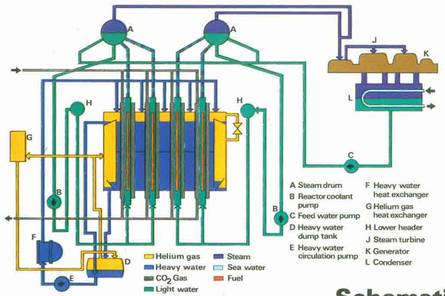
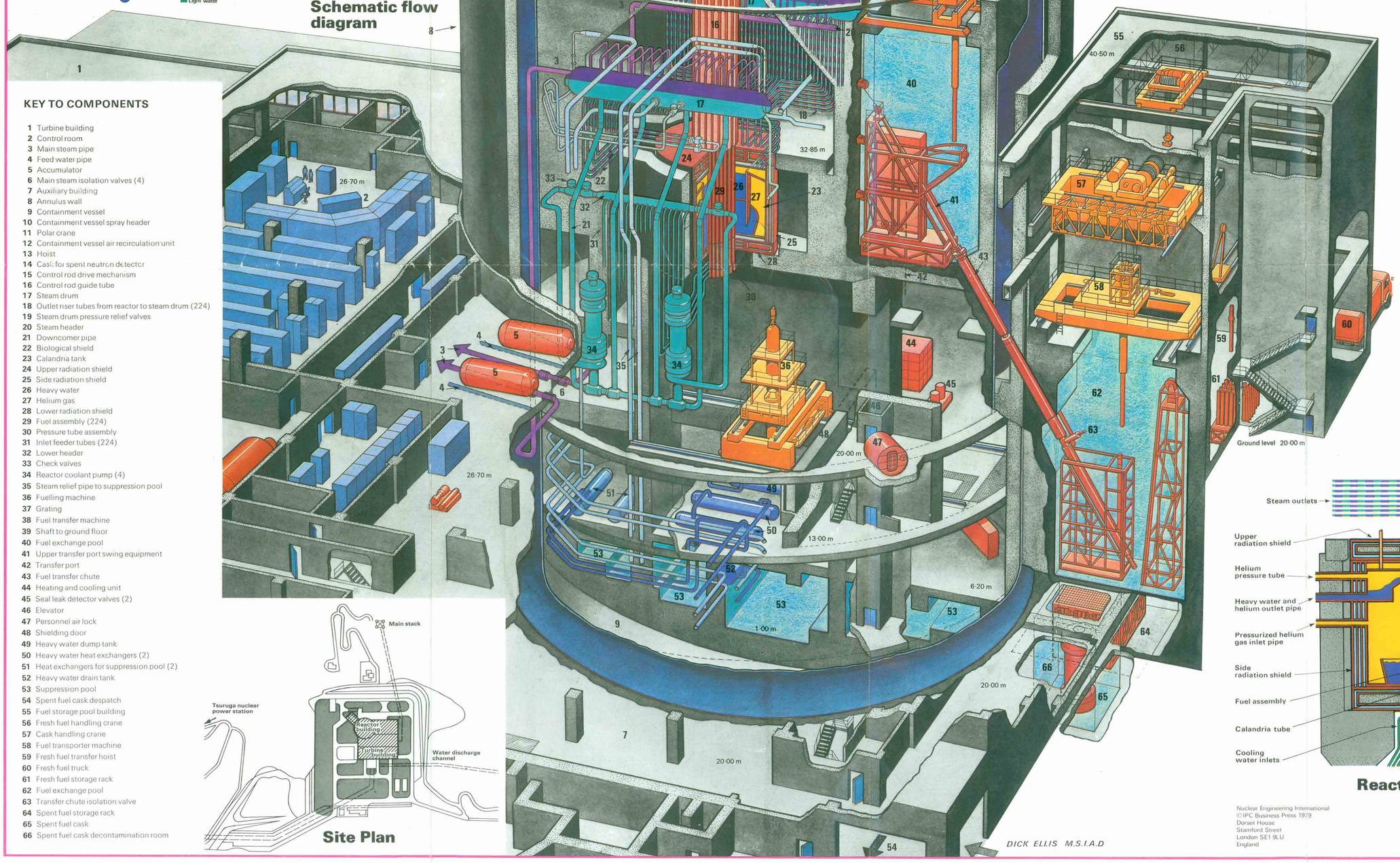
FUGEN

Heavy Water Reactor

The Worlds Reactors No.75



Schematic flow diagram



KEY TO COMPONENTS

1 Turbine building
2 Control room
3 Main steam pipe
4 Feed water pipe
5 Accumulator
6 Main steam isolation valves (4)
7 Auxiliary building
8 Annulus wall
9 Containment vessel
10 Containment vessel spray header
11 Polar crane
12 Containment vessel air recirculation unit
13 Hoist
14 Cask for spent neutron detector
15 Control rod drive mechanism
16 Control rod guide tube
17 Steam drum
18 Outlet riser tubes from reactor to steam drum (224)
19 Steam drum pressure relief valves
20 Steam header
21 Downcomer pipe
22 Biological shield
23 Calandria tank
24 Upper radiation shield
25 Side radiation shield
26 Heavy water
27 Helium gas
28 Lower radiation shield
29 Fuel assembly (224)
30 Pressure tube assembly
31 Inlet feeder tubes (224)
32 Lower header
33 Check valves
34 Reactor coolant pump (4)
35 Steam relief pipe to suppression pool
36 Fuelling machine
37 Grating
38 Fuel transfer machine
39 Shaft to ground floor
40 Fuel exchange pool
41 Upper transfer port swing equipment
42 Transfer port
43 Fuel transfer chute
44 Heating and cooling unit
45 Seal leak detector valves (2)
46 Elevator
47 Personnel air lock
48 Shielding door
49 Heavy water dump tank
50 Heavy water heat exchangers (2)
51 Heat exchangers for suppression pool (2)
52 Heavy water drain tank
53 Suppression pool
54 Spent fuel cask despatch
55 Fuel storage pool building
56 Fresh fuel handling crane
57 Cask handling crane
58 Fuel transporter machine
59 Fresh fuel transfer hoist
60 Fresh fuel truck
61 Fresh fuel storage rack
62 Fuel exchange pool
63 Transfer chute isolation valve
64 Spent fuel storage rack
65 Spent fuel cask
66 Spent fuel cask decontamination room

Site Plan

Fugen Design Data

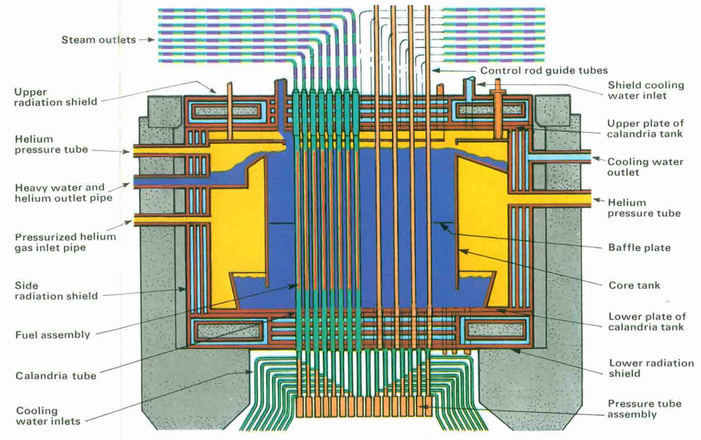
Owner/operator: Power Reactor & Nuclear Fuel Development Corporation

Main contractors

Hitachi	Reactor
Mitsubishi Heavy Industry	Reactor cooling system
Toshiba	Primary containment Turbine & generator
Fuji Electric Co	Fuel handling Emergency core cooling system
Sumitomo Atomic Energy Industry	Heavy water & helium system
Power Reactor & Nuclear Fuel Development Corporation	Reactor system (design) Fuel fabrication
Civil Works	Kajima Corporation Maeda Construction Co and Kumagai-gumi Company Ltd
Site	Tsuruga, on west coast of Japan
Schedule	Start of construction December 1970 Criticality March 1978 Commercial operation March 1979

Reactor data

Reactor type	Heavy water moderated, boiling light water cooled, pressure tube type	
Output	Gross thermal output	557 MWt
	Gross electrical output	165 MWe
Core	Core height	3,700 mm
	Core diameter	4,050 mm
	Lattice	240 mm²
	Number of fuel channels	224
	Fuel inventory	34 tons
	Fuel assemblies	96 mixed oxide + 124 1.5% enriched UO_2
	Design burn-up	12,000 MWd/t
Fuel	Fuel material	Slightly enriched (1.5%) UO_2 and plutonium-mixed oxide PuO_2—UO_2 (0.55—0.8 w/o Pu)
	Pellet diameter	14.4 mm
	Fuel assembly	28 fuel rods, 9 spacers
	Nominal element spacing	2.1 mm
	Total length of fuel assembly	4,388 mm
	Cladding material	Zircaloy–2
	Cladding thickness (min.)	0.8 mm
Pressure tube	Material	Zr–2.5W%Nb alloy
	Inside diameter	117.8 mm
	Thickness	4.3 mm
	Length	5m
	Design temperature	296°C
	pressure	82 kg/cm²
Steam drum	Diameter	2m
	Length	16m
	Material	Low carbon steel lined with stainless steel
Calandria tube	Material	Zircaloy–2
	Inside diameter	156.4 mm
	Thickness	1.9 mm
Moderator	Heavy water inventory	160 tons
	Heavy water temperature (max.)	70°C
Control rods	Number of control rods	49
	Material	B_4C in stainless steel
	Mechanism	Motor-driven wire drum
Primary coolant system	Coolant	H_2O
	Coolant pressure in steam drum	68 kg/cm²
	Coolant temperature in steam drum	284°C
	Coolant flow rate	7,600 t/h
	Steam exit quality (mean)	14%
	Number of cooling loops	2
Primary containment	Configuration	Cylindrical steel
	Diameter	34m
	Height	64m
	Design temperature	100°C
	pressure	1.35kg/cm²
Turbine system	Steam pressure	63.5kg/cm²
	Steam temperature	279°C
	Steam flow rate to turbine	910 t/h
	Speed	3,600 rev/min
	Generator rating	200 MVA



Reactor cross section

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