

1.3 Comparisons with Similar Facility Designs

A comparison of the major AP1000 design features and nominal parameters with the certified AP600 and a typical two-loop Westinghouse plant is provided in Table 1.3-1. The values provided for AP1000 are nominal and provided for comparison. Design parameter values for design certification are delineated in the sections referenced. The values provided in Table 1.3-1 for the reference AP600 and two-loop plants are typical. The two-loop plant parameters are represented by Waterford Unit 3.

1. Introduction and General Description of the Plant AP1000 Design Control Document

Table 1.3-1 (Sheet 1 of 6)

AP1000 PLANT COMPARISON WITH SIMILAR FACILITIES

Systems – Components	DCD	AP1000	AP600	Reference 2 Loop
Plant design objective	1.2	60 yrs	60 yrs	40 yrs
NSSS power	4.0	3,415 MWt	1,940 MWt	3,410 MWt
Core power	4.0	3,400 MWt	1,933 MWt	3,390 MWt
Net electrical output	1.2	≥ 1,000 MWe	600 MWe	1,075 MWe
Reactor operating pressure	5.1	2,250 psia	2,250 psia	2,250 psia
Hot leg temp	5.1	610°F	600°F	611°F (Cycle 1) 603°F (current)
Steam generator design pressure	5.4	1200 psia	1200 psia	1100 psia
Main feedwater temp	10.3	440°F	435°F	445°F
Core	4.0			
Number fuel assem.		157	145	217
Active fuel length		168 in	144 in	150 in
Fuel assembly array		17 x 17	17 x 17	16 x 16
Fuel rod OD		0.374 in	0.374 in	0.382 in
Number control assem.		53	45	83
– Absorber material		Ag-In-Cd	Ag-In-Cd	B ₄ C/Ag-In-Cd
Number gray rod assem.		16	16	8 (part length)
– Absorber material		SS-304/Ag-In-Cd	SS-304/Ag-In-Cd	Inconel 625/ B ₄ C
Avg linear power		5.707 kW/ft	4.10 kW/ft	5.34 kW/ft
Heat flux hot channel factor, FQ		2.60	2.60	2.35

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AP1000 PLANT COMPARISON WITH SIMILAR FACILITIES

Systems – Components	DCD	AP1000	AP600	Reference 2 Loop
Reactor Vessel	5.3			
Vessel ID		159 in	157 in	172 in
Construction		forged rings	forged rings	welded plate
Number hot leg nozzles		2	2	2
– ID		31.0 in	31.0 in	42 in
Number cold leg nozzles		4	4	4
– ID		22.0 in	22.0 in	30 in
Number safety injection nozzles		2	2	0
Steam Generators	5.4.2			
Type		Vertical U-tube Recirc. design	Vertical U-tube Recirc. design	Vertical U-tube Recirc. design
Model		Delta-125	Delta-75	–
Number		2	2	2
Heat transfer area/SG		123,538 ft ²	75,180 ft ²	103,574 ft ²
Number tubes/SG		10,025	6,307	9,300
Tube material		I 690 TT	I 690 TT	I 600 TT
Separate startup feedwater nozzle		Yes	Yes	No
Reactor Coolant Pumps	5.4.1			
Type		canned	canned	shaft seal
Number		4	4	4
Rated HP		7,300 hp/pump	≤3,500 hp/pump	9,700 hp/pump
Estimated flow/loop		150,000 gpm	102,000 gpm	198,000 gpm

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Table 1.3-1 (Sheet 3 of 6)

AP1000 PLANT COMPARISON WITH SIMILAR FACILITIES

Systems – Components	DCD	AP1000	AP600	Reference 2 Loop
Pressurizer	5.4.5			
Total volume		2,100 ft ³	1,600 ft ³	1,500 ft ³
Volume/MWt		0.618 ft ³ /MWt	0.825 ft ³ /MWt	0.440 ft ³ /MWt
Safety valves #/size		2 – 6"x8"	2 – 6"x6"	3 – 6"
PORV #/size		no	no	no
PRT volume		no	no	2,400 ft ³
Auto depressurization		yes	yes	no
Turbine Island	10.2			
Turbine – # HP cylinder		1	1	1
# LP cylinders		3	2	3
Max blade length		52 in	47 in	40 in
Number reheat stages		2	1	1
Feedwater heating stages				
– # LP stages		4	4	5
– # HP stages		2	2	1
Deaerator		yes	yes	no
Main feedwater pumps		3 motor driven	2 motor driven	2 turbine driven
Condensate pumps		3	3	3
Condenser tube material		Ti	Ti	SS
Condensate polishing		0–33%	33%	0–100%

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AP1000 PLANT COMPARISON WITH SIMILAR FACILITIES

Systems – Components	DCD	AP1000	AP600	Reference 2 Loop
Containment	6.2			
Type		Steel	Steel	Steel
Inside dia.		130 ft	130 ft	140 ft
Volume		2.06 E+06 ft ³	1.76 E+06 ft ³	2.677 E+06 ft ³
Volume/MWt		606 ft ³ /MWt	910 ft ³ /MWt	785 ft ³ /MWt
Post accident cooling		Air and water on outside of steel containment vessel	Air and water on outside of steel containment vessel	Component cooling water cooled fan coolers
Safety Injection	6.3			
Accumulator – #/volume		2/2,000 ft ³	2/2,000 ft ³	4/2,250 ft ³
Core makeup tank – #/volume		2/2,500 ft ³	2/2,000 ft ³	no
High head pumps – #		none	none	3
– runout flow		–	–	380 gpm
– shutoff head		–	–	1,365 psi
Low head pumps – #		none	none	See RHR pumps
Refuel water storage tank – #		1	1	1
– location		in containment	in containment	ex-containment
– volume		590,000 gal	530,000 gal	475,000 gal
Boron inject tank #/vol		no	no	1/630 gal (batching) 2/11,800 gal (makeup)
Normal Residual Heat Removal (NRHR)	5.4.7			
Design pressure		900 psig	900 psig	650 psig
Normal RHR pumps – #/design flow		2/1,000 gpm per pump	2/1,000 gpm per pump	2/4,050 gpm per pump

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AP1000 PLANT COMPARISON WITH SIMILAR FACILITIES

Systems – Components	DCD	AP1000	AP600	Reference 2 Loop
Cooling Water Systems	9.2			
Safety-related		no	no	yes
Component cooling water pumps		2	2	3
Service water pumps		2	2	none
Heat sink		Separate mechanical draft cooling towers	Separate mechanical draft cooling towers	Separate mechanical draft cooling towers
Startup/Auxiliary Feedwater	10.4			
Motor pumps – #/flow per pump/safety-related		2/520 gpm/no	2/380 gpm/no	2/350 gpm/yes 1/900 gpm/no
Turbine pumps – #/flow		none/–	none/–	1/700 gpm
Passive RHR HX – #/heat removal/safety-related		1/60 MW/Yes	1/42 MW/Yes	None/–/–
Chemical and Volume Control	9.3.6			
Purification/Letdown flow				
– normal		100 gpm	100 gpm	38 gpm
– max		100 gpm	100 gpm	126 gpm
Purification location		IRC	IRC	ORC
RCP seal injection/pump		none	none	5 – 8 gpm
Charging pumps		2 @ 100 gpm	2 @ 100 gpm	3 @ 44 gpm
– SI use		no	no	no
– safe shutdown use		no	no	yes
– continuous oper.		no	no	yes
Boron thermal regeneration		no	no	no
Boron recycle evaporator		no	no	no

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AP1000 PLANT COMPARISON WITH SIMILAR FACILITIES

Systems – Components	DCD	AP1000	AP600	Reference 2 Loop
Instrumentation and Control	7.7			
Type I&C system		digital	digital	analog
Type control room		work station	work station	control boards
Electrical				
Diesels – #	8.31	2	2	2
– safety-related		no	no	yes
– capacity		4,000 kW	4,000 kW	4,400 kW
1E batteries – total capacity	8.32	14,400 amp-hr	28,800 amp-hr	3 x 2,320 amp-hr (@ 8 hour rate)