9.0 AUXILIARY SYSTEMS

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements as identified in the following sections.

9.1 FUEL STORAGE AND HANDLING

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

9.1.1 CRITICALITY SAFETY OF NEW AND SPENT FUEL STORAGE AND HANDLING

9.1.1.1 Design Bases

No departures or supplements.

9.1.1.2 Facilities Description

No departures or supplements.

9.1.1.3 Safety Evaluation

The U. S. EPR FSAR includes the following COL Item in Section 9.1.1.3:

> A COL applicant that references the U.S. EPR design certification will demonstrate that the design satisfies the criticality analysis requirements for the new and spent fuel storage racks, and describe the results of the analyses for normal and credible abnormal conditions, including a description of the methods used, approximations and assumptions made, and handling of design tolerances and uncertainties.

This COL Item is addressed as follows:

{The design and analyses for the new and spent fuel storage racks will be incorporated into a future revision to the U.S. EPR FSAR which will incorporate additional analyses to bound the site-specific conditions at Callaway Plant Unit 2}.

9.1.1.4 References

{No departures or supplements.}

9.1.2 NEW AND SPENT FUEL STORAGE

No departures or supplements.

9.1.2.1 Design Bases

No departures or supplements.

9.1.2.2 Facilities Description

9.1.2.2.1 New Fuel Storage

The U. S. EPR FSAR includes the following COL Item in Section 9.1.2.2.1:

> A COL applicant that references the U.S. EPR design certification will describe the new fuel storage racks, including a description of confirmatory structural dynamic and stress analyses.

This COL Item is addressed as follows:

{The design and analyses for the new and spent fuel storage racks will be incorporated into a future revision to the U.S. EPR FSAR which will incorporate additional analyses to bound the site-specific conditions at Callaway Plant Unit 2}.

9.1.2.2.2 Spent Fuel Storage

The U. S. EPR FSAR includes the following COL Item in Section 9.1.2.2.2:

> A COL applicant that references the U.S. EPR design certification will describe the spent fuel storage racks, including a description of confirmatory structural dynamic and stress analyses and thermal-hydraulic cooling analyses.

This COL Item is addressed as follows:

{The design and analyses for the new and spent fuel storage racks will be incorporated into a future revision to the U.S. EPR FSAR which will incorporate additional analyses to bound the site-specific conditions at Callaway Plant Unit 2}.

9.1.2.3 Safety Evaluation

No departures or supplements.

9.1.2.4 Inspection and Testing Requirements

No departures or supplements.

9.1.2.5 Instrumentation Requirements

No departures or supplements.

9.1.2.6 References

{No departures or supplements.}

9.1.3 SPENT FUEL POOL COOLING AND PURIFICATION SYSTEM

No departures or supplements.

9.1.4 FUEL HANDLING SYSTEM

No departures or supplements.

9.1.5 OVERHEAD HEAVY LOAD HANDLING SYSTEM

No departures or supplements.

9.1.5.1 Design Basis

No departures or supplements.

9.1.5.2 System Description

9.1.5.2.1 General Description

No departures or supplements.

9.1.5.2.2 Reactor Building Polar Crane

No departures or supplements.

9.1.5.2.3 Fuel Building Auxiliary Crane

No departures or supplements.

9.1.5.2.4 Other Overhead Load Handling Systems

No departures or supplements.

9.1.5.2.5 System Operation

The U. S. EPR FSAR includes the following COL Item in Section 9.1.5.2.5:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information on the heavy load handling program, including a commitment to procedures for heavy load lifts in the vicinity of irradiated fuel or safe shutdown equipment, and crane operator training and qualification.

This COL Item is addressed as follows:

Procedures

Administrative procedures to control heavy loads shall be developed prior to fuel load to allow sufficient time for plant staff familiarization, to allow NRC staff adequate time to review the procedures, and to develop operator licensing examinations. Heavy loads handling procedures address the following:

- Equipment identification.
- Required equipment inspections and acceptance criteria prior to performing lift and movement operations.
- Approved safe load paths and exclusion areas.
- Safety precautions and limitations.
- Special tools, rigging hardware, and equipment required for the heavy load lift.
- Rigging arrangement for the load.
- Adequate job steps and proper sequence for handling the load.

Safe load paths are defined for movement of heavy loads to minimize the potential for a load drop on irradiated fuel in the reactor vessel or spent fuel pool or on safe shutdown equipment. Paths are defined in procedures and equipment layout drawings. Safe load path procedures address the following general requirements.

- When heavy loads must be carried directly over the spent fuel pool, reactor vessel or safe shutdown equipment, procedures will limit the height of the load and the time the load is carried.
- When heavy loads could be carried (i.e., no physical means to prevent) but are not required to be carried directly over the spent fuel pool, reactor vessel or safe shutdown

equipment, procedures will define an area over which loads shall not be carried so that if the load is dropped, it will not result in damage to spent fuel or operable safe shutdown equipment or compromise reactor vessel integrity.

- Where intervening structures are shown to provide protection, no load travel path is required.
- Defined safe load paths will follow, to the extent practical, structural floor members.
- When heavy loads movement is restricted by design or operational limitation, no safe load path is required.
- Supervision is present during heavy load lifts to enforce procedural requirements.

Inspection and Testing

Cranes addressed in U.S. EPR FSAR Section 9.1.5 are inspected, tested, and maintained in accordance with ASME B30.2 (ASME, 2005), with the exception that tests and inspections may be performed prior to use for infrequently used cranes. Prior to making a heavy load lift, an inspection of the crane is made in accordance with the above applicable standards.

Training and Qualification

Training and qualification of operators of cranes addressed in U.S. EPR FSAR Section 9.1.5 meet the requirements of ASME B30.2 (ASME, 2005), and include the following:

- Knowledge testing of the crane to be operated in accordance with the applicable ANSI crane standard.
- Practical testing for the type of crane to be operated.
- Supervisor signatory authority on the practical operating examination.
- Applicable physical requirements for crane operators as defined in the applicable crane standard.

Quality Assurance

Procedures for control of heavy loads are developed in accordance with Section 13.5. In accordance with Section 17.5, other specific quality program controls are applied to the heavy loads handling program, targeted at those characteristics or critical attributes that render the equipment a significant contributor to plant safety.

9.1.5.3 Safety Evaluation

No departures or supplements.

9.1.5.4 Inspection and Testing Requirements

No departures or supplements.

9.1.5.5 Instrumentation Requirements

No departures or supplements.

9.1.5.6 References

{**ASME, 2005**. Overhead and Gantry Cranes – Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist, ASME B30.2, American Society of Mechanical Engineers, 2005.

NRC, 1980. Control of Heavy Loads at Nuclear Power Plants, NUREG-0612.}

9.2 WATER SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

9.2.1 ESSENTIAL SERVICE WATER SYSTEM

No departures or supplements.

9.2.1.1 Design Bases

{The Callaway Plant Unit 2 site-specific environmental conditions were determined using the guidance of Regulatory Guide 1.27 (NRC, 1976).

The maximum evaporation loss from the ESWS cooling towers in the standard design is bounding for the analysis performed using Callaway Plant Unit 2 site metrological data for 72 hours.

The Essential Service Water System (ESWS) cooling towers for Callaway Plant Unit 2 are designed in accordance with Regulatory Guide 1.27 guidance and the requirements of U.S. EPR FSAR Table 2.1-1. The tower size is thus based on a wet bulb temperature of 81°F (27°C) with a coincident 115°F (46°C) dry bulb temperature. The wet bulb temperature includes a 1°F (0.5°C) addition for "interference" due to each pair of ESW cooling towers' close proximity to each other.

Based on the analysis of the Ultimate Heat Sink (UHS) with local meteorological data, Callaway Plant Unit 2 is bounded by the standard design maximum basin temperature 95°F (35°C), following a postulated DBA and the maximum evaporative loss of the ESW cooling towers is 571 gpm (2161 lpm), during design basis accident conditions, as described in the U.S. EPR FSAR Table 2.1-1.

Section 2.3.1.2.2.13 provides site specific meteorological data considered for determining bounding evaporation, cooling, and freezing analysis.}

9.2.1.2 System Description

No departures or supplements.

9.2.1.3 Component Description

No departures or supplements.

9.2.1.4 Operation

No departures or supplements.

9.2.1.5 Safety Evaluation

No departures or supplements.

9.2.1.6 Inspection and Testing Requirements

No departures or supplements.

9.2.1.7 Instrumentation Requirements

No departures or supplements.

9.2.1.8 References

{**NRC, 1976**. Ultimate Heat Sink for Nuclear Power Plants (for Comment), Regulatory Guide 1.27, Revision 2, U. S. Nuclear Regulatory Commission, January 1976.}

9.2.2 COMPONENT COOLING WATER SYSTEM

No departures or supplements.

9.2.3 DEMINERALIZED WATER DISTRIBUTION SYSTEM

No departures or supplements.

9.2.4 POTABLE AND SANITARY WATER SYSTEMS (PSWS)

{The U.S. EPR FSAR describes the Potable and Sanitary Water System as a single system. While the function will remain the same, Callaway Plant Unit 2 classifies these as two systems: the Potable Water System; and the Sanitary Waste Water System.

The Potable Water System delivers drinking quality water to various points throughout the plant, to individual components and for use as process water in other systems. Potable water is used for human consumption, sanitation and cleaning, and other domestic and process purposes inside the Nuclear Island (NI), Turbine Island and Balance of Plant.

The Sanitary Waste Water System collects water discharged from water closets, urinals, showers, sinks and other sources of sanitary water and, with the exception of sources within the radiologically controlled area (RCA), directs it via the domestic waste water collection system through the sewage treatment system for processing. The sanitary water from sources within the RCA is directed to the Liquid Radwaste System by the NI Vents and Drains system.

9.2.4.1 Design Basis

The Potable Water System supplies potable water for human consumption, cleaning and other domestic purposes, plus process water to other systems, during periods of normal operation, shutdown, maintenance and construction. The Potable Water System provides potable water at a flow rate sufficient to meet demand and keep potable water pressure above that of connected SSCs. Potable water supplied to, and equipment provided for, emergency eyewash stations and emergency showers complies with the requirements of ANSI Z358.1, Emergency Eyewash and Shower Equipment (ANSI, 2004).

The Sanitary Waste Water System conveys sanitary wastes from their point of origin, and provides necessary treatment of the non-radiologically contaminated waste water, during periods of normal operation, shutdown, maintenance and construction. Where piping for the Sanitary Waste Water System is buried, provisions are made to assure adequate separation from Potable Water System piping. Where local conditions prevent this separation, controls on layout and installation provide similar assurance of protection of potable water from contamination.}

9.2.4.2 System Description

9.2.4.2.1 General Description

The U.S. EPR FSAR includes the following COL Item in Section 9.2.4.2.1:

> A COL applicant that references the U.S. EPR design certification will provide site-specific details related to the sources and treatment of makeup to the PSWS along with a simplified piping and instrumentation diagram.

This COL Item is addressed as follows:

{Potable Water System

The Potable Water System is shown schematically in Figure 9.2-1. It provides potable-grade water throughout the plant, for human consumption, cleaning and sanitation, and other domestic and selected process purposes. The Potable Water System supplies water that meets the requirements of local, state and federal codes and specifications regarding potability. The system is designed to satisfy peak anticipated demand for potable water, including hot water, during all phases of plant operation.

The Potable Water System consists of treatment of incoming water from a deep well for potability, a potable water storage tank, pressure maintenance pumps, distribution piping and valves, water heaters, and electrical components and instrumentation for system monitoring, operation and control.

Clean water is supplied to the system from the deep well, with the water chemically treated to ensure its potability in the potable water storage tank.

Sanitary Waste Water System

The Sanitary Waste Water (SWW) System is shown schematically in Figure 9.2-2.

Sanitary waste water or sanitary water is the term applied to the drainage from water closets, urinals, showers, bathroom/washroom sinks, kitchen and janitorial sinks, clothes washing and dish washing machines. Sanitary waste loading usually includes biological waste (including fecal matter), soaps, cooking grease and food scraps. However, at Callaway Plant Unit 2, the sanitary waste stream is processed in two different ways depending on the source, due to differing contaminants.

The following locations within the NI have sanitary waste streams that have the potential to contain radioactive material. However, because these particular waste streams do not contain biological waste, cooking grease or food scraps, it is acceptable to collect them in the NI Vents and Drains System and direct them to the Liquid Waste Management System for processing as potentially radioactive waste:

- Personnel decon showers and decon sinks in the Access Building.
- Contaminated laundry facility in the Radioactive Waste Processing Building.

U.S. EPR FSAR Section 9.3.3 provides a discussion of the NI Vents and Drains System. The Liquid Waste Management System is discussed in U.S. EPR FSAR Section 11.2.

The following locations within the NI have sanitary waste water streams that are directed to the Sanitary Waste Water System, because they have no connections to systems with the potential to carry radioactive materials:

FSAR: Chapter 9.0

- Water closets, urinals, hand wash sinks and personnel showers in the following areas:
  - Non-radiologically controlled area (non-RCA) in the Access Building.
  - Non-RCA in the Safeguards Buildings.
- Sink and dishwasher in the kitchen in Safeguards Building 2.
- Hand wash sinks in the Emergency Power Generating Buildings 1 through 4.

The waste stream from each of these locations/components is collected by the Sanitary Waste Water System and flows to collection pits or tanks, from which it is pumped to the sewage lagoons.

The flow through sewage treatment lagoons consists of three separate unaerated lagoons. The sewage treatment lagoon system is designed and constructed in accordance with the Missouri Code of State Regulations, 10 CSR 20 - Chapter 8 (10 CSR 20). The effluent from the lagoons is discharged to the sewage treatment wetlands. The sewage treatment wetlands are located at the former site of Callaway Plant Unit 1 water treatment plant sludge lagoons #1 & #2. The wetlands are now used as a polishing area for the SWW system to complete the treatment process. Effluent from the wetlands is recycled to cooling tower makeup.

9.2.4.2.2 Component Description

Potable Water System

Potable Water Source

Clean water is supplied to the Potable Water System from a deep well.

Potable Water Storage Tank

The potable water storage tank has a usable volume sufficient to accommodate demand surges during peak periods of potable water usage. It is equipped with isolable inlet and outlet lines, an overflow line and a vent, as well as instrumentation for level control, indication and alarm functions. The tank is constructed of material compatible with drinking-quality water.

Pressure Maintenance Pumps

Pumps and pressure control valves are provided to maintain system pressure within the prescribed operating range. These pumps are made of materials compatible with drinking-quality water. Each pump is equipped with a discharge check valve and suction and discharge isolation valves.

Piping and Valves

Branch connections to equipment, including hose bibs, or to other systems are individually isolable and are equipped with backflow preventers to prevent backflow and potential contamination of the Potable Water System. Connections to sinks or showers do not require backflow preventers, because there is an air gap between the potable water and the receiving drains. However, siphon breakers are installed where needed.

Water Heaters

Water heaters are provided for showers, wash and janitorial sinks, lunchroom, kitchen, laundry, and eyewash stations, and are sized, installed and controlled in such fashion as to supply on-demand hot water. Eyewash stations and emergency showers also include pre-set temperature control valves to deliver tepid water, per OSHA requirements.

Sanitary Waste Water System

Piping and Valves

Sanitary waste water piping is sized for peak anticipated loading during outage periods and as required to meet national and local plumbing code requirements.

Collection Pits and Tanks

Sanitary waste collection pits are concrete lined with steel.

9.2.4.2.3 Operations

No departures or supplements.

9.2.4.3 Safety Evaluation

Potable Water System

The Potable Water System is not a safety-related system. Therefore, it does not require a safety evaluation with respect to plant design basis events.

With respect to compliance with Criterion 60 of Appendix A to 10 CFR 50 (CFR, 2008), the Potable Water System is not connected to any components or other systems that have the potential to carry radiological material, nor do any systems discharge to it. Further, under normal operating conditions, system pressure is maintained above the pressure of supplied components or systems, thus preventing backflow from that supplied component / system.

In addition, a backflow preventer and isolation valve are provided at "hard" connections to supplied components or systems, including hose bibs. These devices are on the potable water side of the connection to prevent backflow under abnormal, reversed differential pressure conditions.

At sinks or showers, an air gap between the potable water supply and the receiving drain prevents possible contamination from backflow. There are also siphon breakers where necessary on supply risers.

With respect to flooding concerns, the potable water storage tank is located such that even its catastrophic failure would not threaten the functionality of safety-related SSCs. Intervening topography and site drainage configuration would direct released water away from areas where it might otherwise cause damage. Site flooding is discussed in Section 2.4.10.

Sanitary Waste Water System

The Sanitary Waste Water System provides no safety-related function. Therefore, it does not require a safety evaluation with respect to design basis events.

Sanitary waste water from decon showers, decon sinks and the laundry in the Access Building is directed to the Liquid Waste Management System, through the NI Vents and Drains System. Although drainage from showers, sinks and laundry is typically classified as sanitary water, the decon showers and sinks are used exclusively for radiological decontamination of personnel, and the laundry is used for personnel anti-contamination clothing and equipment (e.g., respirators). This does not result in biological waste loading, and is acceptable for forwarding to the Liquid Waste Management System.

With respect to compliance with Criterion 60 of Appendix A to 10 CFR 50, sanitary waste piping in the Access Building leads from the non-RCA through the portion of the Sanitary Waste Water

System that collects domestic waste water. This sanitary waste piping is completely separate from the NI Vents and Drains system. Further, the portion of the Sanitary Waste Water System that collects domestic waste water in the Access Building, the Safeguards Buildings, and outside (underground) areas in the NI is not connected to any other system, so there is no potential for inadvertent introduction of radioactive material. The remainder of the Sanitary Waste Water System is outside the NI portion of the plant, and does not connect to any system or equipment that has the potential to carry/contain radiological contamination.

With respect to flood protection:

- The sanitary waste water collection pits or tanks are located at or below grade and in areas that are separated from safety-related SSCs. The drain lines from these pits or tanks are embedded in floor slabs and run underground outside the buildings. Inside the buildings, flooding from pits, tanks or broken sanitary lines will be effectively controlled by building floor drain systems that are designed to handle larger flows from, for example, the Fire Protection System (refer to U.S. EPR FSAR Section 9.3.3 for discussion of floor drains). Therefore, failures of the Sanitary Waste Water System, including failures of pits or tanks, will not jeopardize safety functions by flooding.

- The sewage lagoons and wetlands are physically separated and located down-grade from safety related SSCs. In addition, buildings that house safety related SSCs are constructed with ground floor slabs elevated above grade and with surrounding site drainage established to direct potential flood waters away, as described in Section 2.4.10. Therefore, the lagoons and wetlands will not jeopardize safety functions by flooding.

9.2.4.4 Inspection and Testing Requirements

Potable Water System

Once the system is placed in service, periodic routine sampling of the water provides ongoing verification of potability.

Sanitary Waste Water System

The Sanitary Waste Water System is visually inspected to verify installation in accordance with design drawings and documents, and functionally tested to demonstrate proper system operation.

9.2.4.5 Instrumentation Requirements

Instrumentation includes level, temperature, pressure and flow as required for process automation, and for the visual and audible indication and alarms necessary for monitoring of system performance.

9.2.4.6 References

This section is added as a supplement to the U. S. EPR FSAR.

ANSI, 2004. Emergency Eyewash and Shower Equipment, ANSI Z358.1, American National Standards Institute, 2004.

CFR, 2008. Control of Releases of Radioactive Materials to the Environment, Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 60, U. S. Nuclear Regulatory Commission, 2008.

10 CSR 20 - Chapter 8. Department of Natural Resources, Division 20 - Clean Water Commission Chapters - Design Guides.}

9.2.5 ULTIMATE HEAT SINK

No departure or supplements.

9.2.5.1 Design Basis

{ESWS support systems are schematically represented in Figure 9.2-3. Normal essential service water makeup provides up to 940 gpm (3560 lpm) of water to each operating ESWS cooling tower basin to replenish ESWS inventory losses due to evaporation, blowdown, drift, and incidental system leakage during normal operations and shutdown/cooldown. ESWS cooling tower blowdown discharges up to 470 gpm (1780 lpm) of water from each operating ESWS cooling tower basin to the plant blowdown line to maintain ESWS chemistry. This quantity is based on maintaining two cycles of concentration in the cooling tower basin, plus evaporative losses during shutdown and cooldown, with ambient conditions at 81° F (27° C) design wet bulb temperature and coincident 115° F (46° C) dry bulb temperature.

After a design basis accident, the Essential Service Water Emergency Makeup System (ESWEMS), schematically represented in Figure 9.2-3, provides up to 400 gpm (1515 lpm) of water to each operating ESWS cooling tower basin to replenish ESWS inventory losses due to evaporation, drift, and incidental system leakage starting 72 hours post-accident. The ESWEMS makeup flow rate to the ESWS cooling tower basins exceeds the required makeup to replace losses, including maximum evaporative losses due to ambient conditions matching the historical worst case 30-day period for the Callaway site.

The makeup water supply available for the ESWEMS is contained in a safety-related retention pond. The pond is sized considering losses due to either calculated ice cover or evaporative from using the worst case 30-day period and accounting for seepage. The worst case 30-day period for pond evaporation is depicted in Table 2.3-103.

The ESWS makeup chemical treatment system provides a means for adding chemicals to the ESWEMS makeup water and to the normal ESWS makeup water. This is done to limit corrosion, scaling, and biological contaminants in order to minimize component fouling.}

9.2.5.2 System Description

The U. S. EPR FSAR includes the following COL Item in Section 9.2.5.2:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information for the UHS support systems such as makeup water, blowdown and chemical treatment (to control biofouling).

This COL Item is addressed as follows:

{Sections 9.2.5.2.1 through 9.2.5.2.4 are added as a supplement to the U. S. EPR FSAR.

9.2.5.2.1 Normal ESWS Makeup

Normal ESWS makeup water is provided to the ESWS cooling tower basins using treated water from the site Water Treatment Plant (WTP). FSAR Section 9.2.9 provides additional discussion of the Raw Water Supply System.

Normal ESWS makeup water is delivered from the Water Treatment Plant to the power block area. A separate line feeds each ESWS division. Each ESWS division's normal makeup line ties into its ESWS emergency makeup line through a safety-related motor operated valve (MOV) in the ESWS pumphouse at the ESWS cooling tower basin. The tie-in point is inboard of (or downstream of the ESWEMS isolation MOV. The safety-related normal makeup water isolation MOV ensures the integrity of the ESWS cooling tower basin and the ESWEMS by closing in the event of a design basis accident (DBA).

9.2.5.2.2 Blowdown

Blowdown from the ESWS cooling tower basins is a non-safety related function. The site-specific normal blowdown arrangement for each ESWS cooling tower basin includes a line that runs from the ESWS pump's discharge piping to the circulating water system blowdown line which is routed to the Missouri River.

The blowdown connection at the ESWS pump discharge is made through a safety related MOV that closes automatically in the event of a DBA to ensure ESWS integrity.

An alternate blowdown path is provided from the same pump discharge connection through a second safety-related MOV in case the normal path is unavailable.

Under normal operating conditions and shutdown/cooldown conditions, the normal blowdown valves control blowdown flow from their ESWS trains to the circulating water system blowdown piping to help ensure cooling water chemistry remains within established limits.

During a DBA, blowdown flow can be manually controlled from the main control room by adjustment of the safety-related MOV.

9.2.5.2.3 Essential Service Water Emergency Makeup System

Emergency makeup water for the ESWS is provided by the site-specific, safety-related Essential Service Water Emergency Makeup System (ESWEMS) that draws water from a site specific ESWEMS retention pond. Makeup water enters the ESWEMS Pumphouse through bar screens that remove large debris and trash that may be entrained in the flow.

The ESWEMS Pumphouse is shown in Figure 9.2-8 through Figure 9.2-14.

There are four independent ESWEMS trains, one for each ESWS division. Each parallel train is structurally isolated by concrete walls within the pumphouse structure. Each train consists of one vertical wet pit pump, a discharge check valve, a self-cleaning automatic strainer, a pump discharge isolation valve (all housed in the ESWEMS Pumphouse), and the buried piping running up to and into the UHS Cooling Tower at the ESWS cooling tower basin. The ESWEMS isolation MOV is located inside the UHS Cooling Tower at the connection to the ESWS cooling tower basin.

In addition, each train has a surveillance test recirculation line that runs from just upstream of the isolation valve in the ESWEMS Pumphouse, through a safety-related MOV, to the ESWEMS retention pond. The latter safety-related MOV is normally closed and, if open, the valve will close upon an actuation signal post accident. The MOV can be used to modulate flow of water back to the retention pond to allow the ESWEMS pumps to operate within their optimum range.

Instrumentation and controls are provided for monitoring and controlling individual components and system functions.

The ESWEMS pump, check valve, and strainer for each train are located in one of four separate bays in the ESWEMS Pumphouse. The associated electrical switchgear and equipment for each train's pump and MOV is similarly housed in the same bay as its corresponding train.

9.2.5.2.4 ESWS Makeup Water Chemical Treatment

Normal makeup water to the ESWS cooling towers or to the ESWEMS retention pond is from a treated water source. Specific chemistry requirements are defined to minimize corrosion, prevent scale formation, and limit biological and sedimentary fouling that could inhibit ESWS makeup water flow.

The ESWS makeup water chemical treatment system allows the addition of chemical additives used in the ESWS cooling towers to reduce scaling and corrosion, and to treat potential biological contaminants. Chemical additives are injected via the normal ESWS piping. The treatment system consists of multiple skid-mounted arrangements, one for each division's ESWS cooling tower and at least one for the ESWEMS makeup water treatment. Each skid contains the equipment, instrumentation, and controls to fulfill the system's function of both monitoring and adjusting water chemistry. The root valves at the connections of chemical addition and other lines to the normal ESWS piping or ESWEMS are safety-related as necessary to ensure the integrity of the piping during and following a DBA.

Provision is included to allow further chemical treatment directly to the ESWEMS retention pond, as needed to treat biological contaminants. The ESWEMS pumps can provide limited recirculation of the water contained in the ESWEMS retention pond.

The specific chemicals and addition rates are determined by periodic water chemistry analyses. The chemicals are divided into six categories, based on function:

- biocide - prevents buildup of potentially damaging aquatic life, such as zebra mussels, and controls bacterial growth in the ESWS cooling towers (particularly Legionellae).
- algaecide - prevents buildup of potentially damaging algae and plant growth.
- pH adjuster - counteracts the acidic effects of the algaecide.
- corrosion inhibitor - prevents corrosion of piping and components.
- scale inhibitor - prevents buildup of scale and mineral deposits that could inhibit process flow.
- silt dispersant - prevents buildup of hard silt deposits.

Additions to the ESWS cooling towers are made as necessary on a periodic or continuing basis. The additions to the ESWEMS pond are made coincident with surveillance test runs, or as otherwise needed.

9.2.5.3 Component Description

Normal ESW Makeup Isolation Valves

The normal ESWS Makeup Water System isolation valves are safety-related MOVs designed to ASME Section III, Class 3 requirements, and made of materials compatible with the ESWS and ESWEMS water.

ESWEMS Pumphouse Bar Screens

The ESWEMS Pumphouse includes four bar screens, one in each bay. These screens are designed to Seismic Class II requirements. They prevent debris from passing into the ESWEMS pumps. The influent flow past the bar screens is not sufficient enough to warrant an automatic screen wash system. The bar screens have a large enough face area that potential blockage to the point of preventing the minimum required flow through them is not a concern. The screens are sufficiently submerged that frazil ice blockage is not a concern.

ESWEMS System Pumps

There are four vertical pumps, each rated at 400 gpm (1515 lpm). Each pump is driven by an electric motor, and is equipped with a discharge check valve and a manual isolation valve. They are designed to ASME Section III, Class 3 requirements, and constructed of materials compatible with the ESWEMS makeup water.

ESWEMS Isolation Valves

The ESWEMS isolation valves are safety related and designed to ASME Section III, Class 3 requirements, and are constructed of materials compatible with the ESWEMS makeup water.

ESWEMS Self Cleaning Strainers

There are four ESWEMS self-cleaning strainers, one on the discharge side of each ESWEMS pump. They are designed to ASME Section III, Class 3 requirements, and constructed of materials compatible with the ESWEMS makeup water.

The strainers remove debris from the process flow that could cause buildup in the ESWS Cooling Tower basins. Effluent from the strainers is returned to the retention pond through the ESWEMS strainer flushing line.

ESWEMS Piping

The safety related ESWEMS piping and fittings are designed to ASME Section III, Class 3 requirements, including normal operation and anticipated transient conditions. They are constructed of materials compatible with the ESWEMS makeup water.

ESWEMS Retention Pond

The ESWEMS retention pond is an excavation in existing soils. Embankments are provided for additional freeboard and as required to match higher topography, but are not necessary to maintain the required volume of water for emergency makeup.

The approximate dimensions of the pond at grade 840 feet (256 m) msl are 400 by 695 feet (122 x 212 m). The bottom of the pond elevation is nominal 818 feet (249 m) msl, and the side slopes are 3 horizontal to 1 vertical. The side slopes are protected by riprap from the surrounding grade elevation to 828 feet (252 m) msl. The normal water level in the pond is 17 feet (5.2 m) which corresponds to elevation 835 feet (254.5 m) msl. A reinforced concrete outlet structure is provided for outflow from the pond.

Approximately 76 acre-feet (93,700 m^3) of water is maintained below the ESWEMS Pond normal operational water level of 17 feet (5.2 m), elevation 835 feet (254.5 m) msl. The minimum required pond water level is 15 feet (4.6 m), elevation 833 feet (254 m) msl, which maintains a volume of approximately 65.2 acre-feet (80,400 m^3). The ESWEMS retention pond was sized for the design basis LOCA in accordance with NRC Regulatory Guide 1.27 assuming the ESWEMS begins providing makeup water 72 hours post-accident with two ESWS trains running. The total inventory loss from the ESWEMS retention pond during the 30 day period under the most limiting meteorological conditions (maximum evaporation conditions) was conservatively calculated to be 59.0 acre-feet (72,776 m^3). The worst case environmental conditions are described in Section 2.3.1.2.2.13. This inventory loss consists of the following calculated losses and design allowances: (a) 47.5 acre-ft (58,600 m^3) for cooling tower evaporation; (b) 9.7 acre-ft (11,965 m^3) for ESWEMS Pond loss to an ice cover; (c) 1.8 acre-ft (2,220 m^3) for ESWEMS pond seepage. ESWEMS pond inventory loss due to potential ice cover was found to bound losses due to evaporation. The total minimum volume of water remaining in the pond after 30 days is 6.2 acre-ft (7,648 m^3). The remaining water is usable, which provides a margin greater than 10% of the total volume required assuming that the pond is initially at the minimum fill elevation, or a margin of over 20% considering the pond initially at the normal fill elevation.

Degradation of the ESWEMS Pond due to silt buildup will not occur because of the normally quiet state of the pond and the composition of the in situ clay materials. Periodic surveillances will be used to ensure no significant silt buildup occurs.

Structural design of the ESWEMS retention pond is discussed in Section 3.8.4.

A non-safety related makeup line provides normal makeup water for the ESWEMS retention pond from the water treatment plant. Makeup water enters the pond at an elevation above the minimum required fill elevation to ensure it does not provide a drain path for the required pond volume. Plant procedures control makeup to the pond.

Chemical Treatment System Isolation Valves

These are safety-related valves at chemical treatment system connections to normal ESWS or ESWEMS piping that assure normal ESWS or ESWEMS integrity in the event of a DBA. They comply with the requirements of ASME Section III Class 3, and are constructed of materials compatible with the ESWS or ESWEMS water and the chemicals injected, as are the piping branches from the safety related piping to which they connect.

Chemical Treatment System Components

The components of the chemical treatment system upstream of the safety-related MOV are non-safety-related. They include:

Metering Pumps - These are positive displacement pumps capable of delivering adjustable, measured amounts of chemical product.

Tanks - These storage tanks are provided for each category of chemical.

Control Valves - These are needle valves that can be adjusted for precise control of the rate of chemical addition.

Sample Valves/Lines - These are several sample points located at representative points in the normal and emergency makeup piping for confirmatory sampling of makeup water chemistry.

pH Monitor - This device measures makeup water pH.

Conductivity Meter - This device measures makeup water conductivity.

All of these components are constructed of materials compatible with the chemicals utilized in the treatment system.

ESWS Cooling Tower Blowdown System Isolation Valves

These are safety-related MOVs that isolate blowdown at the branch connection on the ESWS pump discharge, for assurance of ESWS integrity in the event of an accident. The valves and the branch connections up to the valves are designed to ASME Section III, Class 3 requirements, and constructed of materials compatible with the blowdown water.

ESWS Cooling Tower Blowdown System Piping, Valves and Fittings

The ESWS Cooling Tower Blowdown System components downstream of the MOV are non-safety related. They are constructed of materials compatible with the blowdown water and are rated for system design conditions.

9.2.5.4 System Operation

9.2.5.4.1 Normal Operating Conditions

The normal ESWS makeup is supplied to the ESWS cooling tower basins using water from the Water Treatment Plant. The two operating ESWS trains have the normal makeup MOVs open, while the two standby trains normal makeup MOVs are closed.

Blowdown from each train is aligned to tie into the circulating water blowdown piping, with flow rate controlled by manual adjustment of the safety-related motor operated blowdown isolation valve.

The ESWEMS for each train is in standby, with the ESWEMS isolation MOV at the ESWS cooling tower basin closed. The bypass line's MOV is also closed.

Periodic surveillance testing is conducted to demonstrate ESWEMS operability, and includes addition of chemicals as necessary to maintain its water chemistry within the prescribed limits.

9.2.5.4.2 Abnormal Operating Conditions

On receipt of an accident signal, the normal ESWS Makeup Water System isolation MOVs that are open will close; those that are closed will remain closed. In addition, the ESWS cooling tower blowdown isolation valves will close, and any open safety-related valves in the chemical treatment system will close. None of these safety-related valves can be opened until the accident signal is cleared. Subsequent action is manually initiated from the control room or locally, based on operators' judgment resulting from prevailing conditions and indications. This includes initiating the ESWEMS to any and/or all ESWS cooling tower basins, as well as blowdown from any and/or all ESWS cooling tower basins.

9.2.5.5 Safety Evaluation

Normal ESWS makeup is a non-safety related function, and thus requires no safety evaluation with respect to design basis events. Similarly, both cooling tower blowdown and chemical treatment are non-safety related functions and require no safety evaluation. However, the connections to safety-related piping through which these functions are made and the accompanying isolation valves are safety-related, which ensures the integrity of the safety-related piping in the event of a DBA.

The ESWEMS function is to provide reliable makeup to the ESWS cooling tower basins, starting no later than 72 hours after receipt of an accident signal, to ensure that sufficient makeup flow is provided so the ESWS can fulfill its design requirement of shutdown decay heat removal for a minimum of 30 days following a DBA.

This function is assured because the ESWEMS:

- Is designed, procured, constructed and operated in accordance with the criteria for ASME Section III, Class 3 safety-related systems, structures and components, and

Seismic Category 1 requirements, including the tie-in piping and isolation valves for normal makeup, and chemical addition and sampling.

- Has four equivalent and completely independent trains, any two of which are capable of providing the required worst case makeup flow.
- Has an ESWEMS Pumphouse structure which is designed and built for protection against seismic and missile hazards.
- Maintains adequate NPSH for the ESWEMS pumps for the required duration of service.
- Has seismically qualified and installed (buried) piping runs from the ESWEMS Pumphouse to the individual ESWS cooling tower basins.
- Is treated to meet specified limits on system water chemistry in order to prevent potentially detrimental fouling of stagnant piping sections and surfaces.
- Is periodically performance tested and sampled to confirm operability and verify system water chemistry requirements.
- Has Seismic Category II bar screens large enough to preclude the occurrence of blockage so that minimum required flow can be maintained.
- Electrical power is supplied via Emergency Diesel Generators.

In addition, reconciliation of site-specific climatology data has demonstrated that the ESWS cooling tower performance maintains the ESWS temperature below the required 95° F (35° C).

9.2.5.6 Inspection and Testing Requirements

The ESWS support system components, including the safety-related motor operated isolation and control valves for makeup and blowdown, and the safety related isolation valves for chemical treatment and sampling, are procured and fabricated in accordance with the quality requirements for safety related ASME Section III, Class 3 systems, structures and components to ensure compliance with approved specifications and design documents.

Installation of individual components and overall system construction are inspected to verify as-built condition is in accordance with approved drawings. Performance testing upon completion of construction verifies the system's ability to perform its design safety function.

Finally, periodic surveillance testing of the system, including the safety-related isolation valves, provides continuing assurance of the system's ongoing capability to perform its design function. Surveillance testing includes system performance tests and inspection of individual components, as appropriate to their importance to system function and their tendency to degrade due to their operational conditions and environment.

9.2.5.7 Instrumentation Applications

Instrumentation is applied to the normal ESWS Normal Makeup Water System, ESWEMS and blowdown, to the extent necessary to monitor essential component conditions and verify real time system performance. This includes limit switches that provide remote position indication for valves. It also includes pressure, temperature and differential pressure sensors that provide local and remote display of system pressure, temperature and flow. In addition, temperature and amperage sensors can be used for indirect flow indication and direct indication of component status. ESWEMS retention pond level and temperature indication is provided in each pump bay.

System performance can also be assessed using level indication on the cooling tower basins.}

9.2.5.8 References

No departures or supplements.

9.2.6 CONDENSATE STORAGE FACILITIES

No departures or supplements.

9.2.7 SEAL WATER SUPPLY SYSTEM

No departures or supplements.

9.2.8 SAFETY CHILLED WATER SYSTEM

No departures or supplements.

9.2.9 RAW WATER SUPPLY SYSTEM

The U. S. EPR FSAR includes the following COL Item in Section 9.2.9:

> The RWSS and the design requirements of the RWSS are site-specific and will be addressed by the COL applicant.

This COL Item is addressed as follows:

{Raw water is the term applied to untreated water. At Callaway Plant Unit 2, raw water is supplied from the Missouri River/Missouri River Alluvial Aquifer by collector wells and is directed to the Water Treatment Plant. The Water Treatment Plant processes the raw water through chemical treatment and filtration and delivers normal makeup water to the Callaway Plant Unit 2 ESWEMS pond, the Essential Service Water System (ESWS) cooling tower(s), and the circulating water system cooling tower(s). Treated water will also provide emergency makeup to the fire protection system. The deep wells provide water suitable for various plant services, including the demineralized water system, the potable water system, and normal makeup for the fire protection system. This encompasses all of the plant water demands, with the exception of ESW emergency makeup.

Sections 9.2.9.1 through 9.2.9.7 are added as a supplement to the U. S. EPR FSAR.

9.2.9.1 Design Basis

No cross connections exist between raw groundwater supplied to the Water Treatment Plant and any system with the potential to carry radioactive material. This design requirement satisfies Criterion 60 of Appendix A to 10 CFR 50 (CFR, 2008).

Raw water from the collector wells is supplied to the Water Treatment Plant. Treated water is then supplied to the Callaway Plant Unit 2 circulating water system cooling towers and Essential Service Water System cooling towers during periods of normal power operation, shutdown, maintenance and construction. Treated water is also supplied for emergency makeup to the fire protection system. Note that the emergency makeup to essential service water is provided by a dedicated, safety related system. The essential service water system cooling towers emergency makeup system is discussed in Section 9.2.5. Raw water from deep wells supply water to the demineralized makeup water, potable water, and fire water protection systems.

9.2.9.2 System Description

Raw water is delivered to the Water Treatment Plant through a non-safety related line and the Water Treatment Plant is a non-safety related, non-seismic system that provides water for initial fill and makeup to the following Callaway Plant Unit 2 systems:

- Essential Service Water System cooling towers, during all but emergency conditions,
- Circulating Water System cooling towers, and
- the ESWEMS retention pond.

The Water Treatment Plant also provides water for emergency makeup to the fire protection system. The deep wells provide water suitable for various plant services, including the demineralized water system, the potable water system, and normal makeup for the fire protection system.

The raw water/treated water supply is schematically represented in Figure 9.2-4.

Raw water is supplied by the collector well system. The collector well pumps provide the force for this flow, which is directed to the Water Treatment Plant, where the raw water is processed through chemical treatment and filtration. From the Water Treatment Plant, the treated water is distributed to the ESWEMS pond, the circulating water system cooling towers, and the essential service water system cooling towers for their initial fill, and as needed for makeup. Emergency makeup to essential service water system is provided by the dedicated ESW emergency makeup system, described in Section 9.2.5.

During normal operation, treated water demand is approximately 24,170 gpm (91,484 lpm). Peak demand is approximately 34,320 gpm (129,901 lpm) and occurs during periods of peak evaporation from the circulating water system cooling towers.

9.2.9.3 Component Descriptions

Collector Wells

Raw water is provided by the collector well river intake system installed at the approximate locations shown on Figure 9.2-5. Each collector well consists of an approximate 20-foot (6.1m) inside diameter concrete caisson constructed to bedrock and 200-foot (61 m) (typical) laterals installed in two tiers and arranged laterally around the perimeter of the caisson. The caisson walls are of sufficient thickness to overcome external hydraulic pressures. Schematics of a typical collector well are shown in Figure 9.2-6 and Figure 9.2-7. The caisson top is completed above the 200-year flood elevation of 539 feet (164.3 m) msl. Access to the collector wells is provided via an access road off of Missouri Highway 94 as shown on Figure 9.2-5.

Raw Water Piping

Raw water flows to the water treatment system through an existing underground pipe. The existing pipeline consists of a 48-inch (1.22 m) diameter welded steel pipe extending approximately 5.7 miles (9.2 km) from the Missouri River intake location to the Water Treatment Plant (WTP) at the power generation facility. A pipe connects the collector wells and the pipeline, as shown in Figure 9.2-5. The maximum rated pressure for the pipeline is not exceeded when the flow from Callaway Plant Unit 2 is added to the pipeline.

Vertical Turbine Pumps

Vertical turbine pumps move water from the collector wells to the treatment system. Each pump is equipped with a discharge check valve, suction and discharge isolation valves, and a recirculation line for maintaining system pressure while assuring minimum flow. Redundant capacity is included in the pump design to make online inspection and maintenance of these pumps possible without unduly affecting system operation.

Pump design is driven by system head requirements over the anticipated range of groundwater levels including low river elevation of approximately 489 feet (149m) msl based on a 30-year historical record, and high river elevation of approximately 539 feet(164.3m) msl based on the 200-year flood event probability.

Treated Water Distribution Piping and Valves

The piping and valves which connect the system components to each other and to the supplied systems are made of materials compatible with the process fluid.

Raw Water Supply Power and Controls

The electrical supply for the collector well field is composed of two independent 13.8 kV sources from Callaway Plant Unit 1. Each source is capable of supplying the required demand load to support the entire well field. Routing of the sources is overhead to the point where the right-of-way reaches the 200-year floodplain elevation. The service then continues underground to the collector well field. Each well is designed for connection to either source using a distribution switch independent of the other wells.

Each collector well has a dedicated 13.8kV primary service transformer with a 4160V secondary. This transformer supplies 4160V switchgear located in the electrical room. This switchgear feeds each of the collector well pumps as well as the collector well service transformer. The collector well service transformer is a pad-mounted 4160V primary transformer with 480/277V secondary conductors and supplies a motor control center. This motor control center provides service for all other station loads including mechanical systems, lighting, and a convenience power transformer.

DC power for switchgear operation is provided at each collector well. The DC power source includes a battery rack and 480V battery eliminator supplied from the MCC. The battery system is sized with sufficient capacity to operate all required loads for a minimum of 8 hours. The battery eliminator is sized to restore the battery system from design minimum to full capacity within 12 hours of power restoration.

System communication consists of a redundant fiber optic network to connect each collector well to the control rooms providing system monitoring and control. Each well is connected to each side of the network independent of the conditions at the other wells.

Alarms and status points are transmitted via the fiber network to the operator workstations in the control rooms. From the workstations the operator will have the ability to monitor the system in "auto" mode, or drive the operation as required. Each well may also be controlled from a local operator interface. In any operation mode the control system safeguards against process conditions that could potentially damage the system or lead to a complete system failure.

9.2.9.4 Safety Evaluation

Raw water supply and the treatment system provide no safety related function and therefore no safety evaluation is required with respect to plant design basis events.

There is no connection between raw water supplied to the treatment system, or the treatment system itself, and components or other systems that have the potential to carry radiological contamination. This complies with Criterion 60 of Appendix A to 10 CFR 50 (CFR, 2008).

With respect to potential flooding caused by failures of piping or components, the raw water delivery piping and the treatment system are located remote from any safety related systems or equipment, except for the lines connecting to the ESWS cooling tower(s) basin. Failures other than at the tower basin connections will not adversely impact safety functions because intervening topography and the plant storm water controls are designed to divert surface water flow, including that which would result from catastrophic failure of the Clearwell at the Water Treatment Plant. The connections to the ESWS cooling tower(s) basin are made through safety-related motor-operated valves, thereby assuring basin integrity under accident conditions. Potential leakage from the water lines in the essential service water pumphouses is controlled, collected and routed away by the floor drains in those structures. These floor drain lines include check valves where necessary to prevent possible backflow from causing flooding that could adversely affect the safety related equipment, as discussed more fully in Section 9.2.7.

9.2.9.5 Inspection and Testing Requirements

Visual inspections are conducted during construction to verify that the as-built condition is in accordance with design documents. Pressure testing and functional testing are conducted during post-construction, pre-commissioning and startup, as necessary to confirm system integrity and proper operation of individual components and the total system. Portions of the system are demonstrated with in-service leak testing where such method does not jeopardize other systems/equipment and is sufficient to demonstrate proper operation.

Ongoing system operation provides continuing demonstration of the system's functionality.

9.2.9.6 Instrumentation Requirements

Instrumentation includes sensing and display of various parameters as necessary to automate system function, and to provide for local and remote system monitoring, including alarms. These parameters include system tank levels, flows, temperatures and pressures, as well as water tank level and temperature, essential service water makeup flow, demineralized water system feed flow, and potable water system feed flow. Valve position indication for selected valves and pump power on/off indication is also provided.

9.2.9.7 References

CFR, 2008. Control of Releases of Radioactive Materials to the Environment, Title 10, Code of Federal Regulations, Part 50, Appendix A, General Design Criterion 60, U. S. Nuclear Regulatory Commission, 2008.}

Figure 9.2-1—{Potable Water System}

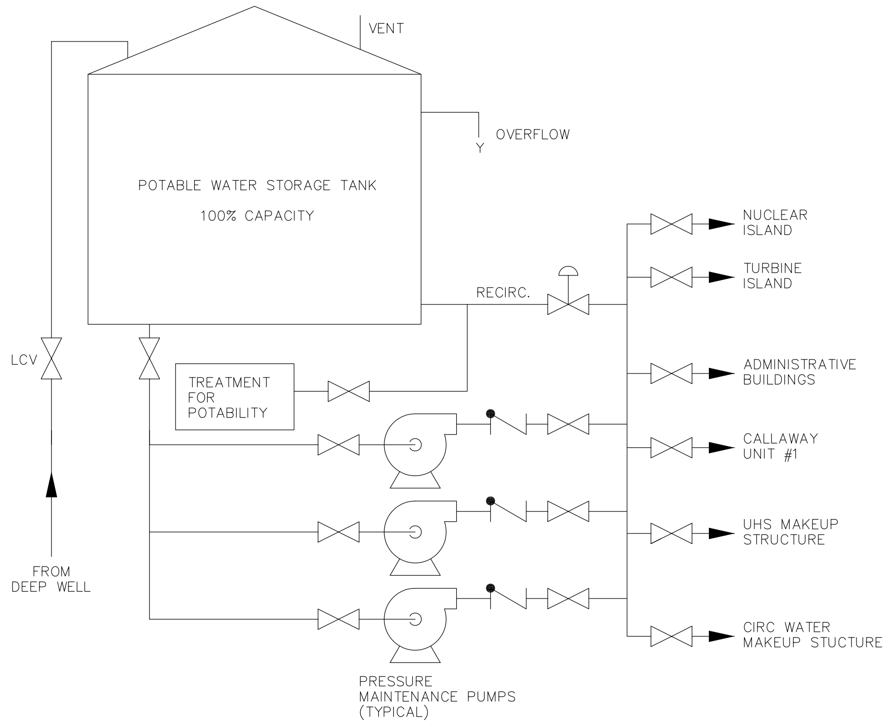


Figure 9.2-2—{Sanitary Waste Water System}

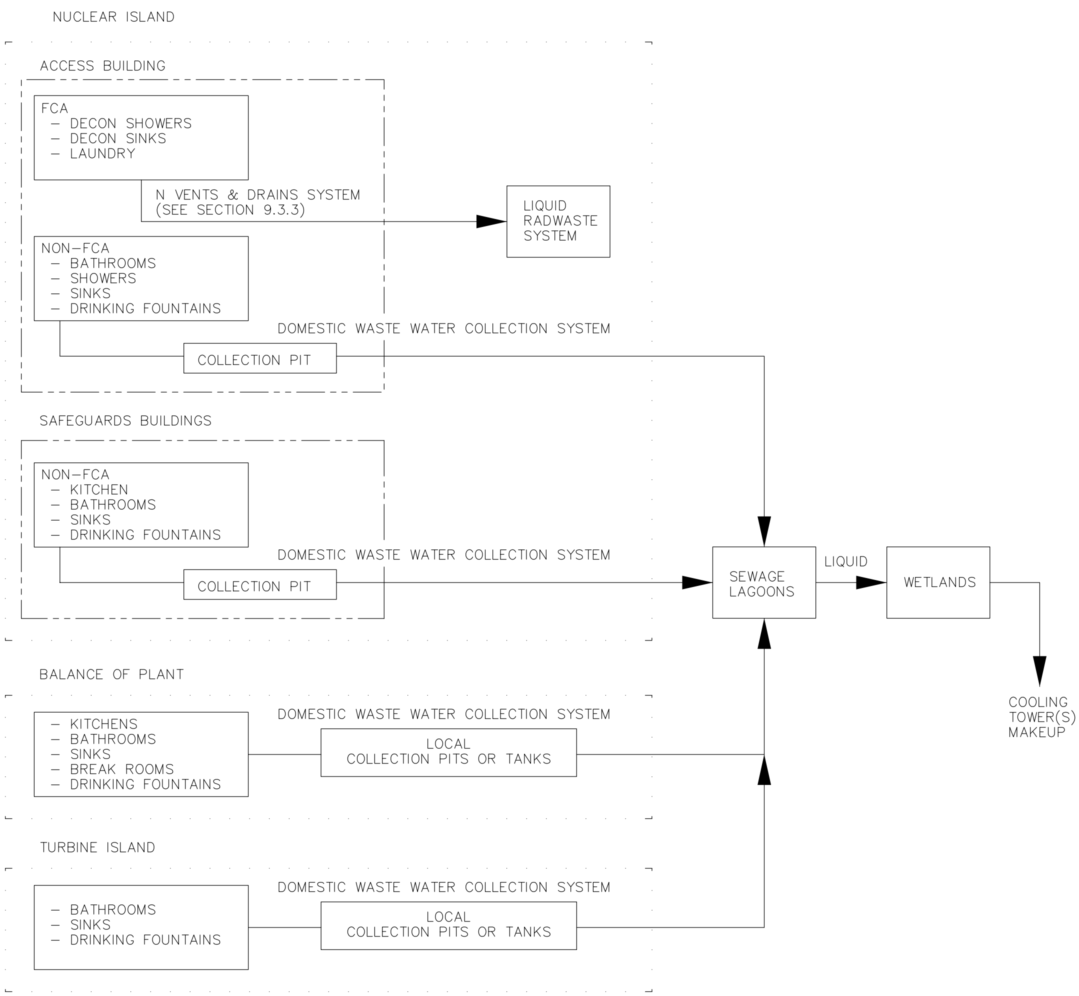
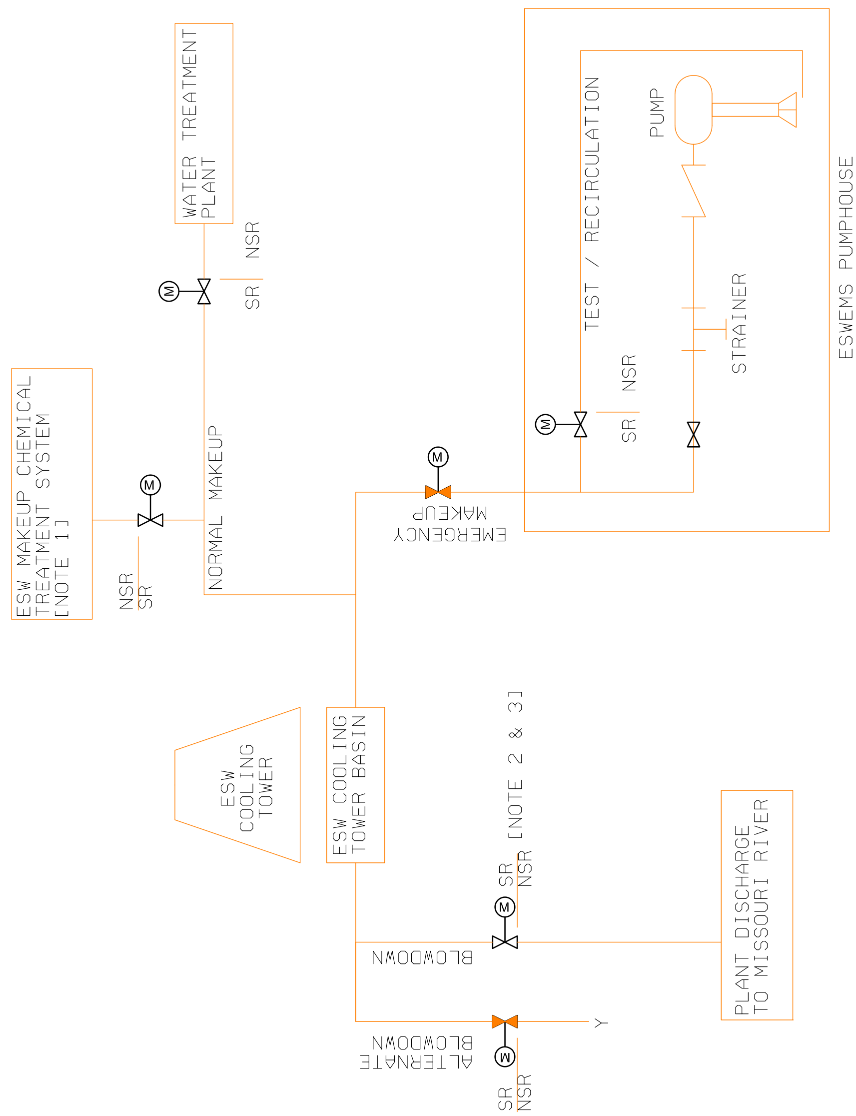


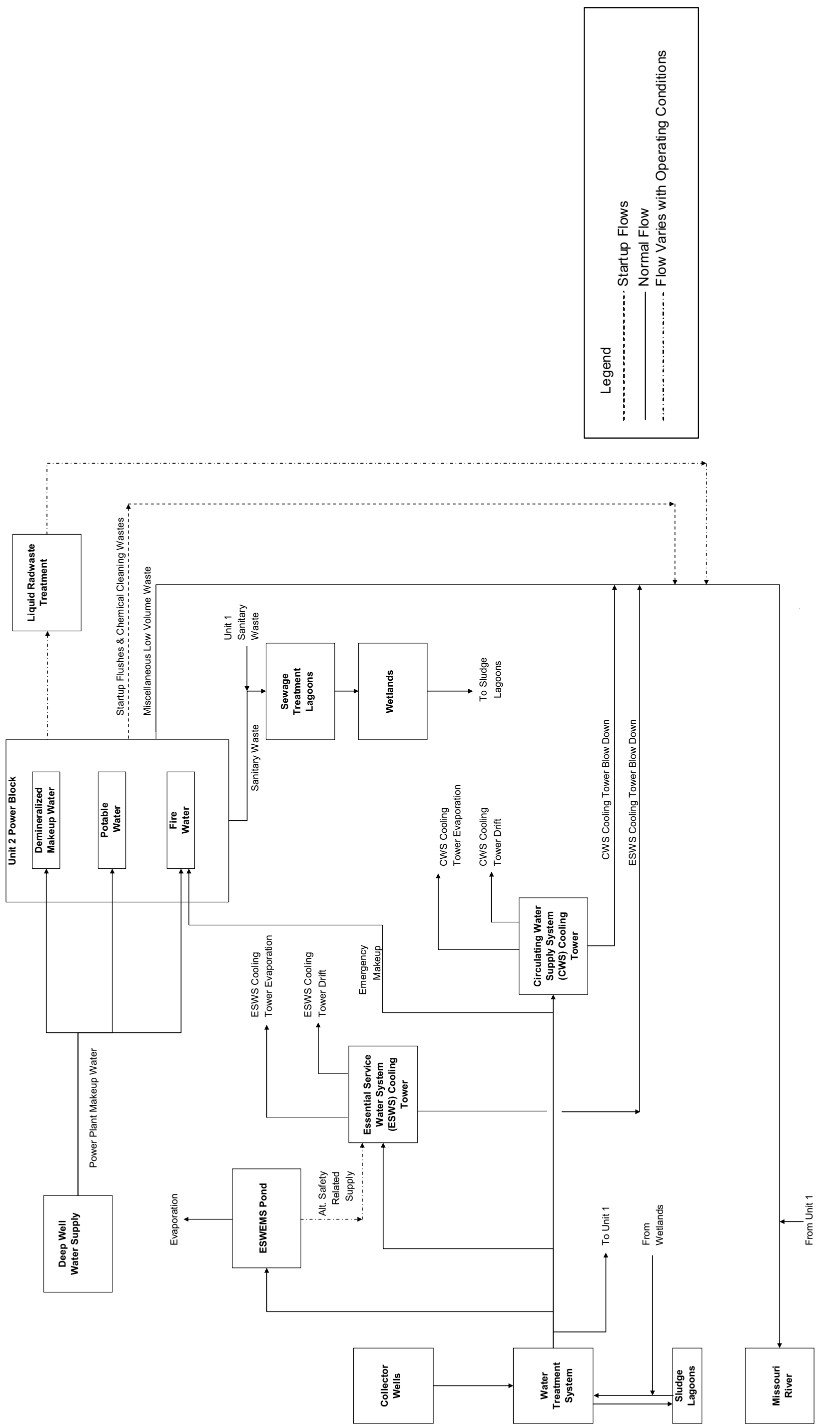
Figure 9.2-3—{Essential Service Water Emergency Makeup System}



NOTES:

1. CHEMICAL TREATMENT SYSTEM TREATS 4 ESWEMS TRAINS AND 4 NORMAL MAKEUP TRAINS.
2. NSR - NON SAFETY RELATED
   SR - SAFETY RELATED (TYP)
3. BOTH SR BLOWDOWN MOVS ARE UTILIZED FOR THROTTLING AS WELL AS ISOLATION.

Figure 9.2-4—{Schematic of Raw Water/Treated Water Supply}



FSAR: Chapter 9.0

Figure 9.2-5—{Collector Well River Intake System}

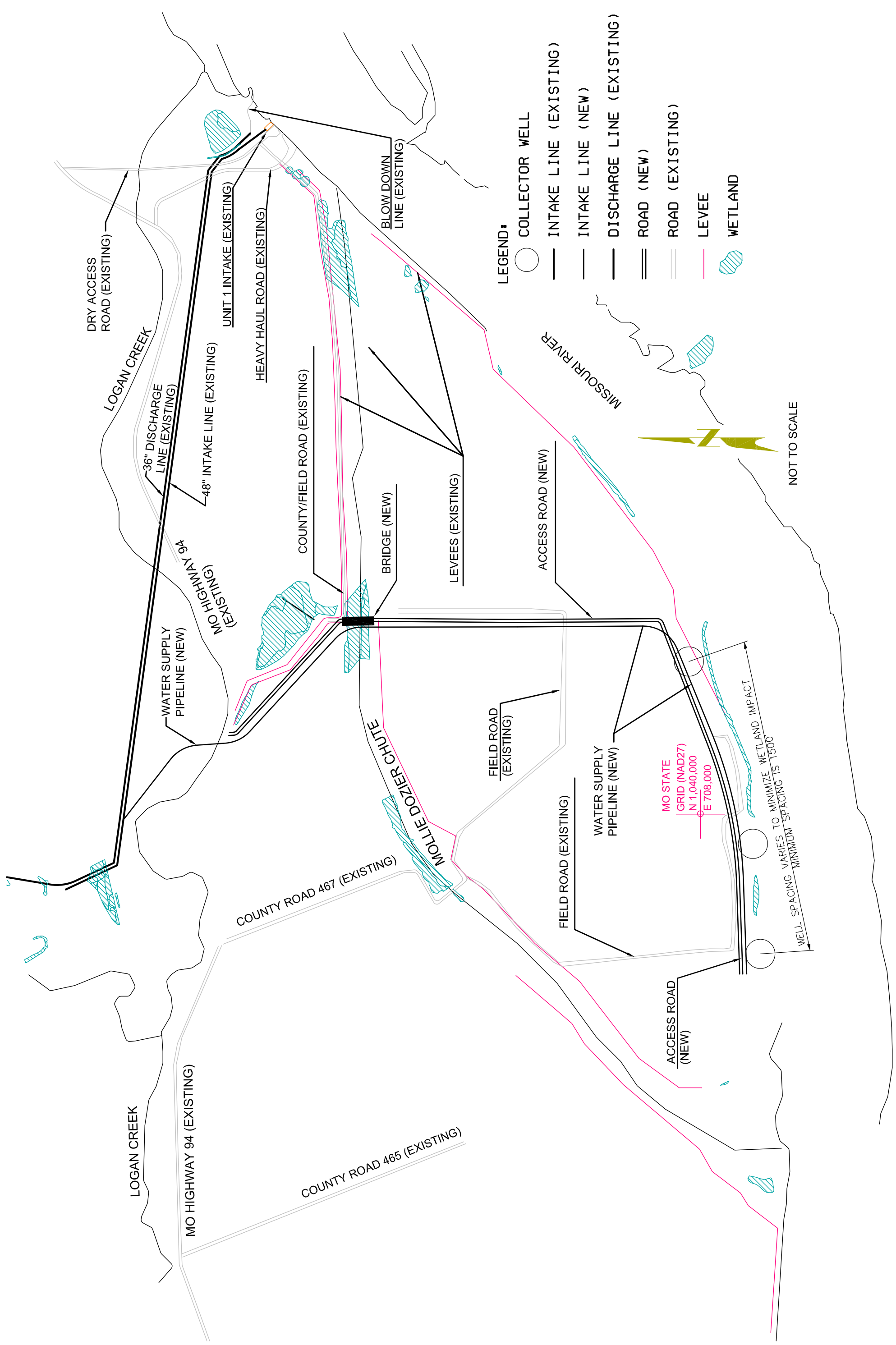


Figure 9.2-6—{Collector Well River Intake System Pump Structure-Plan View}

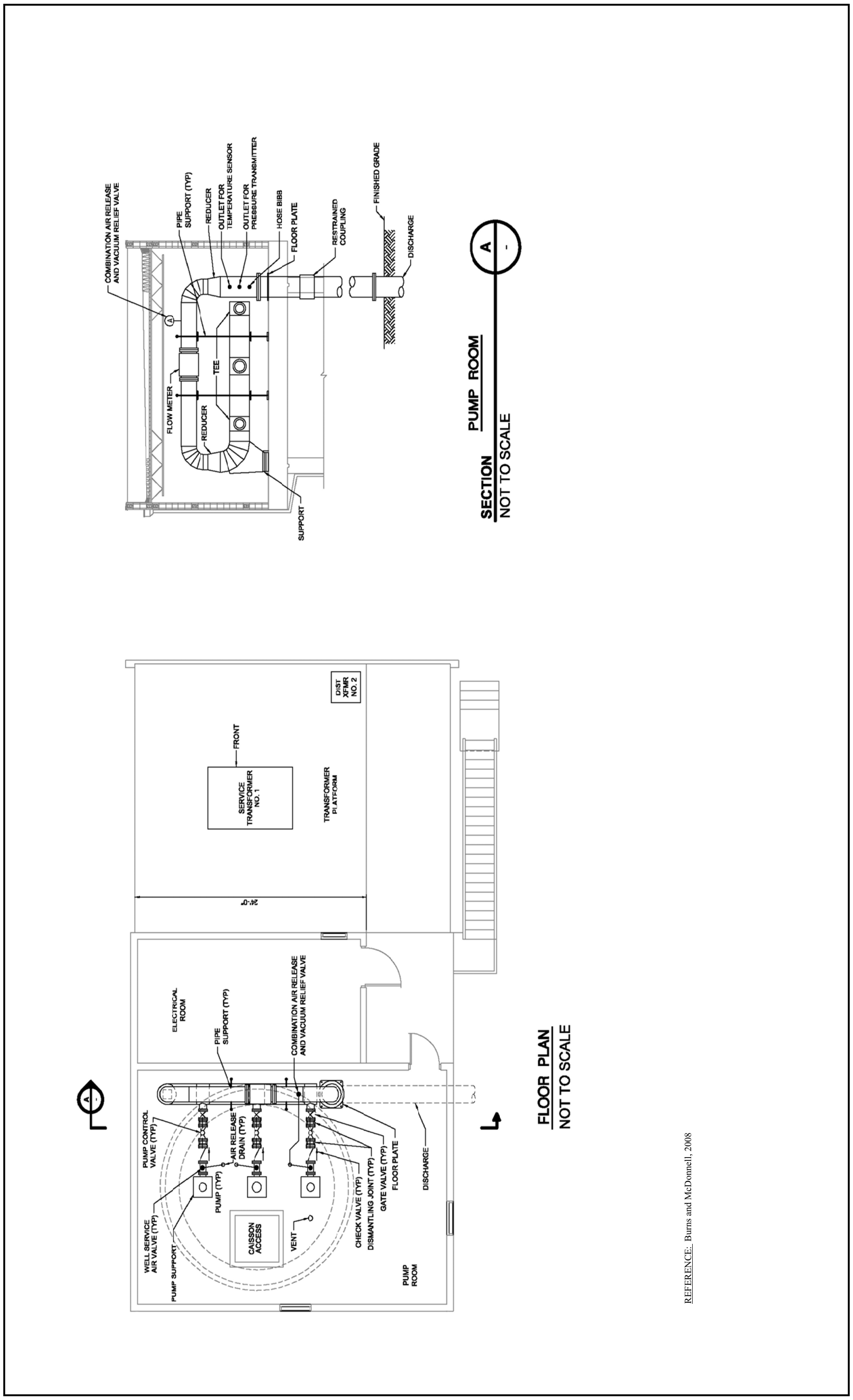


Figure 9.2-7—{Collector Well River Intake System Pump Structure - Section View}

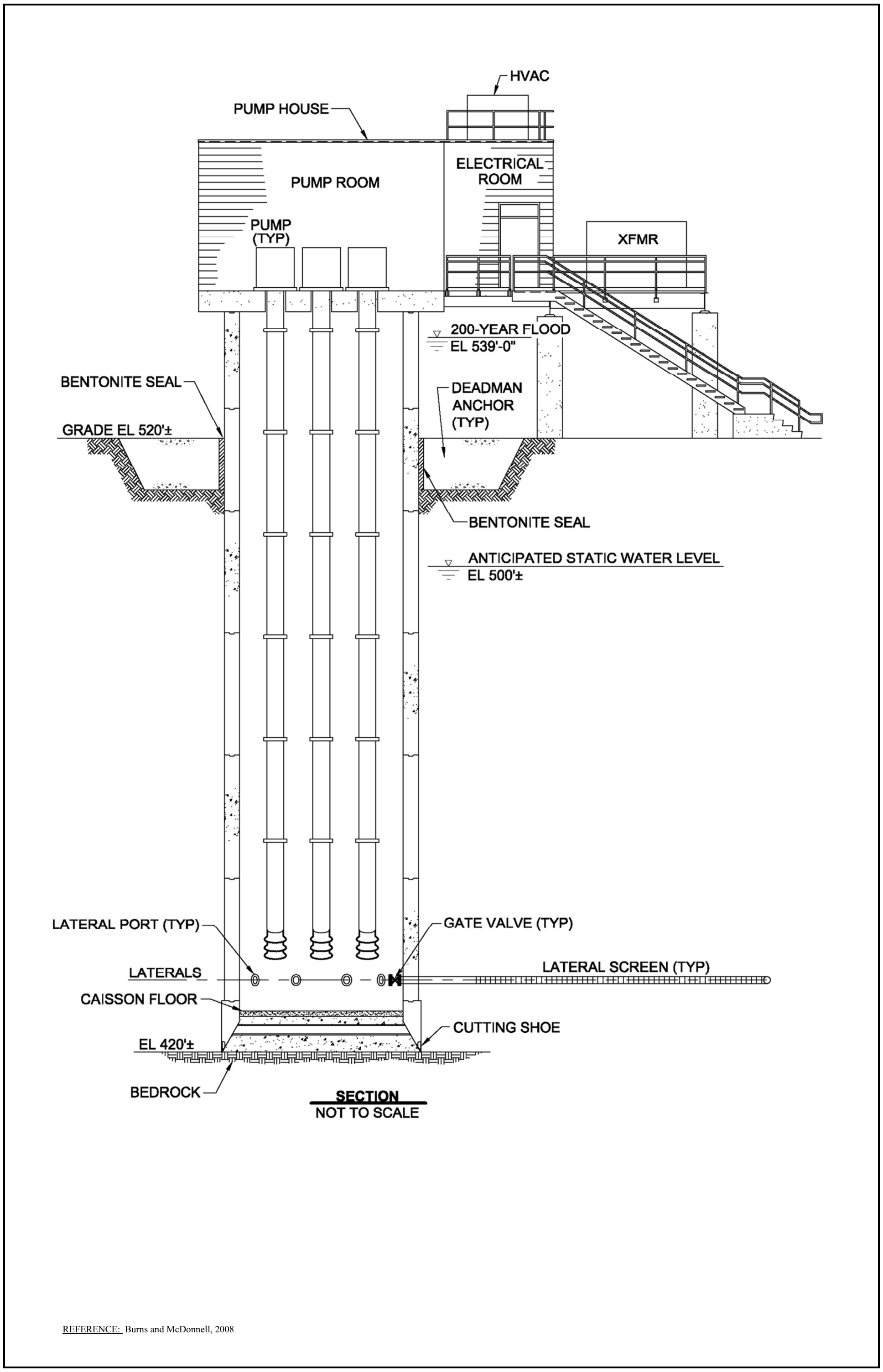


Figure 9.2-8—{Plant Arrangement - ESWEMS Pumphouse Floor Plan}

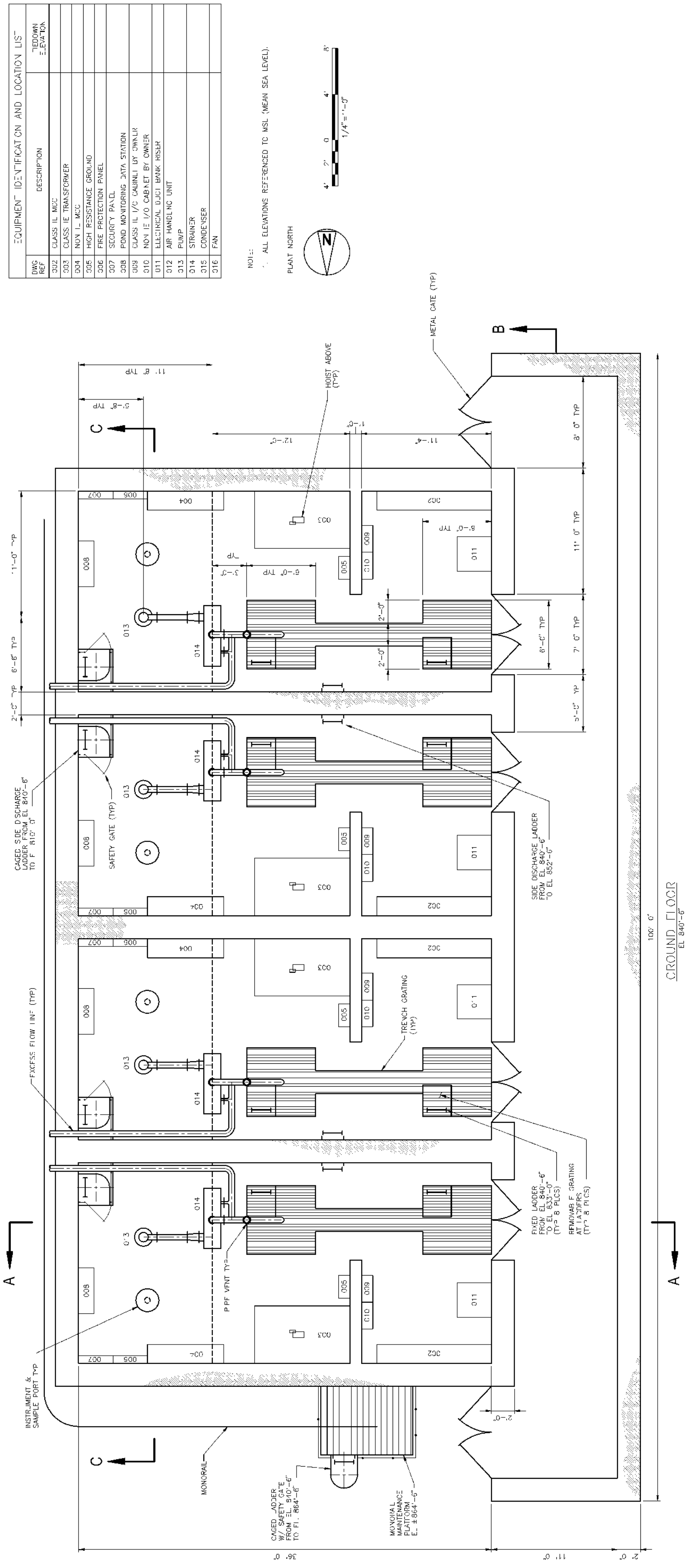


Figure 9.2-9—{Plant Arrangement - ESWEMS Pumphouse Section}

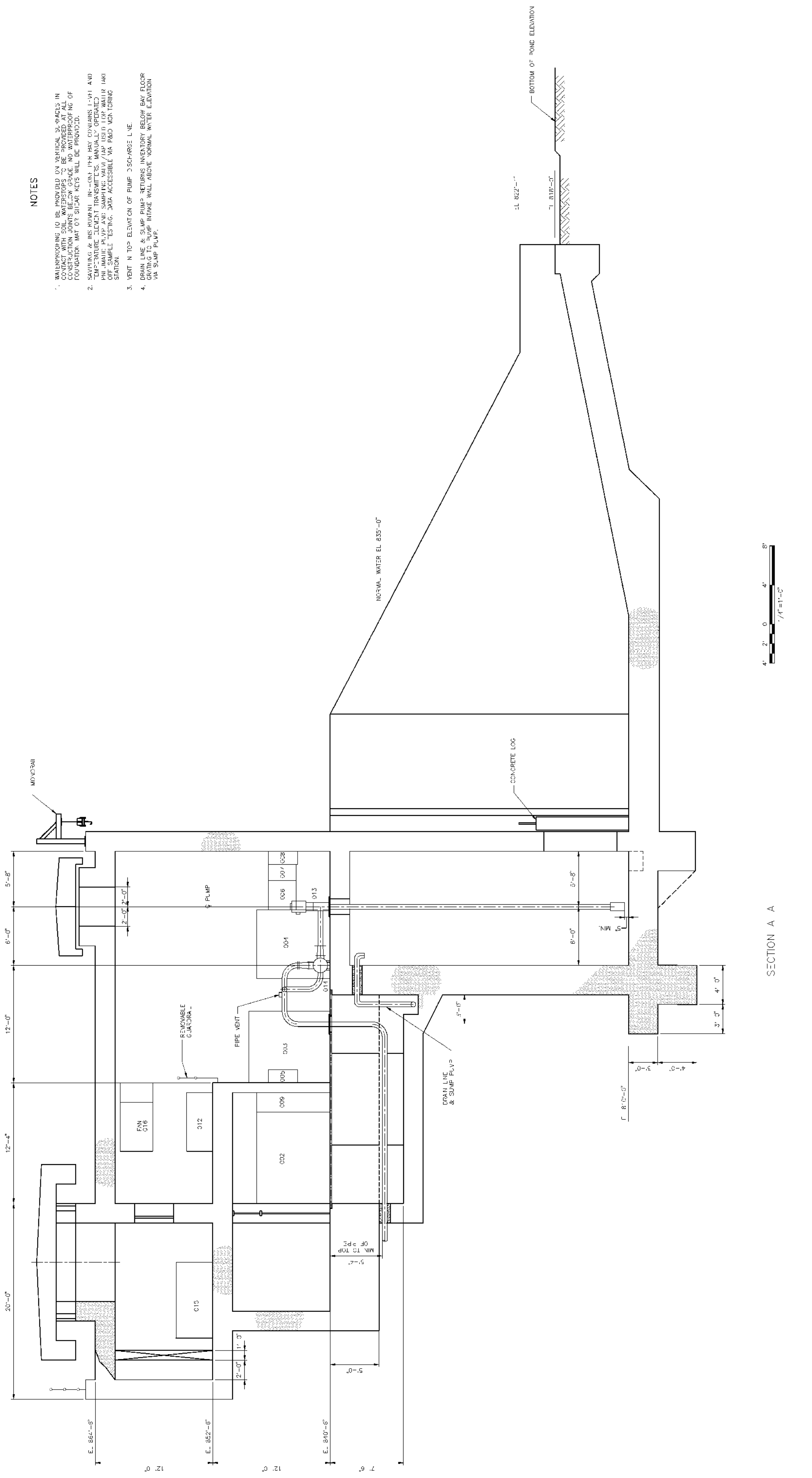


Figure 9.2-10—{Plant Arrangement - ESWEMS Pumphouse Section}

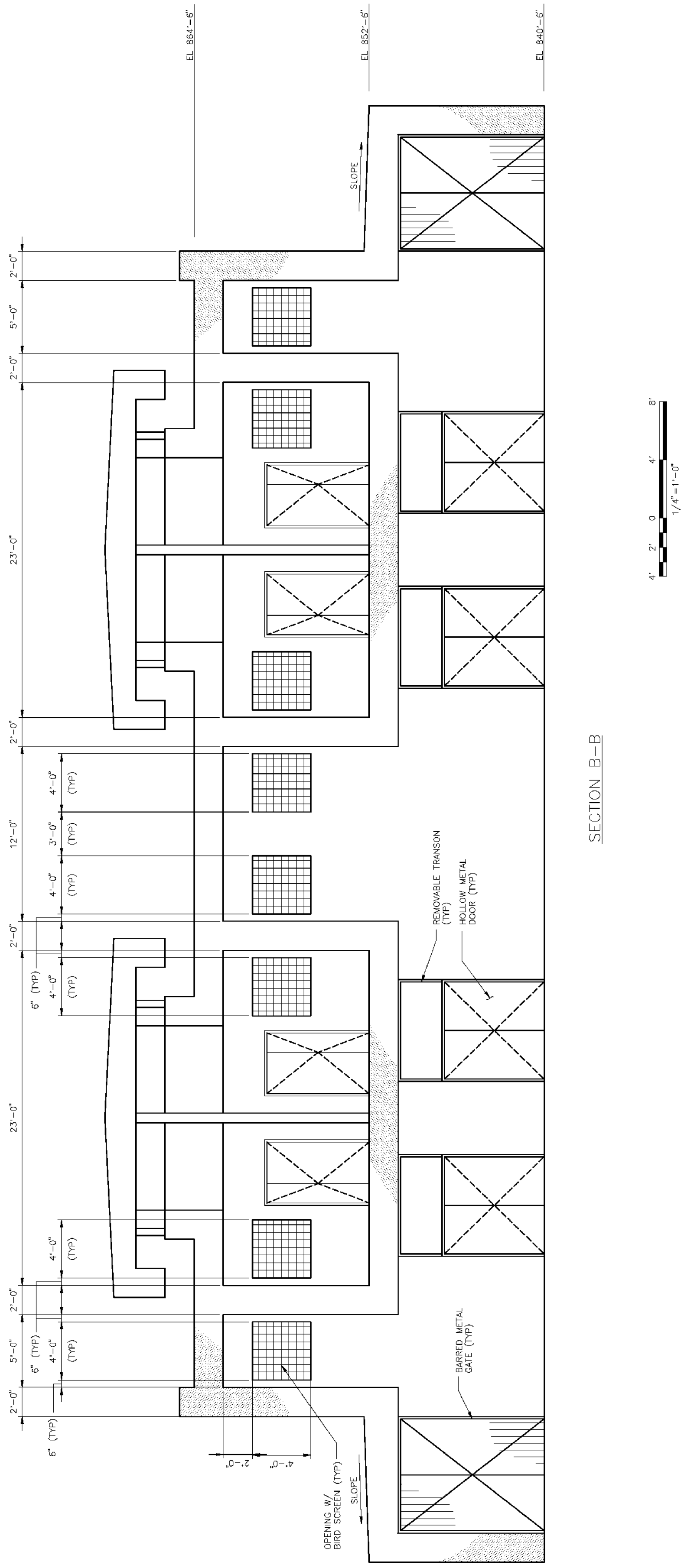
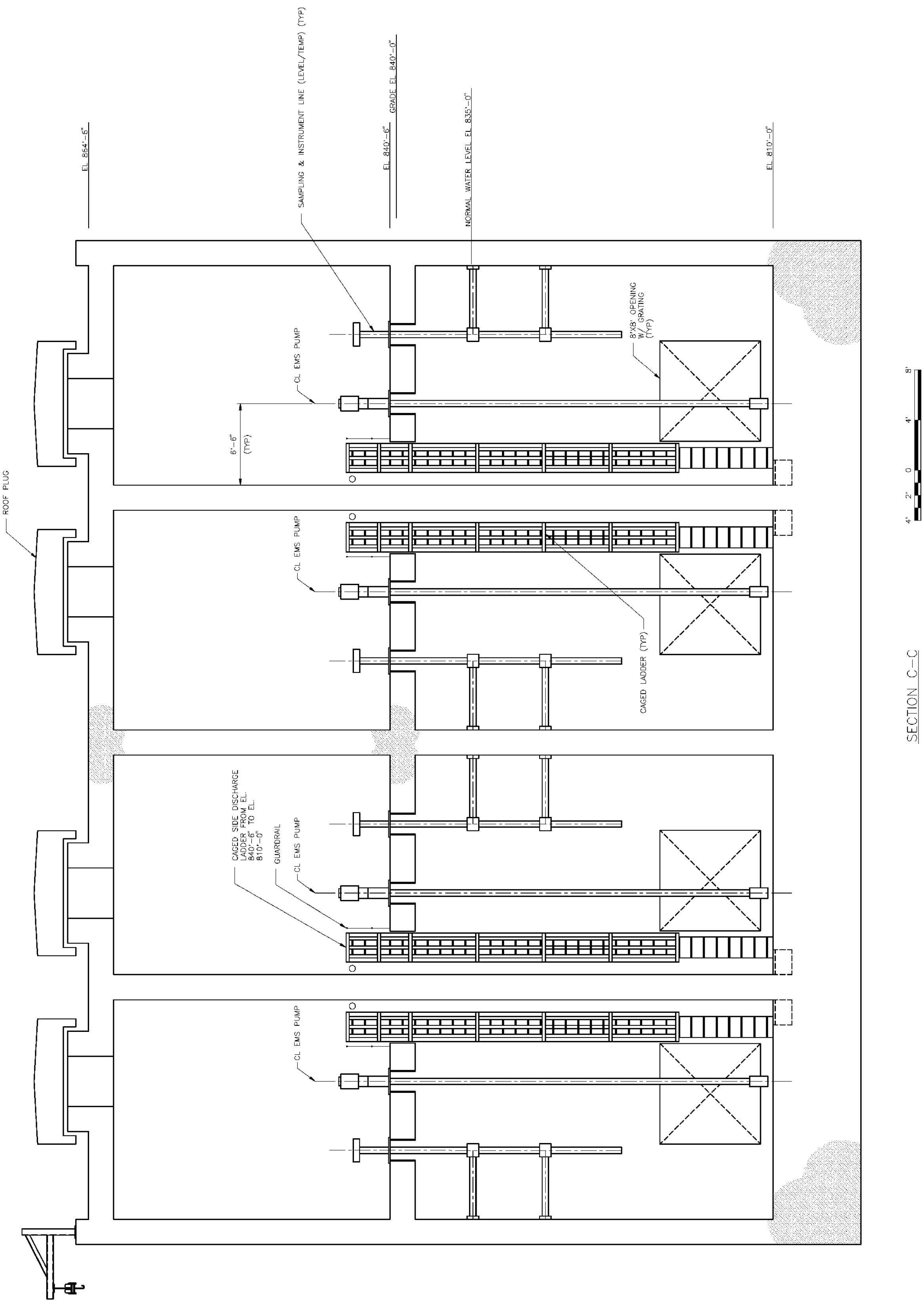


Figure 9.2-11—{Plant Arrangement - ESWEMS Pumphouse Section}



FSAR: Chapter 9.0

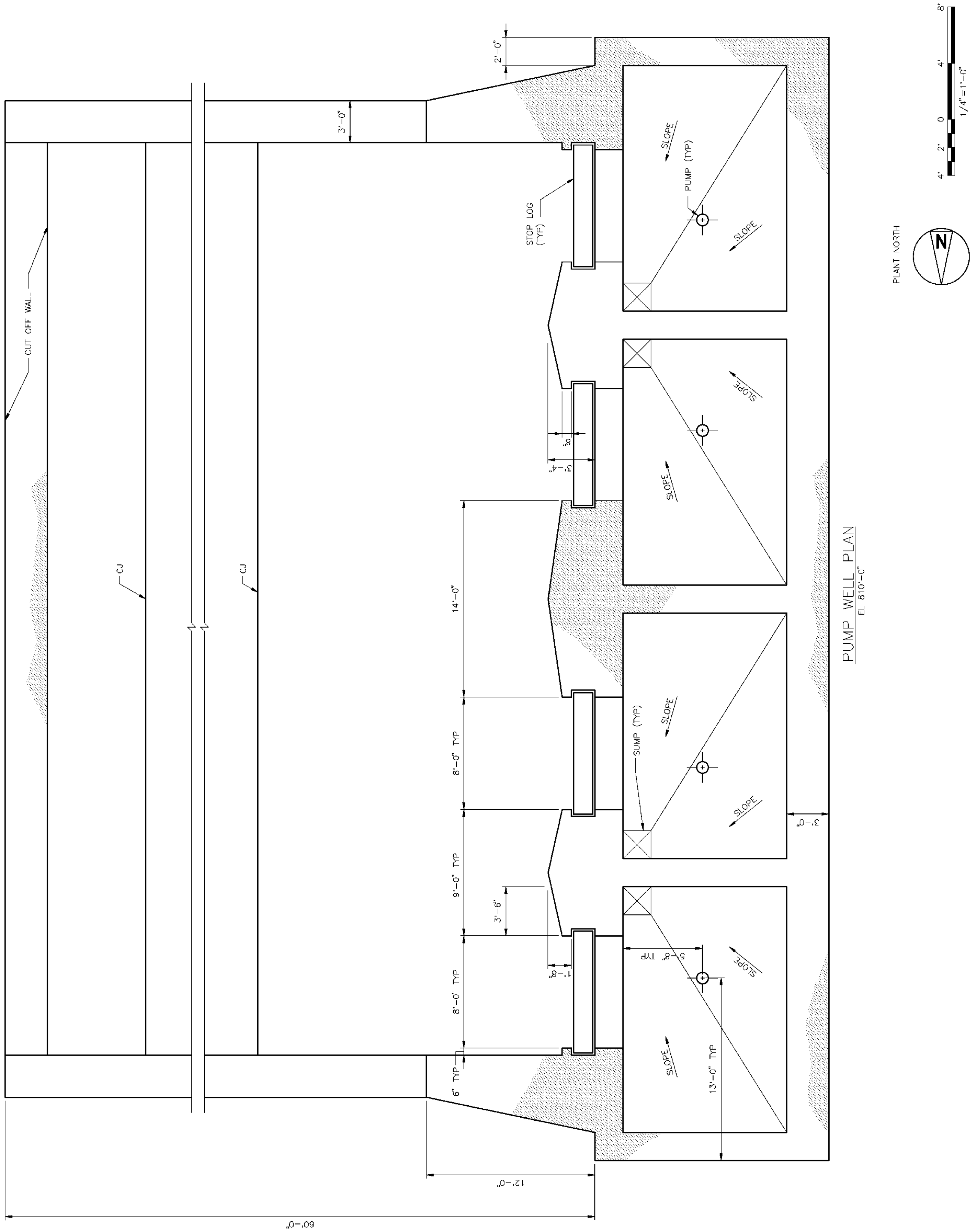


Figure 9.2-12—{Plant Arrangement - ESWEMS Pumphouse Pump Well Plan}

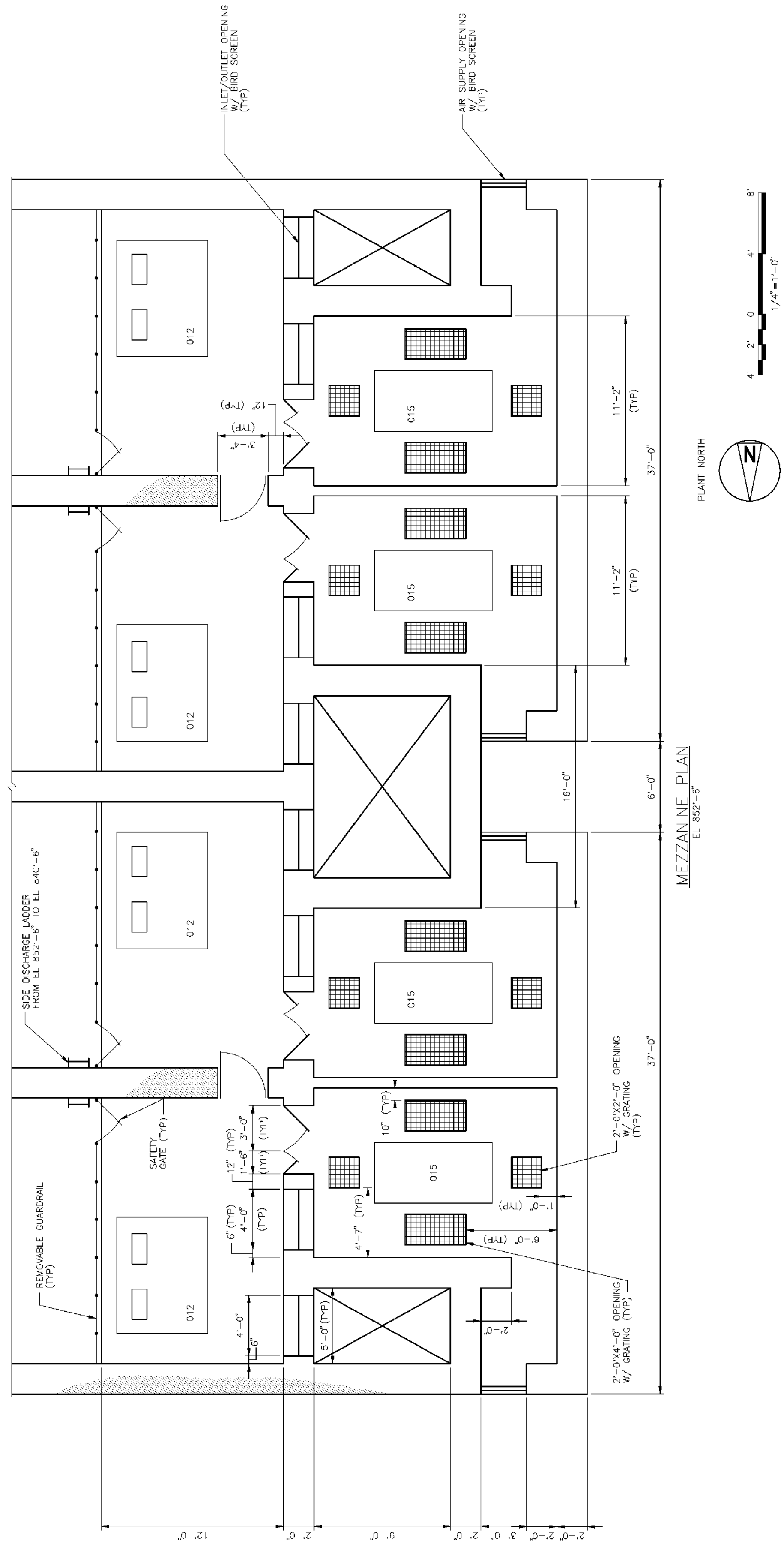
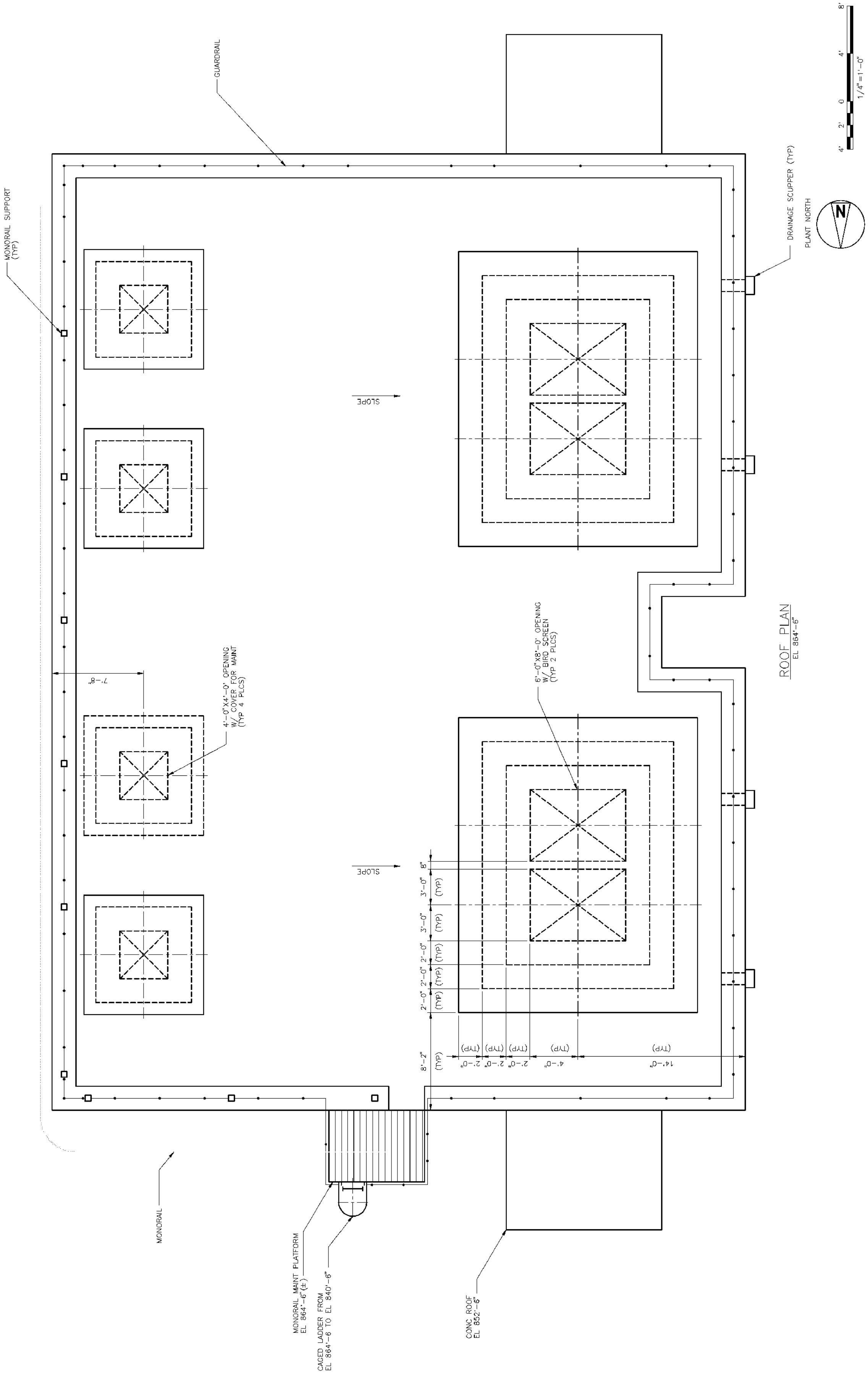


Figure 9.2-13—{Plant Arrangement - ESWEMS Pumphouse Mezzanine Plan}

Figure 9.2-14—{Plant Arrangement - ESWEMS Pumphouse Roof Plant}



9.3 PROCESS AUXILIARIES

This section of the U.S. EPR FSAR is incorporated by reference.

9.4 AIR CONDITIONING, HEATING, COOLING AND VENTILATION SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

{Section 9.4.15 has been added as a supplement to the U.S. EPR FSAR.}

9.4.1 MAIN CONTROL ROOM AIR CONDITIONING SYSTEM

No departures or supplements.

9.4.1.1 Design Bases

The U.S. EPR FSAR includes the following conceptual design information in Section 9.4.1.1:

> The (CRACS) provides adequate protection against radiation [[and hazardous chemical releases]] to permit access to and occupancy of the control room under accident conditions (GDC 19). [[The control room occupancy protection requirements meet the guidance of RG 1.78.]]
>
> The CRACS maintains habitability of the CRE areas during a site radiological contamination event [[or toxic contamination of the environment]] (Refer to Section 6.4).
>
> The CRACS outside air intake is capable of detecting radiation and smoke [[and toxic chemicals]] (see Section 6.4.2.4). Associated monitors actuate alarms in the MCR.
>
> [[Upon actuation of the plant toxic gas alarm signal, the outside air intake dampers close automatically and the CRE air is automatically diverted in the recirculation mode without outside air.]]

This conceptual design information is addressed as follows:

{The evaluation of the Callaway Plant Unit 2 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceeded the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas. As a result, toxic gas detectors and isolation are not required and will not be provided at Callaway Plant Unit 2.}

9.4.1.2 System Description

9.4.1.2.1 General Description

The U.S. EPR FSAR includes the following conceptual design information in Section 9.4.1.2.1 and associated Figure 9.4.1-2:

> Sensors on the outside air inlet protect against [[toxic gas (refer to Section 6.4.2.4) and]] radiological intrusion.

The conceptual design information is addressed as follows:

{The evaluation of the Callaway Plant Unit 2 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceeded the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas.}

9.4.1.2.2 Component Description

{No departures or supplements}

9.4.1.2.3 System Operation

The U.S. EPR FSAR includes the following conceptual design information in Section 9.4.1.2.3:

> [[During a toxic gas accident event, the CRACS is placed in full recirculation mode without any outside air makeup (refer to Section 6.4.2.2.]]
>
> *[[Operation During a Toxic Gas Event*
>
> Outside air is continuously monitored for toxic gas by the toxic gas sensors located at the air intakes. Upon detection of a toxic gas condition, audible and visual alarms are actuated in the MCR.]]
>
> *Operation during External Fire, Smoke [[or Toxic Gas Release]]*
>
> In the event of an external fire, [[external toxic gas release,]] smoke, or excessive concentration of CO or CO_2, outside air to the CRACS is isolated manually or automatically and the system operates in full recirculation mode without fresh air.

The conceptual design information is addressed as follows:

{The evaluation of the Callaway Plant Unit 2 toxic chemicals in Section 2.2.3 did not identify any credible toxic chemical accidents that exceeded the limits established in Regulatory Guide 1.78 (NRC, 2001). No specific provisions are required to protect the operators from an event involving a release of a toxic gas.}

9.4.1.3 Safety Evaluation

No departures or supplements.

9.4.1.4 Inspection and Testing Requirements

No departures or supplements.

9.4.1.5 Instrumentation Requirements

No departures or supplements.

9.4.1.6 References

{**NRC, 2001**. Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release, Regulatory Guide 1.78, Revision 1, U. S. Nuclear Regulatory Commission, December 2001.}

9.4.2 FUEL BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.3 NUCLEAR AUXILIARY BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.4 TURBINE BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.5 SAFEGUARD BUILDING CONTROLLED-AREA VENTILATION SYSTEM

No departures or supplements.

9.4.6 ELECTRICAL DIVISION OF SAFEGUARD BUILDING VENTILATION SYSTEM (SBVSE)

No departures or supplements.

9.4.7 CONTAINMENT BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.8 RADIOACTIVE WASTE BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.9 EMERGENCY POWER GENERATING BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.10 SWITCHGEAR BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.11 ESSENTIAL SERVICE WATER PUMP BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.12 MAIN STEAM AND FEEDWATER VALVE ROOM VENTILATION SYSTEM

No departures or supplements.

9.4.13 SMOKE CONFINEMENT SYSTEM

No departures or supplements.

9.4.14 ACCESS BUILDING VENTILATION SYSTEM

No departures or supplements.

9.4.15 {ESWEMS PUMPHOUSE VENTILATION SYSTEM

This section is added as a supplement to the U.S. EPR FSAR.

The Essential Service Water Emergency Makeup System (ESWEMS) Pumphouse Ventilation System provides an environment suitable for operation of the ESWEMS pumps and associated equipment (which are discussed in Section 9.2.5. The ESWEMS Pumphouse Ventilation System is comprised of four independent ventilation system trains.

9.4.15.1 Design Bases

The ESWEMS Pumphouse Ventilation System maintains acceptable temperature limits to support operation of the ESWEMS pumps and associated electrical distribution equipment, which are required to operate under design basis accident conditions. Cooling is provided by an Emergency Air Conditioning (AC) Unit. Emergency heating is provided by two safety related unit heaters. The ESWEMS Ventilation System maintains a minimum temperature of 41° F (5° C) and a maximum temperature of 104° F (40° C) in the ESWEMS Pumphouse structure. The system is designed to support operation of the ESWEMS pumps and associated electrical distribution equipment as well as to support personnel access to these spaces. This temperature range maintains a mild environment in the pumphouse as defined in U.S. EPR FSAR Section 3.11.

The safety related portion of the ESWEMS Pumphouse Ventilation System is protected from the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, and external missiles (GDC-2). The ESWEMS Pumphouse Ventilation System remains functional after a Safe Shutdown Earthquake (SSE).

The safety related portion of the ESWEMS Pumphouse Ventilation System remains functional and performs its intended function following a postulated hazard, such as a fire, internal missiles, or pipe break (GDC-3 and 4).

Safety functions of the ESWEMS Pumphouse Ventilation System can be performed, assuming a single active component failure coincident with the loss of offsite power.

Active components of the ESWEMS Pumphouse Ventilation System are capable of being tested during plant operation.

The ESWEMS Pumphouse Ventilation System uses design and fabrication codes consistent with the quality group classification and seismic category assigned in Section 3.2.

9.4.15.2 System Description

9.4.15.2.1 General Description

The function of the ESWEMS Pumphouse Ventilation System is to provide an environment suitable for operation of the ESWEMS components, including pump, valves, strainers, transformers, control panels, and associated electrical components. Room temperatures are limited to no more than 104°F (40°C) either by blowing in outside and/or recirculated air, or by isolating the pump room from the outside and air conditioning the pump room. Room temperatures are maintained no less than 41°F (5°C) through the use of thermostatically controlled unit heaters.

The ESWEMS Pumphouse Ventilation System is shown in Figure 9.4-1

9.4.15.2.2 Component Description

Each of the four bays of the ESWEMS Pumphouse contains the following ventilation system main components:

- A safety related split-system Emergency AC Unit. The condenser section (i.e., condenser fans, condenser coils, and compressor) is located outdoors. The evaporator section (i.e., filters, evaporator coils, and cooling fan) is located inside the pumphouse on the mezzanine level. Missile protection is provided by the structure surrounding the condenser, which also provides suitably sized suction and discharge flow paths required for design heat rejection.

- A non-safety related Normal Supply Fan.

- Four Unit Heaters: Two safety related, two nonsafety related.
- A safety related motor-operated outside air flow control damper on the suction side of the Normal Supply Fan. Missile barrier protection is provided external to the damper.
- A nonsafety related motor-operated flow control recirculation air damper on the suction side of the Normal Supply Fan.
- A safety related gravity-actuated exhaust air damper that permits pressurized room air to exhaust to the outside. Missile barrier protection is provided external to the damper.
- Associated ductwork, volume dampers, filters, and instrumentation.

9.4.15.2.3 System Operation

The ESWEMS Pumphouse Ventilation System can operate in various configurations.

ESWEMS PUMPHOUSE VENTILATION SYSTEM EMERGENCY OPERATION

The ESWEMS Pumphouse Ventilation System is automatically placed into service when the associated ESWEMS Pump starts. To accomplish this, the Normal Supply Fan trips off, the safety related outside air inlet and exhaust dampers shut, and the Emergency AC Unit auto starts. Two safety related unit heaters can also operate automatically to maintain minimum temperature requirements if the normal unit heaters are unavailable.

ESWEMS PUMPHOUSE VENTILATION SYSTEM NORMAL HOT WEATHER OPERATION

This emergency alignment described above can be manually placed into service in order to limit room temperatures during hot weather conditions.

ESWEMS PUMPHOUSE VENTILATION SYSTEM NORMAL COLD WEATHER OPERATION

The cold weather configuration is for the Pump Room to be isolated from the outside (i.e., both safety related dampers closed), and the four unit heaters cycling on and off automatically as controlled by local thermostats.

ESWEMS PUMPHOUSE VENTILATION SYSTEM NORMAL MILD WEATHER OPERATION

During mild weather conditions, the Normal Supply Fan will be in service, blowing in either outside air or recirculated room air, or a mixture of the two, as required to control to desired room temperature. The two motor-operated dampers and the exhaust dampers will function automatically to control room temperature. Room pressurization caused by the Normal Supply Fan blowing in outside air will result in opening of the gravity-actuated backdraft exhaust damper.

ESWEMS PUMPHOUSE VENTILATION SYSTEM SMOKE/PURGE MODE

Smoke detection in the outside air intake or in the Pump Room will automatically trip the Normal Supply Fan and result in closure of both outside air dampers. The Emergency AC Unit is not affected by smoke or fire detection and will operate as required to support operation of the associated makeup pump. The Normal Supply Fan can be used to purge the Pump Room of smoke after a fire by supplying outside air, to be exhausted through the gravity-actuated backdraft exhaust damper.

9.4.15.3 Safety Evaluation

The ESWEMS Pumphouse Ventilation System has sufficient heating and cooling capacity to maintain each pump room at temperatures between 41°F (5° C) and 104° F (40° C), when the ESWEMS pumps are operated at rated load.

With the exception of the condenser section, the safety related portions of the ESWEMS Pumphouse Ventilation System are located in the ESWEMS Pumphouse, which is designed to withstand the effects of earthquakes, tornadoes, hurricanes, floods, external missiles, and other appropriate natural phenomena. The enclosure surrounding the condenser section also provides protection from earthquakes, tornadoes, hurricanes, floods, external missiles, and other appropriate natural phenomena. Section 3.8 provides the bases for the adequacy of the structural design of the ESWEMS Pumphouse.

The safety related portions of the ESWEMS Pumphouse Ventilation System are designed to remain functional after an SSE. Section 3E.4 provides the design loading conditions that were considered. Sections 3.5, 9.2.5, and 9B provide the hazards analyses to assure that a safe shutdown can be achieved and maintained.

No single failure compromises the safety functions of the ESWEMS Pumphouse Ventilation System; however, an active failure within an ESWEMS Pumphouse Ventilation System train may render the associated ESWEMS train inoperable. The redundancy provided by four trains of ESWEMS provides the assurance that all safety functions associated with ESWEMS Pumphouse Ventilation System can be performed, assuming a single active component failure coincident with the loss of offsite power.

Table 3.10-1delineates the quality group classification and seismic category applicable to the safety related portion of this system and supporting systems. Power supplies and control functions necessary for safety function of the ESWEMS Pumphouse Emergency Ventilation Systems are Class 1E, as described in Section 8.1.

9.4.15.4 Inspection and Testing Requirements

Refer to section 14.2 for initial plant startup test program for the ESWEMS Pumphouse ventilation system.

After the plant is brought into operation, periodic inspections and tests of the ESWEMS subsystems are performed to verify proper operation. Scheduled inspections and tests are necessary to verify system operability. Major components are accessible during normal plant operation for inspection, maintenance, and periodic testing.

9.4.15.5 Instrumentation Requirements

Instrumentation includes sensing and display of various parameters as necessary to automate system function, and to provide for local and remote main control room (MCR) system monitoring, including alarms. These parameters include room temperatures, outside air intake and Normal Supply Fan discharge temperatures, thermostatic controls for Unit Heaters and the Emergency AC Unit, and differential pressure indications for the Normal Supply Fan filters and Emergency AC Unit filters.}

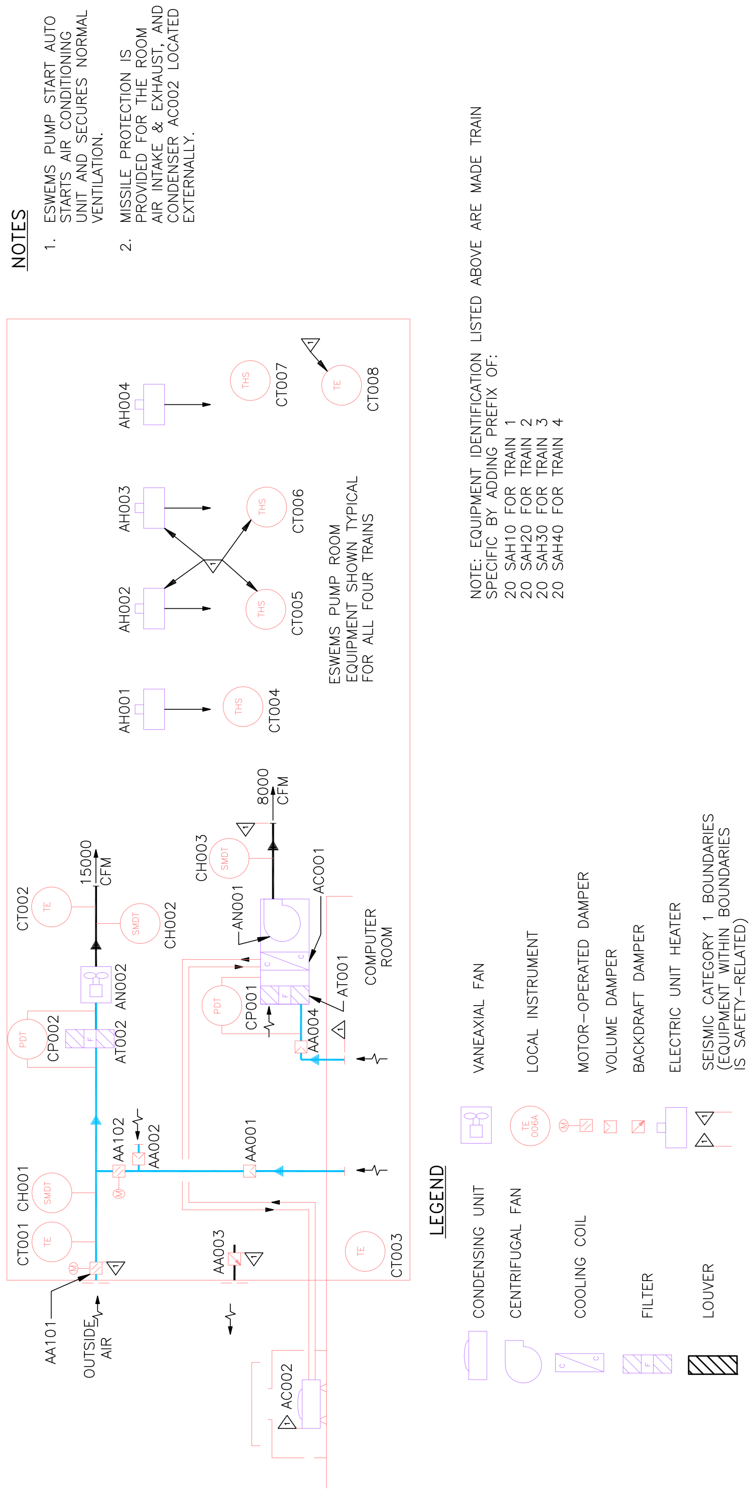


Figure 9.4-1—{ESWEMS Pumphouse Ventilation System}

9.5 OTHER AUXILIARY SYSTEMS

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

9.5.1 FIRE PROTECTION SYSTEM

No departures or supplements.

9.5.1.1 Design Basis

Appendix 9B of this COL FSAR supplements Appendix 9A of the U.S. EPR FSAR.

9.5.1.2 System Description

9.5.1.2.1 General Description

For all aspects of the site specific Fire Protection Program (FPP), the same codes and standards and applicable edition years apply for fire protection as listed in Section 9.5.1.7 of the U.S. EPR FSAR.

Table 9.5-1 provides supplemental information for select items/statements in U.S. EPR FSAR Table 9.5.1-1 identified as requiring COL Applicant input. The supplemental information is in a column headed {"Callaway Plant Unit 2 Supplement"} and addresses {Callaway Plant Unit 2} conformance to the identified requirement of Regulatory Guide 1.189 (NRC, 2007).

Plant Fire Prevention and Control Features

Plant Arrangement

{The site building layout is shown in Figure 2.1-7.} Details of the arrangement of the Turbine Building, Switchgear Building, Auxiliary Power Transformer Area, Generator Transformer Area (the remaining power block structures) and non-power block structures are provided in Appendix 9B of this COL application.

Architectural and Structural Features

Details of the architectural/structural design features for the remainder of the power block and balance of plant structures/areas are provided in Appendix 9B of this COL application.

Electrical System Design and Electrical Separation

Details of the electrical system design/separation for the remainder of the power block and balance of plant structures/areas are provided in Appendix 9B of this COL application.

Fire Safe Shutdown Capability

The remainder of the plant is separated from portions of the facility containing fire safe shutdown systems or components by appropriately rated fire barriers and/or distance. These remaining areas do not contain fire safe shutdown systems or components. This is detailed in Appendix 9B of this COL application.

Ventilation System Design Considerations

Details of the ventilation system for the remainder of the power block and balance of plant structures are provided in Appendix 9B of this COL application.

Smoke confinement/smoke control is not provided in other structures/areas of the plant.

Fire Detection and Alarm System

Details of the fire detection and alarm system for the remainder of the power block and balance of plant structures are provided in Appendix 9B of this COL application.

Fire Water Supply System

{Storage tank makeup is supplied from the Water Treatment Plant and/or a deep well. The fire protection water supply is treated as necessary to help prevent occurrence of biological fouling or corrosion.} The rate of makeup flow to the fire water storage tanks is sufficient to refill the minimum fire protection volume in one tank within eight hours.

In addition, the highest sprinkler system demand is for the Turbine Building and is {approximately 2400 gpm (9084 lpm) at 161 psig (11.1 bar)}. The highest standpipe system demand is for the Containment Building and is {approximately 1250 gpm (4731 lpm) at 176 psig (12.13 bar)}.

Automatic Fire Suppression Systems

Details of the automatic fire suppression systems for the remainder of the power block and balance of plant structures are provided in Appendix 9B of this COL application.

In addition, automatic sprinkler systems, designed and installed in accordance with National Fire Protection Association (NFPA) 15 (NFPA, 2007a), are provided for the following buildings:

- {Turbine Building under operating deck and skirt areas
- SBO Diesel Tank Rooms
- SBO Auxiliary Equipment Rooms
- Switchgear Building Diesel Engine Rooms
- Auxiliary Boiler Equipment Room
- Fire Protection Building}

Automatic single or double interlock preaction sprinkler systems designed and installed in accordance with NFPA 13 (NFPA, 2007b) are provided in the following areas:

- Turbine Generator and Exciter bearings
- Switchgear Building Cable Spreading Rooms
- Switchgear Building Low- and Medium-Voltage Distribution Board Rooms
- Switchgear Building Cable Distribution Division Rooms
- Switchgear Building Battery Rooms
- Switchgear Building Battery Charger Rooms
- Switchgear Building I&C Control / Protection Panel Rooms

Fixed deluge water spray systems designed and installed in accordance with NFPA 15 are provided for the following hazards.

- Hydrogen seal oil unit
- Turbine Building Lube oil drain trenches
- Auxiliary Power Transformers
- Generator Transformers

Manual Fire Suppression Systems

Details of the manual fire suppression systems for the remainder of the power block{, ESWEMS Pumphouse} and balance of plant structures are provided in Appendix 9B of this COL application.

9.5.1.3 Safety Evaluation – Fire Protection Analysis

Appendix 9B addresses the fire protection analysis for the remaining power block and balance of plant structures.

In addition, the plant will maintain an integrated fire hazards analysis (FHA) and supporting evaluations that demonstrate that the plant can:

- achieve and maintain post-fire safe shutdown conditions for a fire in any fire area of the plant, including alternative shutdown fire areas,
- maintain safe plant conditions and minimize potential release of radioactive material in the event of a fire during any plant operating mode,
- detail the plant fire prevention, detection, suppression, and containment features, for each fire area containing structures, systems and components (SSCs) important to safety, and
- achieve and maintain these safe conditions with due consideration of plant fire risk as characterized in the plant-specific fire probabilistic risk assessment (Fire PRA).

9.5.1.4 Inspection and Testing Requirements

The FPP includes procedures for testing fire protection features and systems and includes criteria to ensure design and system readiness. This includes installation and acceptance testing, periodic testing, quality assurance oversight of testing, and proper test documentation.

All fire protection features and systems will be surveilled, inspected, tested, and maintained in accordance with applicable codes and standards of the NFPA including start-up and acceptance tests. The frequency of follow-up inspections and tests will also follow NFPA requirements and ALARA guidelines.

All surveillance, inspection, testing and maintenance is conducted and documented in accordance with approved plant procedures and is performed by qualified personnel.

9.5.1.5 Fire Probabilistic Risk Assessment

No departures or supplements.

9.5.1.6 Fire Protection Program

No departures or supplements.

9.5.1.6.1 Fire Prevention

Governance and control of FPP attributes is provided through policies, procedures, and the {AmerenUE} Quality Assurance Program Description. Procedures are in place for FPP impacting activities including:

- In-situ and transient combustibles.
- Ignition sources.
- Hot Work.
- Annunciator response and pre-fire plans.
- Surveillance, inspection, testing, and maintenance (as applicable) of:
  - Passive fire barriers including opening protectives (i.e., fire doors, fire dampers, and through penetration seal systems).
  - Fire protection water supply system.
  - Automatic and manual fire suppression systems and equipment.
  - Automatic and manual fire detection/fire alarm system equipment.
  - Fire brigade and fire response equipment.

9.5.1.6.2 Fire Protection Program

The FPP organization is shown in Figure 9.5-1. The ultimate responsibility for the FPP rests with the {Senior Vice President/Chief Nuclear Officer (SVP/CNO), AmerenUE}. The responsibilities, lines of authority, training and qualifications by title/position are detailed in administrative procedures and the {AmerenUE} Quality Assurance Program Description. Key positions are described below. The qualifications required for key positions are provided in Section 9.5.1.6.3.

The {Vice President Engineering} has the overall responsibility for development and ongoing assessment of the FPP. A qualified fire protection engineer (FPE) is delegated the responsibility to administer and implement the FPP through procedures governing fire prevention, combustible material control, ignition source control, automatic and manual fire suppression systems, manual fire response equipment, evaluation of work for impact on the FPP, pre-fire planning, and identification of fire protection training requirements for plant personnel including general employees, fire brigade, and contract employees/contractors. The FPE is assisted through the assignment of responsibility for individual portions of the FPP to various departments as defined in administrative procedures.

The {Operations Shift Manager} has the responsibility for ensuring that fire safety and administration of applicable fire protection controls are maintained for all modes of plant operation. In the event of a fire in the plant, the {Operations Shift Manager} is the incident command authority for coordinating fire response and plant operational/shutdown activities unless and until relieved under the Emergency Plan.

{The Fire Marshal has responsibility to implement the day-to-day requirements of the Fire Protection Program. This position reports to the Operations Manager and assists the Fire Protection Engineer and Operations Shift Manager in administrating and implementing the Fire Protection Program through procedures, training, inspections, testing and evaluations.}

Quality assurance oversight of the FPP rests with the Quality and Performance Improvement organization in accordance with the {AmerenUE} Quality Assurance Program Description.

9.5.1.6.3 Fire Protection Training and Personnel Qualifications

Fire Protection Engineer

No departures or supplements.

Fire Brigade Members

No departures or supplements.

Fire Protection System Operation, Testing, and Maintenance

Personnel who perform operation of or surveillance, inspection, test, and/or maintenance activities on fire-protection related structures, systems, or components are trained in the specific activities they are required to perform. Training is conducted through one or more of the following: factory or shop training on individual equipment, recognized apprentice and/or journeyman training courses, training coursework on equipment of similar type or experience-based training and qualification on fire systems in general. All personnel who perform fire protection related maintenance will be trained in conformance to plant procedures and in fire protection feature/system impairment procedures.

Training of the Fire Brigade

No departures or supplements.

General Employee Training

This training is required for all personnel who are granted unescorted plant access. General employee training curriculum provides an overview of the requirements of the FPP including: general fire hazards within the plant, the defense-in-depth objectives of the FPP, and an introduction to the FPP procedures that govern employee actions including appropriate steps to be taken upon discovering a significant fire hazard, actions to be taken upon discovering a fire or hearing/seeing a fire alarm, and combustible material and ignition source controls.

Fire Watch Training

Fire Watch – Hot Work

This training is required for all plant and/or contract personnel assigned duties as a fire watch for hot work. Hot work fire watch training includes training on hot work permitting, hot worker safety, requirements for inspection and authorization for hot work, emergency communication/notification, transfer of fire watch responsibilities, post-work inspection requirements, and hot work recordkeeping requirements. All fire watches are trained in the selection, limitations, and use/application of hand portable fire extinguishers.

Fire Watch – Compensatory Measures

This training is required for all plant and/or contract personnel assigned duties as a fire watch compensating for the inoperability or impairment of a given fire protection system or feature. Compensatory measure fire watch training includes training on impairment procedures, safety functions of fire protection related systems and features and how these functions are degraded, plant features typically being compensated for, emergency communication/notification, transfer of fire watch responsibilities, restoration from compensatory fire watch, and recordkeeping requirements. All compensatory measure fire watches are trained in the selection, limitations, and use/application of hand portable fire extinguishers.

9.5.1.6.4 Fire Brigade Organization, Training, and Records

Fire Brigade equipment including personal protective equipment for structural firefighting is provided for the plant fire brigade. Each fire brigade member is equipped with a helmet (with face shield), turnout coat, turnout pants, footwear, gloves, protective hood, personal alert safety system (PASS) device, and self-contained breathing apparatus (SCBA). All equipment will conform to appropriate NFPA standards. The plant maintains an adequate inventory of firefighting equipment to ensure outfitting of a full complement of brigade members with consideration of the possibility of sustained fire response operations (multiple crews).

SCBAs are required to be worn for interior fire response activities and at similar times when fire/response activities may involve a risk of chemical, particulate, and/or radiological material inhalation exposure.

Other types of fire response equipment are distributed and/or cached at various locations throughout the plant to support response by the plant fire brigade and/or off-site response agencies. The types of equipment provided include fire hose (2-1/2 and 1-1/2 inch diameter), combination and specialty hose nozzles, portable smoke removal equipment, spill control and absorbent materials, supplemental hand portable fire extinguishers, aqueous film-forming foam (AFFF) supply and foam eductors, and other specialty tools.

The plant has procedural controls in place to govern the response to fires. This includes fire annunciator response procedures and pre-fire plans which provide direction for the Control Room to determine: the need to initiate plant safe shutdown, the actions to take to effect shutdown, the mobilization and response of Control Room operators, and the mobilization and response of the plant Fire Brigade to effect fire-fighting activities. These procedures are utilized, in conjunction with the Emergency Plan, to determine when conditions necessitate:

- Requesting support of off-site emergency response resources.
- The declaration and escalation of the fire occurrence as a plant emergency.
- The notification of local, state, and federal governmental agencies.

9.5.1.6.5 Quality Assurance

The {AmerenUE} Quality Assurance Program Description has appropriate provisions to govern the quality attributes of the FPP. The FPP conforms to the applicable provisions of 10 CFR 50, Appendix B (CFR, 2008) and with the quality assurance guidance in Regulatory Guide 1.189 (NRC, 2007).

Audits of the FPP will be performed at the recommended frequencies by an audit team staffed and led by qualified QA and technical auditors.

Additional details of the quality assurance program are provided in Section 17.5.

9.5.1.7 References

{**CFR, 2008**. Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, Title 10, Code of Federal Regulations, Part 50, Appendix B, U.S. Nuclear Regulatory Commission, 2008.

NFPA, 2007a. Standard for Water Spray Fixed Systems for Fire Protection, NFPA 15, National Fire Protection Association, 2007.

NFPA, 2007b. Standard for the Installation of Sprinkler Systems, NFPA 13, National Fire Protection Association, 2007.

NRC, 2007. Fire Protection for Nuclear Power Plants, Revision 1, Regulatory Guide 1.189, Revision 1, U. S. Nuclear Regulatory Commission, March 2007.}

9.5.2 COMMUNICATION SYSTEM

No departures or supplements.

9.5.2.1 Design Basis

No departures or supplements.

9.5.2.2 System Description

No departures or supplements.

9.5.2.3 System Operation Communications Stations

The U. S. EPR FSAR includes the following COL Item in Section 9.5.2.3:

> The COL applicant referencing the U.S. EPR certified design will identify additional site-specific communication locations necessary to support effective communication between plant personnel in all vital areas of the plant during normal operation, as well as during accident conditions.

This COL Item is addressed as follows:

{The Callaway Plant Unit 2 ESWEMS Pumphouse contains safety-related equipment and is a site-specific vital area of the plant. Communication equipment is provided in this area to support effective communication between plant personnel during normal operation, as well as during accident conditions. This location contains equipment to allow use of the plant digital telephone system, PA and alarm system, and sound powered system. A portable wireless communication system is also provided for use by fire brigade and other operations personnel required to achieve safe plant shutdown.

All the communication subsystems are available for use during normal operation of the plant. Except for the sound-powered system, the communication subsystems are powered from the Class 1E Emergency Uninterruptible Power Supply System (EUPS) or the Class 1E Emergency Power Supply System (EPSS), which are supported by the emergency and station blackout diesel generators to provide backup power. Hence all the communication subsystems are expected to be available for use during all accident conditions. However, all communications equipment is categorized as non-safety related, and is not relied upon to mitigate an accident. The sound-powered system does not require an external power source.}

9.5.2.4 Inspection and Testing Requirements

No departures or supplements.

9.5.2.5 References

No departures or supplements.

9.5.3 LIGHTING SYSTEM

No departures or supplements.

9.5.4 DIESEL GENERATOR FUEL OIL STORAGE AND TRANSFER SYSTEM

No departures or supplements.

9.5.5 DIESEL GENERATOR COOLING WATER SYSTEM

No departures or supplements.

9.5.6 DIESEL GENERATOR STARTING AIR SYSTEM

No departures or supplements.

9.5.7 DIESEL GENERATOR LUBRICATING SYSTEM

No departures or supplements.

9.5.8 DIESEL GENERATOR AIR INTAKE AND EXHAUST SYSTEM

No departures or supplements.

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}
(Page 1 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"(1)	Compliance(2)	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.1	Fire Protection Program	Compliance		The Fire Protection Program (FPP) is consistent with the requirements of Regulatory Guide 1.189 and SRP 9.5-1. Details of the FPP are provided in this COL application.
C.1.1	Organization, Staffing, and Responsibilities	Compliance		The FPP organization is shown in Figure 9.5-1. The responsibilities, lines of authority, training and qualifications by title/position are detailed in administrative procedures and the AmerenUE Quality Assurance Program Description.
C.1.2	Fire Hazards Analysis	Compliance	See Fire Protection Analysis Appendix 9A	Appendix 9A of the U.S. EPR FSAR provides the technical analysis for the nuclear island and demonstrates that the EPR has the ability to achieve and maintain safe-shutdown and to minimize the release of radioactive materials to the environment. Appendix 9B is an analysis detailing fire hazards and fire protection attributes for the remainder of the plant. Other structures not listed will be confirmed as not posing fire/explosion risk to the plant using NFPA 80A criteria.
C1.3	Safe Shutdown Analysis	Compliance		The plant will develop and maintain an integrated, detailed site-specific FHA and will have detailed procedures and training to ensure fire-safe shutdown and other fire safe conditions required to minimize radioactive material release are achieved and maintained.
C.1.4	Fire Test Reports and Fire Data	Compliance		If untested barrier configurations are determined necessary during detailed design, they will be evaluated consistent with RG 1.189 requirements.
C.1.5	Compensatory Measures	Compliance		The FPP will apply compensatory measures consistent with RG 1.189 recommendations and standard industry practice whenever fire protection features are degraded and/or inoperable. Compensatory measures will be applied when necessary to accomplish repair or modification or as a result of findings during inspection or surveillance. Fire watches, temporary fire barriers, or backup suppression capability will be implemented, as applicable. Where an uncommon type of compensatory measure is warranted, an evaluation of the alternative will be conducted prior to implementation. Such evaluation will incorporate fire risk insights as applicable.
C.1.6	Fire Protection Training and Qualifications	Compliance		The FPP Organization is shown in Figure 9.5-1.
C.1.6.1	Fire Protection Staff Training and Qualifications	Compliance		The responsibilities, lines of authority, training and qualifications by title/position are detailed in administrative procedures and the AmerenUE Quality Assurance Program Description.
C.1.6.2	General Employee Training	Compliance		General employee training includes instruction on actions to take upon discovery of a fire, hearing a fire alarm, and proper fire preventative and protective administrative controls and actions.

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}
(Page 2 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"(1)	Compliance(2)	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.1.6.3	Fire Watch Training	Compliance		Fire watch training includes instruction on responsibilities, actions, and records for oversight of hot work and when serving as compensatory measure for degraded fire protection feature.
C.1.6.4	Fire Brigade Training and Qualifications	Compliance		The fire brigade will have at least five members available on each shift above the minimum shift complement for safe operation/shutdown. The brigade is trained and equipped to respond to fire-related emergencies.
C.1.6.4.1	Qualifications	Compliance		The fire brigade will be under the direction of the Shift Manager. A Fire Brigade Leader is assigned and qualified to command response to fire emergencies. A minimum of three operations staff members including one licensed operator will be assigned to the shift fire brigade. Fire brigade members are required to be physically fit and undergo an annual physical examination for initial and continuing brigade membership.
C.1.6.4.2	Instruction	Compliance		Fire brigade members are trained in nuclear facility fire response strategy and tactics by qualified trainers using both classroom and hands-on instruction. The training curriculum is detailed in an administrative procedure. Refresher training is structured to ensure that the entire curriculum is repeated every two years.
C.1.6.4.3	Fire Brigade Practice	Compliance		Brigade practice sessions are scheduled to ensure that each member attends at least one session per year.
C.1.6.4.4	Fire Brigade Training Records	Compliance		Brigade training records will be retained for a minimum of three years.
C.1.7	Quality Assurance	Compliance		The AmerenUE Quality Assurance Program Description Section V has appropriate provisions to govern the quality attributes of the fire protection program. The FPP conforms to the applicable provisions of 10 CFR 50, Appendix B and with the quality assurance guidance in RG 1.189.
C.1.7.1	Design and Procurement Document Control	COL Applicant	Note 3	Design and Procurement Document Control shall be in accordance with Section V of the AmerenUE Quality Assurance Program Description. Fire protection quality requirements are included in plant configuration control processes.
C.1.7.2	Instructions, Procedures, and Drawings	COL Applicant	Note 3	The FPP provides instruction and procedures to control fire prevention and firefighting; design, installation, inspection, test, maintenance and modification of fire protection features/systems; and appropriate administrative controls in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.3	Control of Purchased Material, Equipment, and Services	COL Applicant	Note 3	The FPP provides procedures to control procurement of fire protection related items to ensure proper evidence of quality in accordance with Section V of the AmerenUE Quality Assurance Program Description.

FSAR: Chapter 9.0

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}
(Page 3 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"(1)	Compliance(2)	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.1.7.4	Inspection	Compliance		The FPP includes procedures for independent inspection of fire protection-related activities including installation and/or maintenance of features including FP systems, emergency lighting and communication, cable routing, and fire barriers and opening protectives in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.5	Test and Test Control	Compliance		The FPP includes procedures for testing fire protection features and systems and includes criteria to ensure design and system readiness. This includes installation and acceptance testing, periodic testing, quality assurance oversight of testing, and proper test documentation in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.6	Inspection, Test, and Operating Status	Compliance		Fire protection features and systems are provided with suitable marking and labeling to indicate acceptance and readiness for operation in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.7	Non-conforming Items	Compliance		The FPP includes procedures for identification and control of items that do not conform to specified requirements, are inoperable or otherwise unsuitable. This includes tagging or labeling, notification and dispositioning of the nonconforming item in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.8	Corrective Action	Compliance		The plant has an administrative procedure to ensure that proper corrective actions are taken for conditions adverse to fire protection including root cause analysis when appropriate in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.9	Records	Compliance		The FPP includes provisions for preparing and maintaining retrievable records that demonstrate conformance to fire protection requirements in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.10	Audits	Compliance		The FPP requires that audits be performed at the appropriate periodicity by qualified fire protection and QA personnel to verify that the program is being properly implemented and that compliance to fire protection requirements is being met in accordance with Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.10.1	Annual Fire Protection Audit	Compliance		An annual audit will be performed consistent with R.G. 1.189.
C.1.7.10.2	24-Month Fire Protection Audit	Compliance		A biennial audit will be performed consistent with R.G. 1.189 and Section V of the AmerenUE Quality Assurance Program Description.
C.1.7.10.3	Triennial Fire Protection Audit	Compliance		A triennial audit will be performed consistent with R.G. 1.189 and Section V of the AmerenUE Quality Assurance Program Description. Independent auditors will be used to perform triennial audits.

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}
(Page 4 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"(1)	Compliance(2)	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.1.8	Fire Protection Program Changes/Code Deviations	COL Applicant	Note 3	Compliance - If program changes or deviations are required, the plant will use risk-informed, performance-based methodologies consistent with R.G. 1.174 to evaluate and justify changes/deviations.
C.1.8.1	Change Evaluations	COL Applicant	Note 3	Compliance - FPP program changes will be evaluated consistent with 10 CFR 50.59 and the applicable change processes in 10 CFR 52.
C.1.8.5	10 CFR 50.72 Notification and 10 CFR 50.73 Report	COL Applicant	Note 3	Compliance - the plant will report fire events and any fire protection program deficiencies consistent with 10 CFR 50.72 and 10 CFR 50.73.
C.1.8.7	Fire Modeling	COL Applicant	Note 3	Compliance - If fire models are used to evaluate changes, the plant will apply models consistent with R.G. 1.189 including limitations on their use and adequate verification and validation (as required).
C.2	Fire Prevention	Compliance		The FPP includes procedures to ensure minimization of fire hazards in areas important to safety for anticipated operating conditions and to ensure fire safety as part of facility modifications.
C.2.1	Control of Combustibles	Compliance		The FPP includes procedures to control transient combustibles consistent with the Fire Hazards Analysis and good fire prevention practices.
C.2.1.1	Transient Fire Hazards	Compliance		The FPP includes procedures to control transient combustibles consistent with the Fire Hazards Analysis and good fire prevention practices.
C.2.1.2	Modifications	Compliance		The FPP includes procedures to ensure that fire prevention and fire safety practices are maintained and that the facility fire safety design basis is not negatively impacted.
C.2.1.3	Flammable and Combustible Liquids and Gases	Compliance		The FPP includes procedures to ensure flammable and combustible liquids and gases are handled properly and consistent with the facility design basis.
C.2.1.4	External/Exposure Fire Hazards	Compliance		The FPP includes procedures to ensure that any adjacent or external facilities to areas important to safety are evaluated consistent with NFPA 80A and for impact on the facility Fire Hazards Analysis.
C.2.2	Control of Ignition Sources	Compliance		The FPP includes procedures for control of ignition sources. The facility design follows recognized codes, standards, and practices to minimize ignition hazards.
C.2.2.1	Open Flame, Welding, Cutting, and Grinding (Hot Work)	Compliance		The FPP includes procedures for issuance of hot work permits and to control the designation of fixed weld shop areas or similar.
C.2.2.2	Temporary Electrical Installations	Compliance		The FPP includes procedures to monitor and control the use of temporary electrical installations for routine and outage related maintenance consistent with recognized standards and practices.
C.2.2.3	Other Sources	Compliance		The FPP includes procedures to monitor and control other non-routine ignition hazards such as temporary heating, leak testing, tar kettles, heat guns, and similar devices/operations.
C.2.3	Housekeeping	Compliance		The FPP includes procedures for routine housekeeping and monitoring areas important to safety for prompt removal of combustibles.

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}
(Page 5 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"(1)	Compliance(2)	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.2.4	Fire Protection System Maintenance and Impairments	Compliance		The FPP includes procedures to ensure fire protection features and systems are maintained in accordance with applicable reference standards and other regulatory guidance. Fire system and feature impairments are controlled by a permit system authorized by a qualified individual.
C.3.5	Manual Firefighting Capabilities	Compliance		See below
C.3.5.1	Fire Brigade	Compliance		The Fire Brigade consists of at least five members available on each shift above the minimum shift complement for safe operation/shutdown. The brigade is trained and equipped to respond to fire-related emergencies.
C.3.5.1.1	Fire Brigade Staffing	Compliance		The Fire Brigade consists of at least five members available on each shift above the minimum shift complement for safe operation/shutdown. The on-duty Shift Manager is not a member of the fire brigade.
C.3.5.1.2	Equipment	Compliance		The Fire Brigade is suitably outfitted and equipped for interior structural firefighting activities. PPE and related fire brigade equipment conforms with and is maintained per recognized standards. This includes turnout gear and self-contained breathing apparatus and equipment including hoses, nozzles, smoke ejectors, and other specialized equipment. Equipment maintenance and inspection is performed per plant procedure.
C.3.5.1.3	Procedures and Prefire Plans	Compliance		The Fire Brigade and fire response activities are conducted in accordance with annunciator response procedures, pre-fire plans, and related fire response procedures which address strategies and tactics typical to nuclear power plant fire response.
C.3.5.1.4	Performance Assessment/Drill Criteria	Compliance		The Fire Brigade will drill at least quarterly. At least one annual drill will be unannounced and one drill will be on a back shift. Drills will be scheduled to ensure that all brigade members participate in minimum of two drills per year. Drills are based on prepared drill and tabletop guides and will be critiqued by knowledgeable plant staff to ensure that fire response objectives are being met. An independent reviewer will be included at least once every three years.
C.3.5.2	Offsite Manual Firefighting Resources	Compliance		Offsite fire department response is governed through a mutual aid agreement with offsite fire departments. The offsite fire departments are included in pertinent training on the hazards of the facility and participate in a minimum of one drill per year on-site.
C.3.5.2.1	Capabilities	Compliance		The offsite fire department equipment is compatible with the plant equipment and/or adapters are provided and available when required.
C.3.5.2.2	Training	Compliance		The offsite fire departments are included in pertinent training on the hazards of and response within the facility including radiological and operational hazards; site access/security; and roles, responsibilities and authorities including command and response structure.

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}

(Page 6 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"(1)	Compliance(2)	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.3.5.2.3	Agreement/Plant Exercise	Compliance		The plant will establish written mutual aid agreements with off-site fire departments to provide response support to the fire brigade. Said agreements will address authorities and command responsibilities and will provide for periodic participation/joint training including annual drills and participation in radiological emergency response plan exercises.
C.4.1.7	Communications	Compliance		The Fire Brigade will utilize portable radios for communications during fire response. This system is arranged to not conflict with other site radio communications and to provide reliable, comprehensive coverage for the site. The radio system is the primary means of communication for fire brigade operations. Secondary communications are available to the fire brigade via the plant primary and wireless telephone systems and by the plant public address system.
C.5.5	Post-Fire Safe-Shutdown Procedures	COL Applicant	Note 3	Compliance - The plant will have detailed procedures and training to ensure fire-safe shutdown and other fire-safe conditions required to minimize radioactive material release are achieved and maintained.
C.5.5.1	Safe-Shutdown Procedures	COL Applicant	Note 3	Compliance - See C.5.5
C.5.5.2	Alternative/Dedicated Shutdown Procedures	COL Applicant	Note 3	Compliance - See C.5.5
C.5.5.3	Repair Procedures	COL Applicant	Note 3	Compliance - Consistent with the U.S. EPR FSAR, the plant does not permit repairs to achieve hot or cold shutdown conditions; procedures are not required.
C.6.1.6	Alternative/Dedicated Shutdown Panels	Compliance		The FPP includes procedures to control transient combustibles consistent with the Fire Hazards Analysis and good fire prevention practices.
C.6.2.4	Independent Spent Fuel Storage Areas	COL Applicant	Note 3	Compliance – No Independent Spent Fuel Storage Areas are planned for the Callaway Plant Unit 2 at this time and are not included in this COL application.
C.6.2.6	Cooling Towers	COL Applicant	Note 3	Compliance - Essential Service Water Cooling Towers are addressed in Appendix 9A. Callaway Plant Unit 2 Non-Safety natural draft cooling towers are located and protected in such a way that fire will not adversely affect any systems or equipment important to safety
C.7.6	Nearby Facilities	COL Applicant	Note 3	Compliance - Appendix 9A of the U.S. EPR FSAR provides the technical analysis for the nuclear island and related power block structures and demonstrates that the EPR has the ability to achieve and maintain safe-shutdown and to minimize the release of radioactive materials to the environment. FSAR Appendix 9B of this COL application provides an analysis of fire hazards and details fire protection attributes for the remainder of the plant.
C.8.4	Applicable Industry Codes and Standards	Compliance		The FPP will conform to the codes and standards and applicable edition years listed in Section 9.5.1.7 of the U.S. EPR FSAR.

FSAR: Chapter 9.0

Table 9.5-1—{Fire Protection Program Compliance with Regulatory Guide 1.189}
(Page 7 of 7)

R.G. Section	Regulatory Guide 1.189 "C. Regulatory Position"[(1)]	Compliance[(2)]	U.S. EPR Comment	Callaway Plant Unit 2 Supplement
C.8.6	Fire Protection Program Implementation Schedule	Compliance		The required elements of the FPP are fully operational prior to receipt of new fuel for buildings storing new fuel and adjacent areas that could affect the fuel storage area at the plant. Other required elements of the FPP described in FSAR Section 9.5.1 are fully operational prior to initial fuel loading at.

Notes:

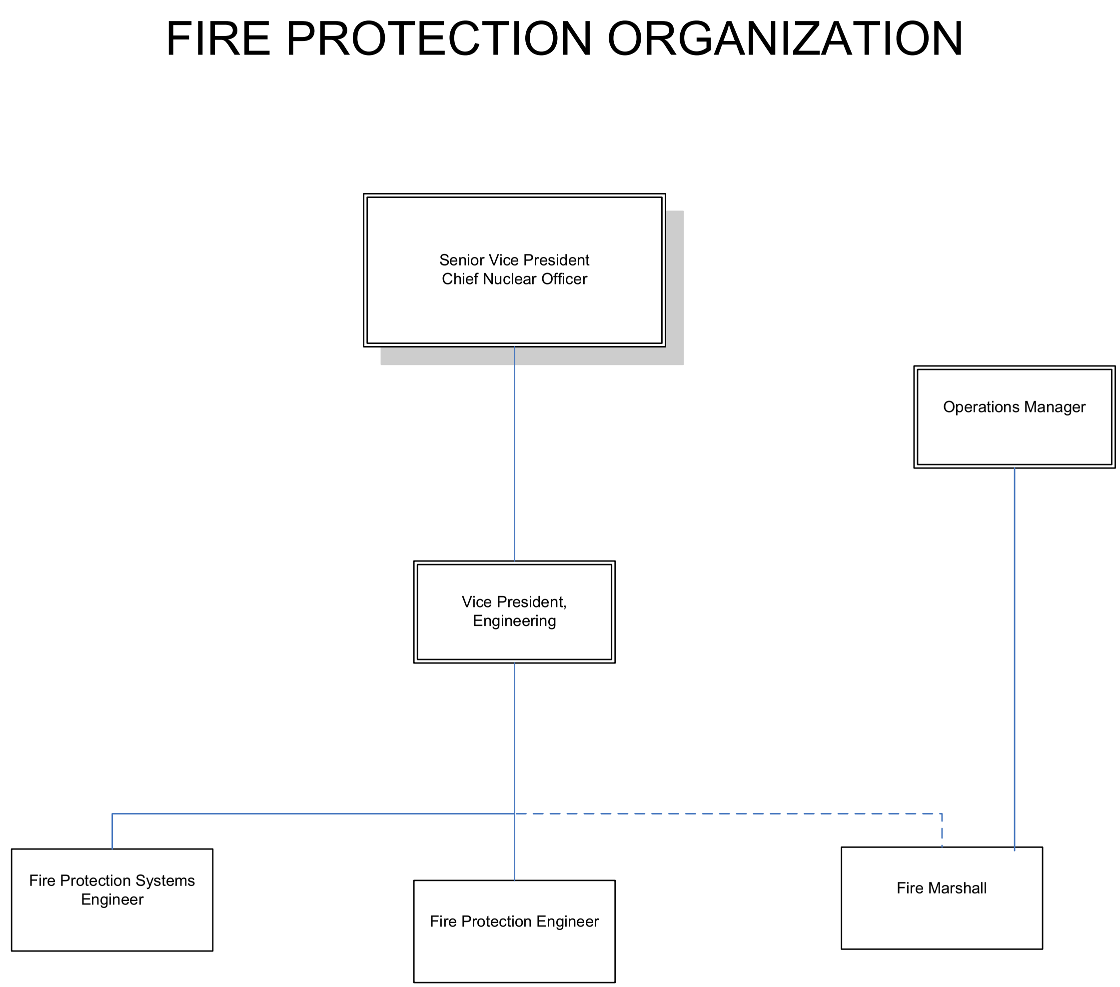
(1) The scope of the Regulatory Position presented in this compliance comparison table is abbreviated, due to the depth of detail contained within the Regulatory Position Appendix C itself. The user should refer to Regulatory Guide 1.189 directly for the text portion of each section addressed by the table.

(2) The U.S. EPR compliance to the regulatory positions delineated in Regulatory Guide 1.189, "Fire Protection for Nuclear Power Plants," is as indicated by the following definitions:

- COL Applicant – The COL Applicant will address the subject regulatory position.
- Compliance – The U.S. EPR design supports compliance with the subject regulatory position.

A COL Applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Position.

Figure 9.5-1—]Fire Protection Organization}



9A FIRE PROTECTION ANALYSIS

Appendix 9A of the U.S. EPR FSAR is incorporated by reference with the following supplement.

The information in U.S. EPR FSAR Appendix 9A – the fire protection analysis of the nuclear island – is supported by additional information provided in Appendix 9B. Appendix 9B provides the fire protection analysis of the remaining power block and balance of plant structures.

Figures 9A-98 through 106 in the U.S. EPR FSAR are identified as conceptual information for the Access Building. These figures and the corresponding fire area parameters in Table 9A-2 of the U.S. EPR FSAR for the Access Building are applicable to the plant.