
1.3 Comparisons with Similar Facility Designs

A comparison of the major U.S. EPR design features and nominal parameters with a typical four-loop pressurized water reactor (PWR) is provided in Table 1.3-1—U.S. EPR Comparison with Similar Facilities. Design parameter values for design certification are delineated in the sections referenced. The values provided in Table 1.3-1 for the reference U.S. EPR and a four-loop plant are typical. The four-loop plant parameters are represented by Callaway Unit 1.

Table 1.3-1—U.S. EPR Comparison with Similar Facilities
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| Parameter or Feature | FSAR Chapter/Section | U.S. EPR | Typical 4-Loop (Callaway Unit 1) |
|---|------------------------------------|--|--|
| Plant design objective | 1.1 | 60 years | 40 years |
| Rated NSSS thermal power output | 1.2, 10.1 | 4614 MWt | 3579 MWt |
| Reactor core thermal power | 1.2, 4.1, 4.3, 4.4, 5.0, 5.1, 15.0 | 4590 MWt | 3565 MWt |
| Net electrical output | 1.1 | 1600 MWe | 1233 MWe |
| Reactor operating pressure | 4.5, 6, 11, and 15 | 2250 psia | 2250 psia |
| Total reactor flow rate | 4.4 | 184 x 10 ⁶ lb/hr | 139.4 x 10 ⁶ lb/hr |
| Reactor coolant temperatures, Core outlet Vessel outlet Core average Vessel average Core inlet Vessel inlet | 4.1, 4.4, 5.1 | 626°F 625°F 597°F 594°F 563°F 563°F | 623.7°F 620°F 592.2°F 588.4°F 556.8°F 556.8°F |
| Average linear power | 4.1, 4.3, 4.4 | 5.22 kW/ft | 5.69 kW/ft |
| Peak linear power for normal operation | 4.1, 4.3, 4.4 | 13.6 kW/ft | 14.22 kW/ft |
| Heat flux hot channel factor, FQ | 4.3 | 2.6 | 2.50 |
| Fuel assembly array | 4.1, 4.3 | 17 x 17 | 17 x 17 |
| Number of fuel assemblies | 4.1, 4.3 | 241 | 193 |
| Uranium dioxide rods per assembly | 4.1, 4.3 | 265 | 264 |
| Nominal fuel weight as uranium dioxide | 4.1, 4.3 | ≈324,000 lb (Note 1) | 204,280 lb |
| Number of grids per assembly | 4.1, 4.3 | 10 | 6 (Zirc-mix), 3 (Zirc-IFM), 2 (Inconel-non mix) |

Table 1.3-1—U.S. EPR Comparison with Similar Facilities
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| Parameter or Feature | FSAR Chapter/Section | U.S. EPR | Typical 4-Loop (Callaway Unit 1) |
|---------------------------------------|-----------------------------|-------------------------------|---|
| Rod cluster control assemblies | 4.1, 4.3 | | |
| Number of full/part length assemblies | | 89/none | 53/none |
| Absorber material | | Ag-In-Cd (lower part) | Ag-In-Cd |
| Clad material | | AISI 316L stainless steel | Stainless steel with chrome plating |
| Clad thickness | | 0.0185 in | 0.0185 in with 0.00075 in plating |
| Equivalent core diameter | 4.1, 4.3 | 148.3 in | 132.7 in |
| Active fuel length | 4.1, 4.3 | 165.35 in | 143.7 in |
| Number of coolant loops | 1.2, 5 | 4 | 4 |
| Total steam flow | 10.3 | 20.68 x 10 ⁶ lb/hr | 15.92 x 10 ⁶ lb/hr |
| Reactor vessel | 5.3, 5.4 | | |
| Inside diameter | | 192 in | 173 in |
| Inlet nozzle inside diameter | | 30.71 in | 27.5 in |
| Outlet nozzle inside diameter | | 30.71 in | 29 in |
| Number of reactor closure head studs | | 52 | 54 |
| Reactor coolant pumps | 5.4.1 | | |
| Motor Horsepower | | 11,801 hp | 7,000 hp |
| Capacity | | 124,741 gpm | 100,200 gpm |
| Steam generators | 5.4.2 | | |
| Heat transfer area | | 85,681 ft ² | 55,000 ft ² |
| Number of U-tubes | | 5980 | 5626 |

Table 1.3-1—U.S. EPR Comparison with Similar Facilities
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| Parameter or Feature | FSAR Chapter/Section | U.S. EPR | Typical 4-Loop (Callaway Unit 1) |
|--|----------------------|--|----------------------------------|
| Residual heat removal | 5.4.7, 9.2.2 | | |
| Initiation pressure | | ≈376 psig | ≈425 psig |
| Initiation/completion temperature | | ≈250°F (Note 2) 212°F (Note 3)/131°F | ≈350°F /140°F |
| Component cooling water design temperature | | 100.4°F | 105°F |
| Cooldown time after initiation | | 9.7 hr | ≈19.3 hr |
| Heat exchanger removal capacity | | 31.73 x 10 ⁶ Btu/hr (Train 1) 30.66 x 10 ⁶ Btu/hr (Train 2) 30.66 x 10 ⁶ Btu/hr (Train 3) 31.73 x 10 ⁶ Btu/hr (Train 4) | 39.1 x 10 ⁶ Btu/hr |
| Pressurizer | 5.4.10 | | |
| Heatup rate using heaters | | 180°F/hr | 55°F/hr |
| Internal volume | | 2649 ft ³ | 1800 ft ³ |
| Pressurizer safety relief valves | 5.4.11 | | |
| Number | | 3 | 3 |
| Maximum relieving capacity | | 793,680 lb/hr | 420,000 lb/hr |
| Accumulators | 6.3 | | |
| Number | | 4 | 4 |
| Operating pressure, minimum | | 638 psig | 600 psig |
| Minimum operating water volume, each | | 1236 ft ³ | 810 ft ³ |
| Medium head safety injection pumps | 6.3 | | |
| Number | | 4 | 2 |
| Design flow | | 600 gpm | 425 gpm |
| Design head | | 2260 ft | 2680 ft |

Table 1.3-1—U.S. EPR Comparison with Similar Facilities
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| Parameter or Feature | FSAR Chapter/ Section | U.S. EPR | Typical 4-Loop (Callaway Unit 1) |
|---|-----------------------|-------------|----------------------------------|
| Low head safety injection/ residual heat removal pumps | 6.3 | | |
| Number | | 4 | 2 |
| Design flow | | 2200 gpm | 3800 gpm |
| Design head | | 480 ft | 350 ft |
| Chemical and volume control | 9.3.4 | | |
| Number of centrifugal pumps | | 2 | 2 |
| Design flow | | 176 gpm | 150 gpm |
| Design head | | 5938 ft | 5800 ft |
| Total seal water supply flow rate, nominal | | 32 gpm | 32 gpm |
| Total seal water return flow rate, nominal | | ≈13 gpm | 12 gpm |
| Letdown flow, normal/ maximum | | 160/480 gpm | 75/120 gpm |
| Charging flow, minimum/ maximum | | 40/440 gpm | 55/100 gpm |

Notes:

- The fuel weight in pounds is derived by:

$$[(\text{nominal metric weight of the fuel assemblies})/0.88] \times 2.2046$$
Where 0.88 is the mass of uranium in UO₂ and 2.2046 is the conversion factor from kilograms to pounds.
- Trains 1 and 4.
- Trains 2 and 3.