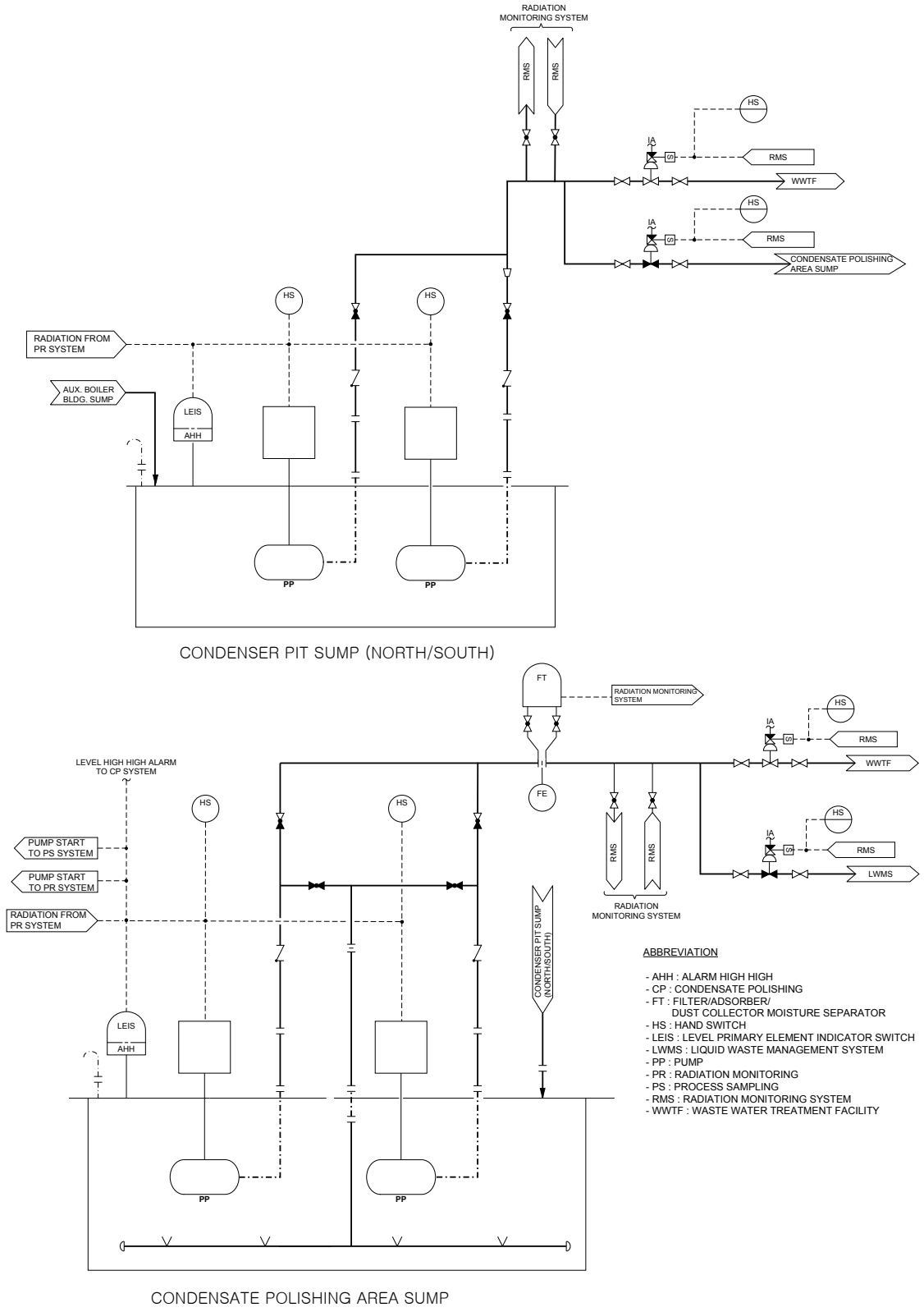

Figure. Turbine Generator Building Drain System

Impact on DCD

DCD Tier 2, Table 1.8-2 (15 of 29), Subsection 9.3.3.2.6, Subsection 9.3.6, Subsection 10.4.10.2.1, Subsection 10.4.10.2.3 and Figure 10.4.10-1 (Sheet 3 of 3) 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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Table 1.8-2 (15 of 29)

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

~~COL 9.3(5) The COL applicant is to provide the flow diagram of turbine generator building drain system.~~

~~COL 9.3(5) The COL applicant is to provide the flow diagram of turbine generator building drain system and the CCW heat exchanger building drain system.~~

COL 9.3(5)
The COL applicant is to provide the flow diagram of turbine generator building drain system and the interconnection from the auxiliary boiler building sump, and the flow diagram of CCW heat exchanger building drain system to LWMS or turbine generator building (TGB) sump.

related equipment since the non-safety-related component in safety-related areas such as reactor containment building and auxiliary building is designed as seismic Category II.

~~The COL applicant is to provide the flow diagram of turbine generator building drain system and the CCW heat exchanger building drain system. (COL 9.3(5))~~

9.3.3.2 System Description

The EFDS collects radioactive and potentially radioactive liquid wastes at atmospheric pressure from drainage of the reactor containment building, the auxiliary building, the compound building, and the turbine generator building. The liquid wastes are segregated, depending upon water quality and/or building, into four groups: equipment drainage, floor drainage, chemical drainage, and detergent drainage. Such drainages are conveyed by gravity to their respective building sumps and pumped to the LWMS. Chemical wastes collected from equipment decontamination and potentially chemical contamination wastes are sent to the chemical waste tanks of LWMS.

The EFDS consists of collection sumps, sump pumps, valves, piping, and instrumentation.

~~The COL applicant is to provide the flow diagram of turbine generator building drain system. (COL 9.3(5)).~~

9.3.3.2.1 General Description

The EFDS consists of several subsystems, as described below. Areas of the plant are served by the appropriate EFDS, based on the potential source of leakage into the subject area. This allows segregation of radioactive and non-radioactive sources. The schematic diagram of radioactive drainage system (RDS) is shown in Figures 9.3.3-1.

9.3.3.2.2 Radioactive Drainage Areas

The RDS collects radioactive and potentially radioactive liquid wastes at atmospheric pressure from equipment and floor drainage of the containment building, auxiliary building, and compound building. Such drainage is conveyed by gravity to sumps and pumped from sumps to the LWMS.

Chemical wastes are collected from equipment decontamination and sent to the LWMS chemical waste tanks. Potentially radioactive wastes from personnel decontamination shower facilities are collected and pumped to the detergent waste tanks of LWMS. Potentially radioactive wastewater entering the sump located in the condensate polishing

The COL applicant is to provide the flow diagram of turbine generator building drain system and the interconnection from the auxiliary boiler building sump, and the flow diagram of CCW heat exchanger building drain system to LWMS or turbine generator building (TGB) sump.(COL 9.3(5))

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Operations and Documentation

a. The EFDS is designed for automated operation. The sumps are designed with dual-level instruments to provide reasonable assurance of a safe operation. A high level signal initiates liquid transfer with one pump. If the liquid level continues to rise, a high-high signal initiates additional liquid transfer with the secondary pump. Level signals are transmitted to the MCR for monitoring and operator response.

b. Adequate space is provided in the vicinity of the sumps to enable prompt assessment and responses when required.

c. The TGB sumps are designed with radiation monitors that are interlocked with the discharge valves to provide the proper routing of the contaminated fluid.

~~The COL applicant is to provide the flow diagram of turbine generator building drain system (COL 9.3(5)).~~

d. The COL applicant is to provide operational procedures and maintenance programs as related to leak detection and contamination control (COL 9.3 (1)). Procedures and maintenance programs are to be completed before fuel is loaded for commissioning.

~~The COL applicant is to provide the flow diagram of turbine generator building drain system and the CCW heat exchanger building drain system. (COL 9.3(5))~~

e. The COL applicant is to maintain complete documentation of the system design, construction, design modifications, field changes, and operations (COL 9.3 (2)). Documentation requirements are included as a COL information item.

Site Radiological Environmental Monitoring

a. Fluids collected in non-radioactive drainage areas generally have low potential for radioactive contamination as condensate and feedwater are continuously polished by ion exchange to keep radiation contamination low. The turbine generator building and miscellaneous building drainage systems are designed to provide continuous monitoring of drain routing and to prevent the spread of contamination. As the contamination level is low, environmental radiation monitoring for the nonradioactive drainage systems is not effective.

b. The RDS is designed to handle radioactive fluids, and the sumps are located at

The COL applicant is to provide the flow diagram of turbine generator building drain system and the interconnection from the auxiliary boiler building sump, and the flow diagram of CCW heat exchanger building drain system to LWMS or turbine generator building (TGB) sump. (COL 9.3(5))

activity. The process radiation monitor serves only as a trending device to alert the operator of possible fuel cladding failure.

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9.3.4.5.6 Boronometer

The boronometer provides indication and a continuous recording in the MCR of reactor coolant boron concentration. High and low alarms warn the operator of deviations from the required boron concentration in the reactor coolant. The principle of operation is neutron absorption. The unit is provided with shielding as required to limit the maximum external radiation level from its source to a low value. All portions of the unit that contact reactor coolant are constructed of austenitic stainless steel. Refer to Subsection 7.7.1.1 for further information on the boron control system.

9.3.5 Combined License Information

COL 9.3(1) The COL applicant is to prepare operational procedures and maintenance programs as related to leak detection and contamination control.

COL 9.3(2) The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.

COL 9.3(3) The COL applicant is to prepare the site radiological environmental monitoring program.

COL 9.3(4) The COL applicant is to provide the supply systems of the nitrogen gas subsystem, the hydrogen subsystem, the carbon dioxide subsystem, and the breathing air systems.

9.3.6 References

~~COL 9.3(5) The COL applicant is to provide the flow diagram of turbine generator building drain system.~~

1. 10 CFR 50.63, "Station Blackout Rule," U.S. Nuclear Regulatory Commission.

2. ANSI/ISA 7.0.01-1996, "Quality Standard for Instrument Air," International Society of Automation, 1996.

~~COL 9.3(5) The COL applicant is to provide the flow diagram of turbine generator building drain system and the CCW heat exchanger building drain system.~~

COL 9.3(5) The COL applicant is to provide the flow diagram of turbine generator building drain system and the interconnection from the auxiliary boiler building sump, and the flow diagram of CCW heat exchanger building drain system to LWMS or turbine generator building (TGB) sump.

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f. Boric acid concentrator package and gas stripper package in the chemical and volume control system

g. Decontamination services in the reactor containment building and fuel handling area

h. Solid radwaste system (SRS) for heating SRS concentrates treatment system

Condensate from the boric acid concentrator package, gas stripper package, and solid waste treatment system is collected in the condensate receiver tank and transferred to the condenser if the source of steam is from the MSS, or to the auxiliary boiler if the source of steam comes from the auxiliary boiler by using the condensate return pumps. Any condensate that flashes inside the condensate receiver tank is condensed in the attached vent condenser and then returns to the condensate receiver tank.

upstream

At the ~~discharge~~ of the condensate return pump, the condensate is monitored continuously for radioactivity. If contaminated, the radiation monitor actuates an alarm in the MCR and automatically diverts the radioactive or potentially radioactive condensate to the liquid radwaste system.

Condensate from the others is collected at the condenser because it is considered non-potentially radioactive condensate.

The auxiliary boiler is located inside the auxiliary boiler building in yard area, and makeup water to the auxiliary boiler is provided from the makeup demineralizer system.

10.4.10.2.2 System Operation

The auxiliary boiler supplies saturated steam at 16.2 kg/cm^{2}A (230 psia) to the auxiliary steam header during plant startup, cleanup/recirculation, and shutdown when main steam is not available.

During plant normal operation, the main steam system of the unit provides steam to the auxiliary steam header. When main steam is used as the source of auxiliary steam, the

actions, and a signal is sent to open the condensate transfer valves to the LWMS for treatment and release. This design approach minimizes cross-contamination to other components.

Decommissioning Planning

a. The SSCs are designed for the full service life and are fabricated as individual assemblies for easy removal.

b. The SSCs are designed with decontamination capabilities. Demineralized water is provided for makeup as well as for decontamination. Design features such as welding techniques used and surface finishes are intended to minimize the need for decontamination, and hence reduce waste generation.

c. The auxiliary steam system is designed with no embedded or buried piping, thus preventing unintended contamination due to leaking of buried or embedded piping. Yard piping is routed in an underground concrete tunnel that is designed with a leakage collection sump, level switch, and pump. An alarm is also provided in the MCR for operator actions in the event of detection of liquid.

Operations and Documentation

a. The auxiliary steam system is designed with adequate instrumentation for automatic operation with manual initiation. The boiler is a self-contained vendor package complete with its own instrumentation. Operation of the boiler operation is controlled from a local panel but with remote shutdown at low fuel oil level, or at operator initiation from the MCR.

b. The auxiliary steam system condensate receiver tank, vent condenser, and pumps are located in an enclosed cubicle inside the auxiliary building, and the boiler is located in an independent auxiliary boiler building for separation purposes. Adequate ingress and egress spaces are provided for prompt assessments and appropriate responses when and where they are needed.

c. The Auxiliary Boiler Blowdown and drains are routed to the Auxiliary Boiler Building Sump and then are routed to the turbine generator building (TGB) sump for radiation monitoring. When contamination level of the drains is detected and exceeds a predetermined setpoint, they are routed to the LWMS for processing and release via the condensate polishing area sump.

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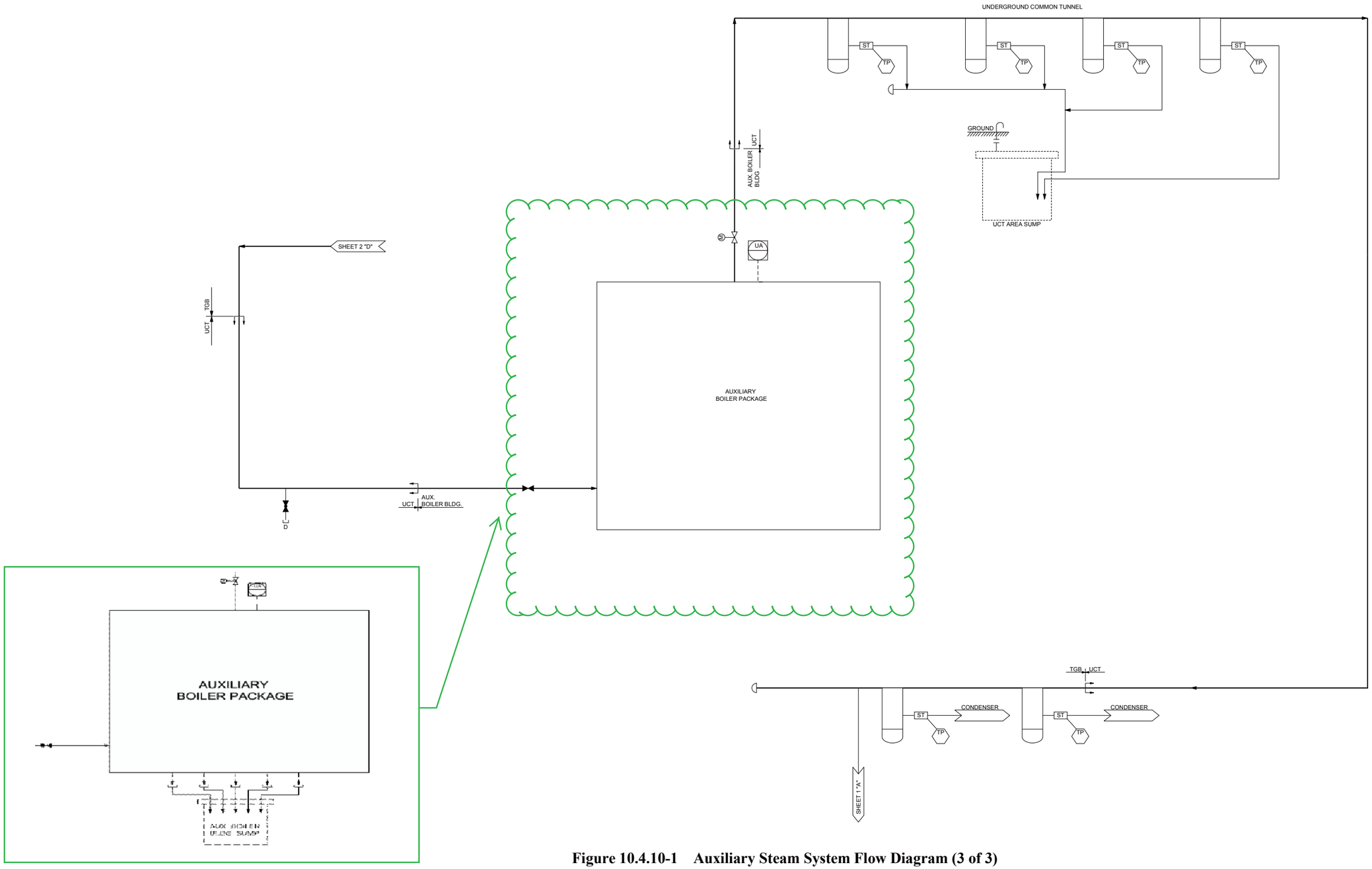

Figure 10.4.10-1 Auxiliary Steam System Flow Diagram (3 of 3)