Section 5.3

AP1000 PLANT OVERVIEW

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5.3 AP1000 PLANT OVERVIEW

5.3.1 Introduction

Westinghouse Electric Company designed an advanced 600-MWe (1933-MWt) nuclear power plant called the AP600. The AP600 uses passive safety systems to enhance plant safety and to satisfy US licensing requirements. The use of passive safety systems provides significant and measurable improvements in plant simplification, safety, reliability, investment protection and plant costs. These systems use only natural forces such as gravity, natural circulation, and compressed gas to provide the driving forces for the systems to adequately cool the reactor core following an accident. The AP600 received Design Certification by the Nuclear Regulatory Commission in December 1999.

Westinghouse then developed the AP1000 standard nuclear reactor design based closely on the AP600 design. The AP1000, with a power output of approximately 1000 MWe (3400 MWt), maintains the AP600 design configuration, use of proven components and licensing basis by limiting the changes to the AP600 design to as few as possible. The AP1000 received Design Certification by the Nuclear Regulatory Commission in January 2006.

The AP1000 reactor and passive safety features retain the same configuration as the AP600. The capacities of the major reactor components have been increased to support the increased power rating. The approach to designing the passive safety features (core cooling and containment cooling) is to evaluate each feature to determine if changes are necessary to provide proper safety margins at the higher power rating. Preliminary safety evaluations have shown that the AP1000 passive safety systems provide adequate performance during limiting design basis accidents.

Figures 5.3-1 and Figure 5.3-2 show the AP1000 containment layout, and Figure 5.3-3 shows the AP1000 site layout.

5.3.2 Plant Overview

5.3.2.1 Design Origin and Overall Plant Description

The AP1000 is a two-loop, 1000-MWe pressurized water reactor (PWR) with passive safety features and extensive plant simplifications to enhance the construction, operation, and maintenance. The AP1000 design is derived directly from the AP600, a two-loop, 600-MWe PWR. The AP1000 retains the AP600 approach of using proven PWR technology and safety features that rely on natural forces.

The AP1000 passive safety systems are the same as those for the AP600, except for some changes in component capacities. The safety systems maximize the use of natural driving forces such as pressurized gas, gravity, and natural circulation flow. Safety systems do not use active components (such as pumps, fans, or diesel generators) and are designed to function without safety-grade support systems (such as alternating current [ac] power, component cooling water, service water, or heating, ventilation, and air-conditioning (HVAC). The number and complexity of operator actions required to control the safety systems are minimized; the approach is to eliminate required operator action rather than to automate it. The net result is a design with reduced complexity and improved operability.

The approach in uprating the AP600 to the AP1000 was to increase the power capability of the plant within the space constraints of the AP600, while retaining the credibility of proven components and substantial safety margins. Therefore, the AP1000 retains the AP600 licensing basis.

Some of the high-level design characteristics of the AP1000 are as follows:

- Net electrical power is approximately 1090 MWe, and nuclear steam supply system (NSSS) thermal power is 3415 MWt.

- Rated performance is achieved with up to 10 percent of the steam generator tubes plugged and with a maximum hot leg temperature of 617°F.

- Major safety systems are passive; they require no operator action for 72 hours after an accident, and maintain core and containment cooling for a protracted time without ac power.

- Predicted core damage frequency will be similar to AP600 (1.7E-07/yr) and will be well below the 1E-04/yr requirement. The frequency of significant release will be similar to AP600 (1.8E-08/yr) which is well below the 1E-06/yr requirement.

- The core is designed for an 18-month fuel cycle.

- Overall plant availability is greater than 93 percent, including forced and planned outages; the goal for unplanned reactor trips is less than one per year.

- The plant is designed to accept a 100-percent load rejection from full power to house loads without reactor trip or operation of the -pressurizer or steam generator safety valves. The design provides for a turbine capable of continued stable operation at house loads.

- The plant is designed with significantly fewer components and significantly fewer safety-related components than a current pressurized water reactor of a comparable size.

- The plant design objective is 60 years without the planned replacement of the reactor vessel, which itself has a 60-year design objective based on conservative assumptions. The design provides for the replaceability of other major components, including the steam generators.

- The design of the major components required for power generation, such as the steam generators, reactor coolant pumps, fuel, internals, turbine, and generator, is based on equipment that has successfully operated in power plants. Modifications to these proven designs were based on similar equipment that had successful operating experience in similar or more severe conditions.

5.3.2.2 Plant Comparisons

Overall Plant Parameters

A comparison of the major AP1000 design features and nominal parameters with conventional pressurized water plants with a similar power rating as the AP1000 is provided in Table 5.3-1. The values provided are nominal and provided for comparison and not for design certification.

The Watts Bar plant was chosen since it is representative of the last generation of Westinghouse plant design. The V. C. Summer plant was chosen for comparison because it has a core power density similar to that of the AP1000. The San Onofre Unit 2 and 3 parameters provide a comparison to a two-loop plant of similar thermal power rating.

Plant Design Features

The design approach for the AP1000 was to utilize design features and components that have been proven in currently operating plants or are based on such proven components. The AP1000 incorporates both design features that are the same as in current operating plants, and those that are based heavily on proven technology. The major design features which are based on proven designs in current plants are discussed here. They include the core design, steam generator design, reactor coolant pump motors.

CORE DESIGN

The AP1000 core design incorporates 157 fuel assemblies. This core design is the same as in V. C. Summer, Doel 3, and Tihange 4. The active fuel region in the Doel and Tihange plants is 14 feet, just as in the AP1000. However, the linear power density of the AP1000 core is approximately the same as the V. C. Summer core, although the active length of the V. C. Summer core is only 12 feet. Thus, the Doel and Tihange plants provide operating experience with the 157 assembly core and the longer fuel assembly mechanical design. The V. C. Summer plant provides operating experience with this core arrangement at the higher AP1000 linear power density compared to Doel and Tihange.

STEAM GENERATOR DESIGN

The AP1000 steam generator is a vertical U-tube design with a triangular pitch tube arrangement. Many of the design features of the Delta 125 units have been incorporated from the operating replacement Delta 75 and Delta 94 steam generators. Operating experience with these generators has been obtained in the V. C. Summer and Shearon Harris plants (Delta 75) and the South Texas plant (Delta 94). These generators operate at a lower power rating than those of the AP1000. However, the replacement steam generators for the Arkansas #1 unit provide experience in the power range of the AP1000. The steam generators for the San Onofre and Waterford units are also rated at the same 1700 MWt as the AP1000. In the past, steam generator tube integrity has been linked with tube material and the reactor coolant system hot leg temperature. The AP1000 steam generator design utilizes Inconel-690 tubes and has a hot leg temperature of 615°F.

REACTOR COOLANT PUMP

The AP1000 reactor coolant pump utilizes a hermetically sealed canned motor of proven design. The addition of a heavy metal alloy flywheel to provide the rotating inertia needed for flow coastdown is based on the design of the AP600 reactor coolant pumps. The AP1000 pump incorporates the hydraulics scaled down from the hydraulics developed for the Tsuruga 3/4 reactor coolant pumps. Thus, the AP1000 reactor coolant pumps are based on components with extensive operating history and previous design work.

Tsuruga 3/4 are Mitsubishi Advanced Pressurized Water Reactors (APWRs) currently planned for construction in Japan (commercial operation scheduled for 2014/2015).

PRESSURIZER

The AP600 pressurizer is essentially the Westinghouse design used in approximately 70 operating plants worldwide. The AP1000 pressurizer is larger, with a volume of 59.5 cubic meters (2100 cubic feet). This is accommodated by making the pressurizer slightly taller with a larger diameter.

The large pressurizer avoids challenges to the plant and operator during transients, which increases transient operation margins resulting in a more reliable plant with fewer reactor trips. It also eliminates the need for fast-acting power-operated relief valves, a possible source of RCS leakage and maintenance.

CONTAINMENT

Containment building - The containment building is comprised of the containment vessel and all structures contained within the containment vessel. The containment building is an integral part of the overall containment system with the functions of containing the release of airborne radioactivity following postulated design basis accidents and providing shielding for the reactor core and the reactor coolant system during normal operations.

The containment vessel is an integral part of the passive containment cooling system. The containment vessel and the passive containment cooling system are designed to remove sufficient energy from the containment to prevent the containment from exceeding its design pressure following postulated design-basis accidents.

The principal systems located within the containment building are the reactor coolant system, the passive core cooling system, and the reactor coolant purification portion of the chemical and volume control system.

Shield building - The shield building is the structure and annulus area that surrounds the containment vessel. During normal operations the shield building, in conjunction with the internal structures of the containment building, provides the required shielding for the reactor coolant system and all the other radioactive systems and components housed in the containment. During accident conditions, the shield building provides the required shielding for radioactive airborne materials that may be dispersed in the containment as well as radioactive particles in the water distributed throughout the containment.

The shield building is also an integral part of the passive containment cooling system. The passive containment cooling system air baffle is located in the upper annulus area. The function of the passive containment cooling system air baffle is to provide a pathway for natural circulation of cooling air in the event that a design basis accident results in a large release of energy into the containment. In this event the outer surface of the containment vessel transfers heat to the air between the baffle and the containment shell. This heated and thus, lower density air flows up through the air baffle to the air diffuser and cooler and higher density air is drawn into the shield building through the air inlet in the upper part of the shield building.

Another function of the shield building is to protect the containment building from external events. The shield building protects the containment vessel and the reactor coolant system from the effects of tornadoes and tornado produced missiles.

PASSIVE SAFTEY SYSTEMS

Passive systems provide plant safety and protect capital investment. They establish and maintain core cooling and containment integrity indefinitely, with no operator or AC power support requirements. The passive systems meet the single-failure criteria and probabilistic risk assessments (PRA) used to verify reliability. The passive safety systems are significantly simpler than typical PWR safety systems. They contain significantly fewer components, reducing required tests, inspections, and maintenance. The passive safety systems have one-third the number of remote valves as typical active safety systems, and they contain no pumps. Equally important, passive safety systems do not require a radical departure in the design of the rest of the plant, core, RCS, or containment. The passive safety systems do not require the large network of active safety support systems needed in typical nuclear plants. These include AC power, HVAC, cooling water, and the associated seismic buildings to house these components.

The AP1000 passive safety-related systems provide the following functions:

- Emergency makeup and boration,
- Safety injection and automatic depressurization,
- Residual heat removal, and
- Containment cooling.

The passive core cooling and containment cooling safety systems provide a major enhancement in plant safety and investment protection as compared with conventional plants. They establish and maintain core cooling and containment integrity indefinitely, with no operator or ac power support requirements. The

passive systems are designed to meet the single-failure criterion, and PRAs are used to verify their reliability.
The AP1000 passive safety systems are significantly simpler than typical PWR safety systems since they contain significantly fewer components, reducing the required tests, inspections, and maintenance. They require no active support systems, and their readiness is easily monitored.

STEAM AND POWER CONVERSION SYSTEMS

The steam and power conversion system is designed to remove heat energy from the reactor coolant system via the two steam generators and to convert it to electrical power in the turbine-generator. The main condenser deaerates the condensate and transfers heat that is unusable in the cycle to the circulating water system. The regenerative turbine cycle heats the feedwater, and the main feedwater system returns it to the steam generators.

The steam generated in the two steam generators is supplied to the high-pressure turbine by the main steam system. After expansion through the high-pressure turbine, the steam passes through the two moisture separator/reheaters (MSRs) and is then admitted to the three low-pressure turbines. A portion of the steam is extracted from the high- and low-pressure turbines for seven stages of feedwater heating.

Exhaust steam from the low-pressure turbines is condensed and deaerated in the main condenser. The heat rejected in the main condenser is removed by the circulating water system (CWS). The condensate pumps take suction from the condenser hotwell and deliver the condensate through four stages of low-pressure closed feedwater heaters to the fifth-stage, open deaerating heater. Condensate then flows to the suction of the steam generator feedwater booster pump and is discharged to the suction of the main feedwater pumps. The steam generator feedwater pumps discharge the feedwater through two stages of high-pressure feedwater heating to the two steam generators.

The moisture separator drains are pumped to the deaerator. The reheater drains and high-pressure feedwater heater drains cascade into the deaerator. Drains from the low-pressure feedwater heaters are cascaded through successively lower pressure feedwater heaters to the main condenser.

The turbine-generator has an output of about 1,199,500 kW for the Westinghouse nuclear steam supply system (NSSS) thermal output of 3,415 MWt. The systems of the turbine cycle have been designed to meet the maximum expected turbine generator conditions.

ELECTRICAL SYSTEMS

The AP1000 on-site power system includes the main AC power system and the DC power system. The main AC power is a non-Class 1E system. The DC power system consists of two independent systems, one Class 1E and one non-Class 1E. The on-site power system is designed to provide reliable electric power to the plant safety and non-safety equipment for normal plant operation, startup, normal shutdown, accident mitigation, and emergency shutdown.

The main generator is connected to the off-site power system via three single-phase main step-up transformers. The normal power source for the plant auxiliary AC loads is provided from the 24-kV isophase generator buses through the unit auxiliary transformers. In the event of a loss of the main generator, the power is maintained without interruption from the preferred power supply by an auto-trip of the main generator breaker. Power then flows from the main transformer to the auxiliary loads through the unit auxiliary transformers.

Off-site power has no safety-related function due to the passive safety features incorporated in the AP1000 design. Therefore, redundant off-site power supplies are not required. The design provides a reliable offsite power system that minimizes challenges to the passive safety systems.

The Class 1E DC power system includes four independent divisions. Any three of the four divisions can shut down the plant safely and maintain it in a safe shutdown condition. Each of divisions B and C has two battery banks. One of these battery banks is sized to supply power to selected safety-related loads for at least 24 hours, and the other battery bank is sized to supply power to another smaller set of selected safety-related loads for at least 72 hours following a design basis event (including the loss of all AC power). Each of divisions A and D has a single 24-hour capable battery bank only.

For supplying power during the post-72-hour period following a design-basis accident, provisions are made to connect ancillary ac generators to the Class 1E voltage regulating transformers (Divisions B and C only). These generators power the Class 1E post-accident monitoring systems, the lighting in the main control room, and ventilation in the main control room and Divisions B and C instrumentation and control rooms.

5.3.3 Regulatory Treatment of Non-Safety-Related Systems (RTNSS)

Regulatory treatment of safety-related AP1000 systems and components is handled in a manner similar to that used for currently operating plants.

Chapter 22 of the AP1000 final safety evaluation report (FSER) discusses the licensing process for RTNSS. In SECY 94-084 the staff discussed uncertainties inherent in the use of passive safety systems resulting from limited operating experience and low driving forces in these systems (density differences, gravity, check valve sticking due to low differential pressure, critical flow through automatic depressurization system valves, thermal hydraulic uncertainties). Residual uncertainties associated with passive safety system performance increase the importance of active systems in providing defense-in-depth functions to back up passive systems. Recognizing this, the NRC and the Electric Power Research Institute (EPRI) developed a process to identify the important active systems and to maintain appropriate regulatory oversight of those systems. The process does not require all safety-related criteria to be imposed, but rather requires controls to provide a high level of confidence that active systems having a significant safety role are available when they are challenged.

Sensitivity studies of the PRA were used to identify the non-safety systems needed to meet the CDF (1E-4/yr) and LRF (1E-6/yr) safety goal guidelines. If a nonsafety-related system, structure, or component (SSC) provides a mitigation function that contributes to the calculated CDF and LRF meeting the safety goal guidelines, it is designated risk important and will be subject to regulatory oversight. Other evaluations were performed to identify the importance of SSCs to initiating events, shutdown operations, containment performance, and post-72-hour actions.

Regulatory oversight methods are to be commensurate with the risk importance. They include inspections, tests, analyses, and acceptance criteria (ITAAC), technical specifications (TSs), quality assurance requirements, short-term availability controls, and credit for normal operational reliability assurance measures.

The results of the studies identified numerous SSCs as subject to RTNSS for the AP1000 and are listed in Section 22.5.7 of the FSER. They include the diverse actuation system (DAS manual and automatic), normal residual heat removal system, component cooling water, service water, post-72-hr makeup water sources, main control room (MCR) fans, instrumentation room fans, hydrogen igniters, onsite ac power, offsite ac power, ancillary diesel generators, non-Class 1E dc and uninterruptible power supplies (UPSs) for the DAS anticipated transient without scram (ATWS) mitigation function, and reactor vessel insulation.

Regulatory oversight methods in addition to ITAAC were determined as follows:

- Inclusion of a TS limiting condition for operation (LCO) is the appropriate operational regulatory control for the manual DAS. A quality assurance program meeting the guidance of GL 85-06 is applicable to the DAS and the non-Class 1E dc and UPSs supporting the DAS ATWS mitigation function.

- Investment Protection Short-Term Availability Controls (contained in a document formatted similar to technical specifications) provide administrative operational controls for the majority of the other SSCs.

- The Design Reliability Assurance Program (D-RAP), a quality assurance program for risk-important nonsafety-related SSCs, provides reasonable assurance that the AP1000 is designed, procured, constructed, maintained, and operated in a manner consistent with the PRA.

Balance-of-plant (BOP) systems (main feedwater, main steam, condensate, turbine, BOP controls) were also found to be important to main feedwater transients. Since these systems are normally operating, credit would be given for normal operational reliability assurance measures described in the design control document (DCD) and no additional regulatory oversight requirements would be required.

Inspection Considerations

Inspection will be focused on those SSCs with targeted ITAAC and findings would be documented. If they are associated with safety-related SSCs, enforcement should be documented. Findings associated with nonsafety-related SSCs would be considered failures to meet commitments under the D-RAP.

5.3.4 Summary

The AP1000 is a logical extension of the AP600 design. The AP1000 maintains the same design philosophy of AP600, such as use of proven components, systems simplification and state-of-the-art construction techniques. The AP1000 optimizes the power output while maintaining the AP600 Nuclear Island footprint, to reduce capital and generation costs.

A concerted effort has been made to simplify AP1000 systems and components, to facilitate construction, operation and maintenance and to reduce the capital and generating costs.

The use of passive systems allows the plant design to be significantly simpler. In addition, the passive safety systems do not require the large network of safety support systems found in current generation nuclear power plants (e.g., Class 1E ac power, safety HVAC, safety cooling water systems and associated seismic buildings). The AP1000 uses 50% fewer valves, 83% less pipe (safety grade), 87% less cable, 36% fewer pumps, and 56% less seismic building volumes.

Table 5.3-1 (Sheet 1 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Overall Plant				
Design Life (years)	60	40[a]	40[a]	40[a]
NSSS Power (MWt)	3,415	3,475	3,410	2,912
Core Power	3,400	3,459	3,390	2,900
Net MWe	1,090	1,218	1,100	950
RCS Operating Pressure (psia)	2,250	2,250	2,250	2,250
T_{hot} (°F)	615	619	611	622
SG Design Pressure (psia)	1200	1200	1200	1200
Feedwater Temperature (°F)	440	442	445	440

Notes:

a. Plus 20 years life extension

Table 5.3-1 (Sheet 2 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Core				
Fuel Assemblies	157	193	217	157
Active Fuel Length (inches)	168	144	150	144
Fuel Assembly Array	17x17	17x17	16x16	17x17
Number of Control Rods	53	57	83 full length 8 part length	48
Number of Gray Rods	16	0	0	0
Average Linear Power (kw/ft)	5.707	5.52	5.34	5.69
Heat Flux Hot Channel Factor (F_Q)	2.60	2.50	2.35	2.45

Table 5.3-1 (Sheet 3 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Reactor Vessel				
Vessel ID (inches)	157	148	172	157
Number of Hot Leg nozzles	2	4	2	3
Hot Leg ID (inches)	31	29	42	29
Number of Cold Leg Nozzles	4	4	4	3
Cold Leg ID (inches)	22	27.5	30	27.5
Number of Direct Vessel Injection Nozzles	2	0	0	0
Reactor Coolant Pumps				
Type	Sealless	Shaft Seal with Seal Inj	Shaft Seal without Seal Inj	Shaft Seal with Seal Inj
Number	4	4	4	3
Rated HP (Rated Temp/Press)	7,300	7,000	7,200	7,000
Flow/Pump (gpm)	78,750	100,100	99,000	103,400
Pressurizer				
Volume (ft^3)	2,100	1,800	1,514	1,400
Number Safety Valves/ Size (inches)	2/6	3/6	2/6	3/6
Number PORV/ Size (inches)	0	2/3	0	2/3
PRT Volume (ft^3)	No PRT	1,800	320	1,300
Auto Depressurization	Yes	No	No	No

Table 5.3-1 (Sheet 4 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Steam Generators				
Type	Vertical U-Tube, Recirc Design	Vertical U-Tube Design with Preheater Section	Vertical U-Tube Design	Vertical U-Tube Design
Model	Delta-125	68 AXP	CE	Delta-75
Number	2	4	2	3
Heat Transfer Area (ft^2) per SG	~125,000	68,000	103,574	75,180
Number Tubes/SG	~10,000	5,618	9,300	6,307
Tube Material	I 690 TT	I 690 TT	I 600	I 690 TT
Separate SU FW Nozzle	Yes	Yes	No	No
Turbine Island				
Turbine - # HP	1	1	1	1
Turbine - # LP	2 or 3	3	3	2
Number of Reheating Stages	1	2	2	1
# LP FW Heating Stages	4	6	5	4
# HP FW Heating Stages	2	1	1	2
Deaerator	Yes	No	No	Yes
# MFW Pumps	3	2	2	3
Type MFW Pump	Motor	Turbine	Turbine	Turbine

Table 5.3-1 (Sheet 5 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Containment				
Type	Free Standing Steel Vessel with Reinforced Concrete Shield Bldg	Free Standing Steel Vessel with Reinforced Concrete Shield Bldg	Reinforced Concrete	Reinforced Concrete
Free Volume (ft^3)	$2.07x10^6$	$1.14x10^6$	$2.34x10^6$	$1.84x10^6$
Volume (ft^3)/MWt	605	330	690	635
Post Accident Cooling	Air & Water on outside of cnmt vessel	Passive ice condenser with cnmt spray and safety grade coolers	Cnmt spray and safety grade coolers	Cnmt spray and safety grade coolers
Safety Injection				
Accumulator #/Volume (ft^3)	2/2,000	4/1,800	4/2,250	3/1,450
Core MU Tank #/Volume (ft^3)	2/2,500	0	0	0
High Head Pumps	0	2	3	3
Low Head Pumps	0	2	2	2
RWST #/Volume (gal)	1/590,000	1/400,000	1/490,000	1/491,000
RWST Location	In-Cnmt	Outside-cnmt	Outside-cnmt	Outside-cnmt
Passive RHR Hx #/Safety Related	1/Yes	0	0	0

Table 5.3-1 (Sheet 6 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Normal RHR				
Design Pressure (psig)	900	600 discharge 450 suction	650 discharge 435 suction	600 discharge 450 suction
Number of Pumps	2	2	2	2
Design Flow (gpm)	1,000	3,000	4,150	3,750
Safety Related	No	Yes	Yes	Yes
Cooling Water Systems				
Safety Related	No	Yes	Yes	Yes
Number Component Cooling Pumps	2	5	3	3
Number Service Water Pumps	2	8	4	3
Heat Sink	Mechanical Draft Cooling Tower	Natural Draft Cooling tower	Ocean	Lake
Startup/Aux Feedwater				
Turbine Pumps	0	1	1	1
Motor Pumps	2	2 AFW 1 SU Pump	2 EFW	2 AFW
Safety Related	No	Yes-AFW No-SU	Yes	Yes

Table 5.3-1 (Sheet 7 of 7)

AP1000 Plant Comparison With Other Facilities

System/Component	AP1000	Watts Bar	San Onofre	V. C. Summer
Chemical & Volume Control				
Normal Letdown (gpm)	100	75	40	60
Max Letdown (gpm)	100	120	128	120
System Location	Containment	Aux Bldg	Aux Bldg	Aux Bldg
RCP Seal Injection	No	Yes	No	Yes
# Charging Pumps	0[a]	2	3	3
Safety Related	No	Yes	Yes	Yes
Boron Thermal Regen	No	No	No	Yes
Boron Recycle Evaporator	No	No	No	Yes
Electrical				
Number Diesel Gen	2	2	2	2
Diesel Gen Capacity (kw)	4,000	4,400	4,700	4,400
Safety Related	No	Yes	Yes	Yes
1E Batteries	Yes	Yes	Yes	Yes

a. 2 centrifugal makeup pumps are provided for the AP1000 design but are only operated when needed for boration, dilution, and blended flow makeup for pressurizer level control.

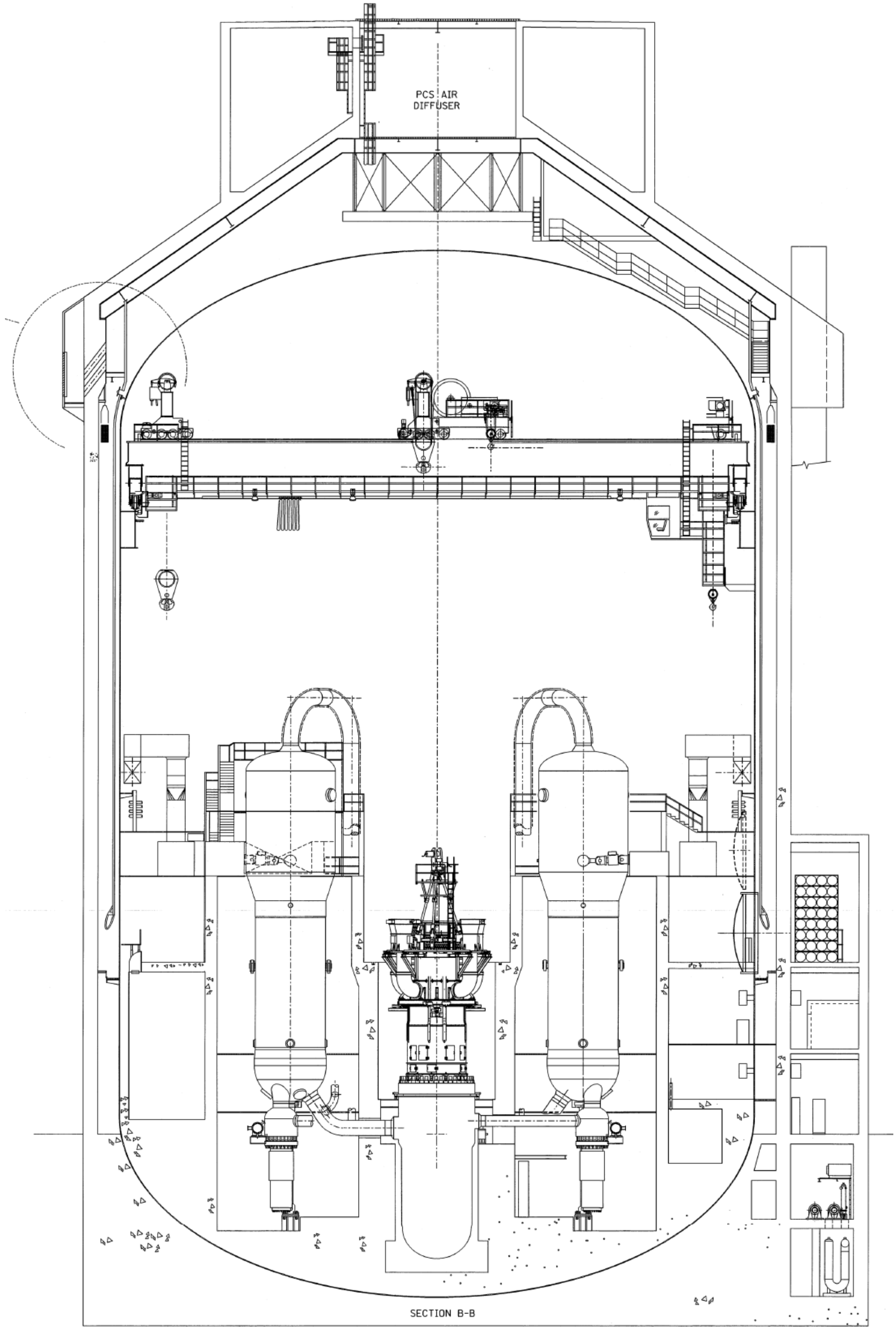

Figure 5.3-1 AP1000 Containment Layout (Sheet 1)

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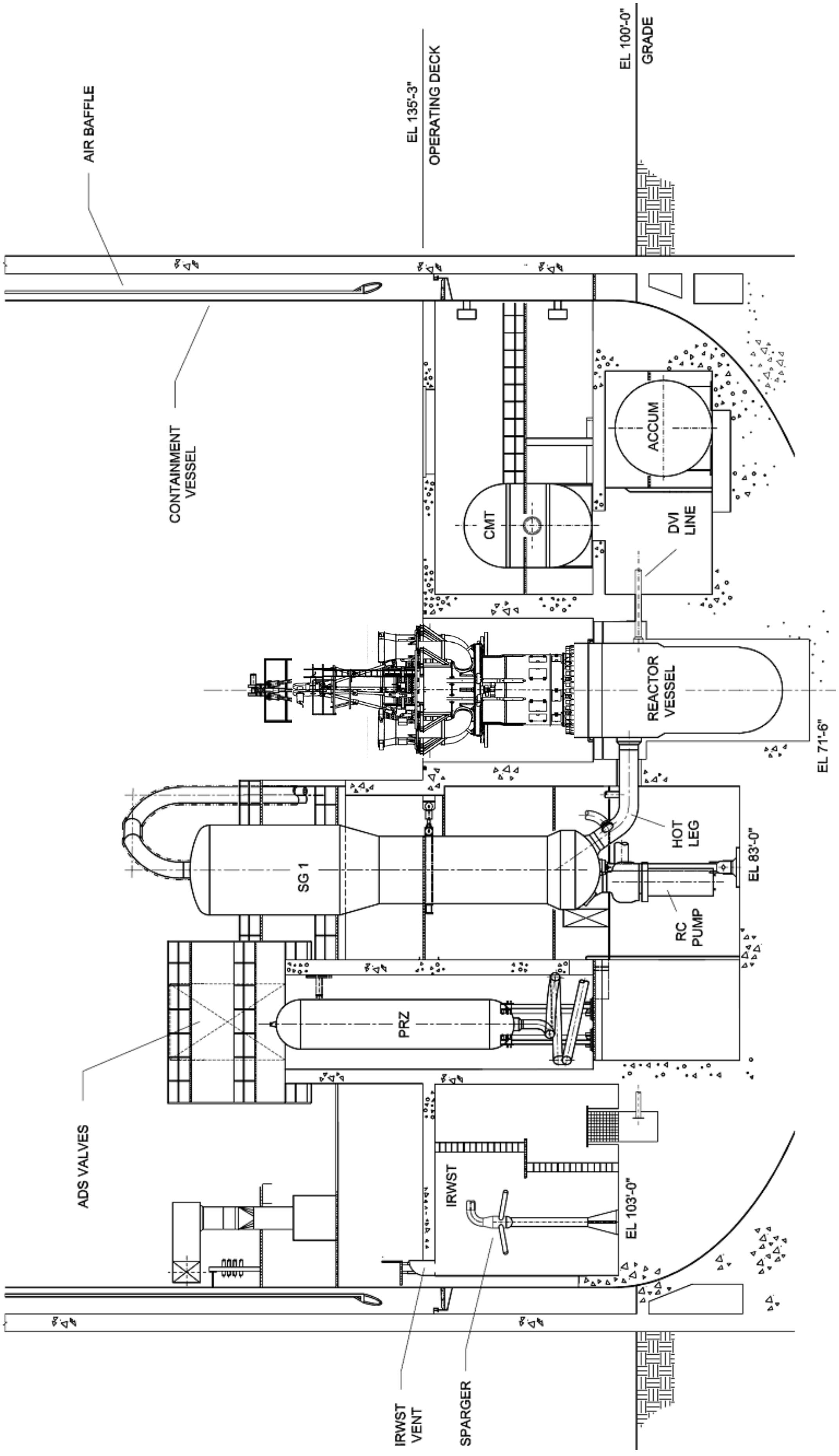

Figure 5.3-2 AP1000 Containment Layout (Sheet 2)

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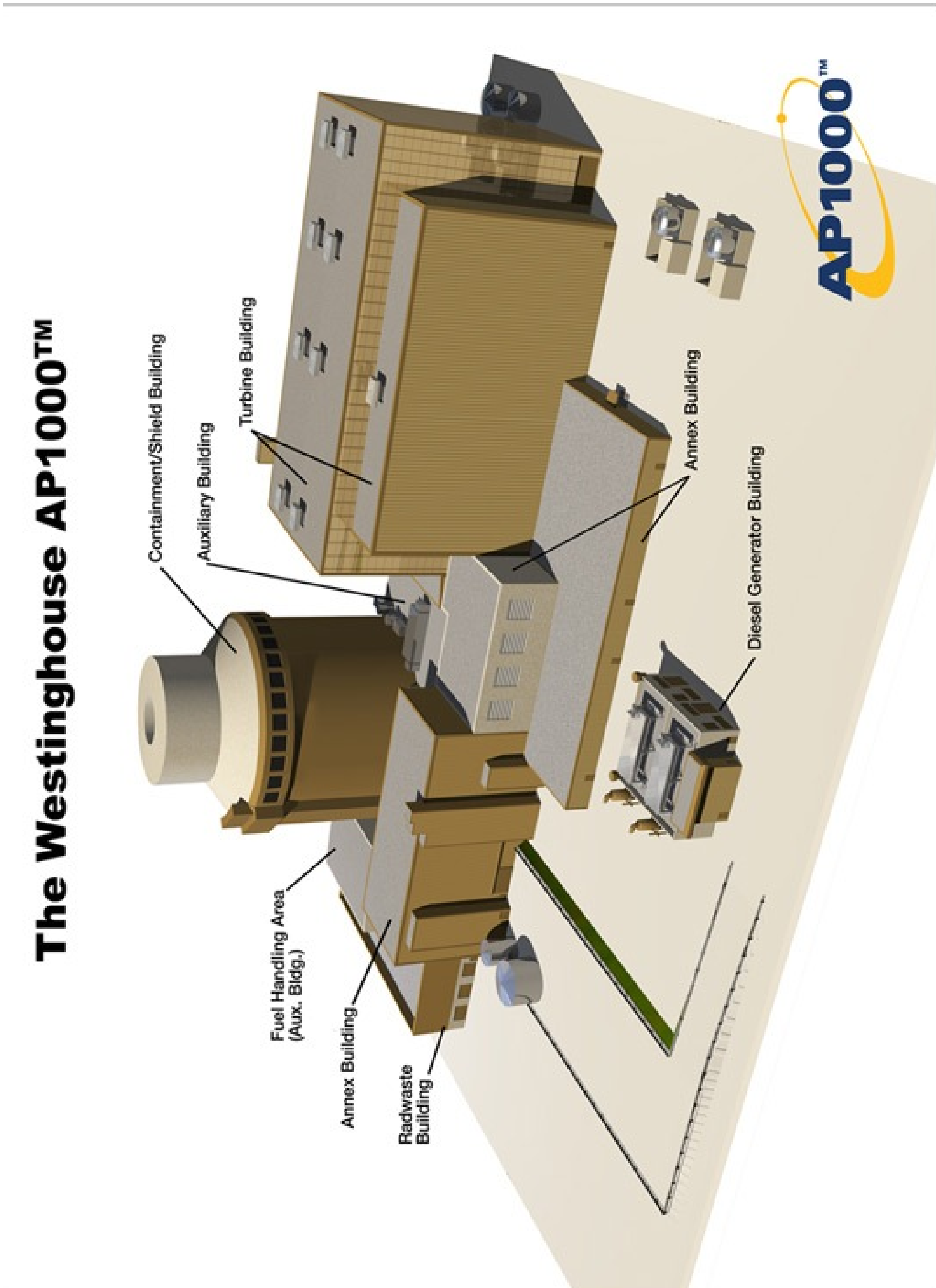

Figure 5.3-3 AP1000 Site Layout

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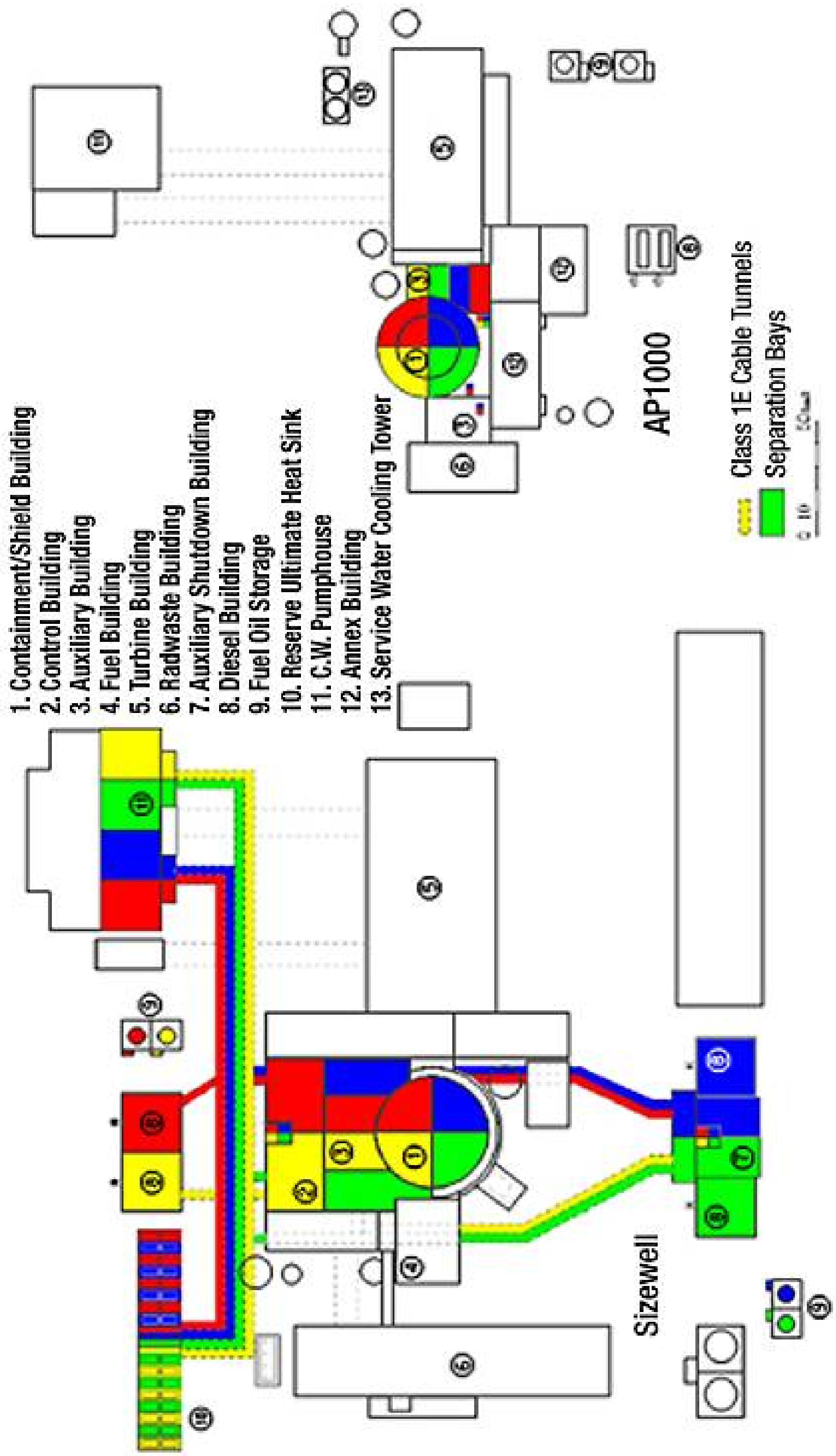

Figure 5.3-4 AP1000 vs. Current Site Layout

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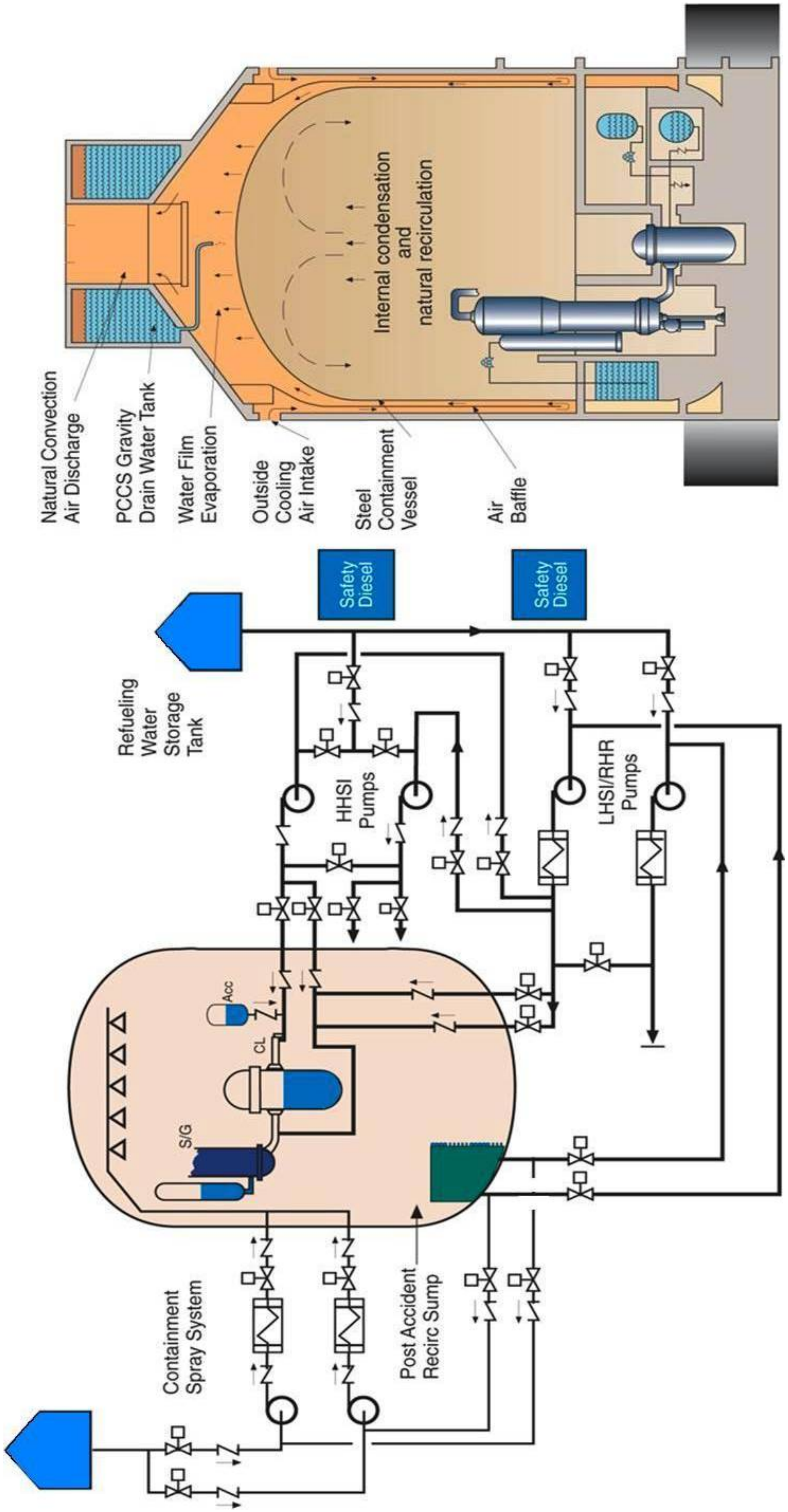

Figure 5.3-5 AP1000 vs. Current Safety Systems

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