

# The World's Reactors

No. 26 DRAGON



# DRAGON

**OWNER:** O.E.E.C. High Temperature Reactor Project (DRAGON)  
**LOCATION:** Winfrith, Dorset.  
**TYPE:** Thermal, homogeneous.  
**PURPOSE:** Experimental.  
**CAPACITY:** 20 MW thermal.

**FUEL AND MODERATOR:** Enriched uranium and thorium carbide sintered ring-type inserts, 1.428 in. (36.2 mm) o.d., and 0.26 in. (6.55 mm) radial thickness x 0.95 in. (24.12 mm) long; arranged around graphite spine in graphite fuel boxes (6 inserts per box). Combined containment and moderation is provided by hollow graphite fuel rods (10 boxes per rod). Each fuel element consists of a hexagonal cluster of 7 rods, at 2.5 in. (63 mm) centres, the overall length (including end reflectors) being 100 in. (254 cm) and the active length 63 in. (160 cm).

**CORE:** 37 fuel elements at 6.615 in. (16.8 cm) triangular pitch, surrounded by movable and fixed annular graphite reflectors. Equivalent diameter of core: 42.25 in. (107 cm). Outside diameter of movable reflector: 66 in. (167.6 cm). Outside diameter of fixed reflector: 116.625 in. (296 cm). Voidages: Core coolant 13.1% total core voidage, 15.5/16.0% end reflector 20%; radial reflector 5.73%. Total loading: U<sup>235</sup> 20 kg, Th<sup>232</sup> 134.8 kg. Graphite/U<sup>235</sup> ratio (ats.): 2128. Th<sup>232</sup>/U<sup>235</sup> ratio (ats.): 6.83. Initial conversion factor: 0.52. Initial flux: 4.5 x 10<sup>13</sup> n/cm<sup>2</sup> sec.

**TEMPERATURE COEFFICIENTS:** Fuel (at 1,300°K): -0.7 x 10<sup>-4</sup>/°C. Moderator (at 1,200°K): -4.5 x 10<sup>-4</sup>/°C. Side reflector (at 700°K): +2.5 x 10<sup>-4</sup>/°C. End reflector (at 1,100°K): +0.1 x 10<sup>-4</sup>/°C. End reflector (at 700°K): +0.2 x 10<sup>-4</sup>/°C.

**CONTROL:** 24 rods on pitch circle 48.5 in. (123 cm) diameter. Stainless steel sheaths 2.5 in. (63.5 mm) o.d., 1.62 in. (41.1 mm) i.d., and 5 ft (152.4 cm) long, packed with boron carbide. Maximum withdrawal rate: 0.611 in./sec (15.5 mm/sec). Time of fall: 1.2 sec.

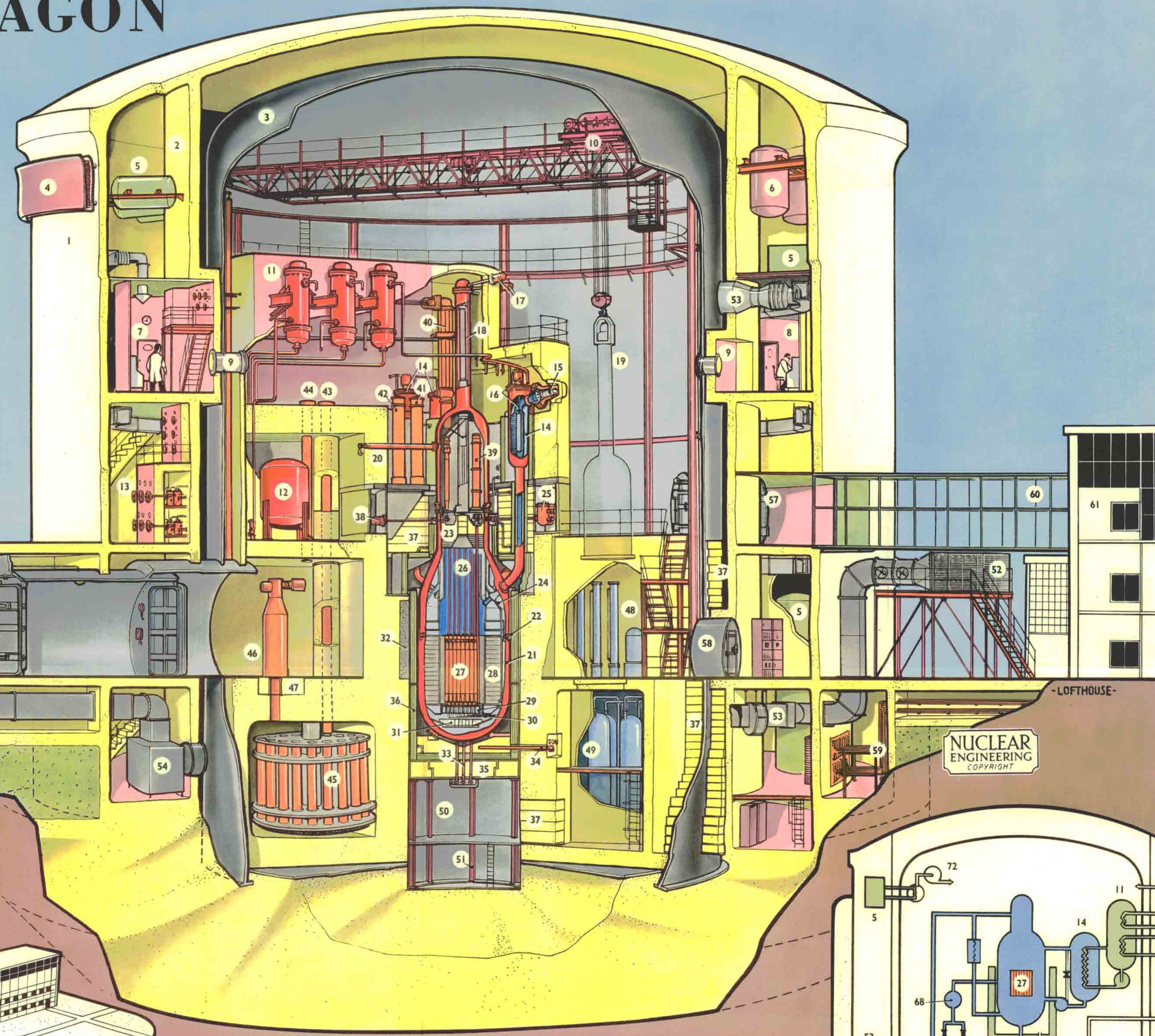
**COOLANT:** Helium at 20 ats. primary coolant, with water as secondary and tertiary coolant. Inlet temperature: 350°C. Outlet temperature: 750°C (926°C from hottest channel). Total area of coolant passages in core: 1,271 cm<sup>2</sup> (196.8 in.<sup>2</sup>). Mass flow: 9,618 g/sec (76.4 lb/h).

**BLOWERS:** 6 in parallel. Pressure drop: 5 p.s.i. Maximum speed: 12,000 r.p.m. Normal speed: 10,900 r.p.m. Variable-frequency squirrel-cage motors rated 100 h.p. at 12,000 r.p.m.

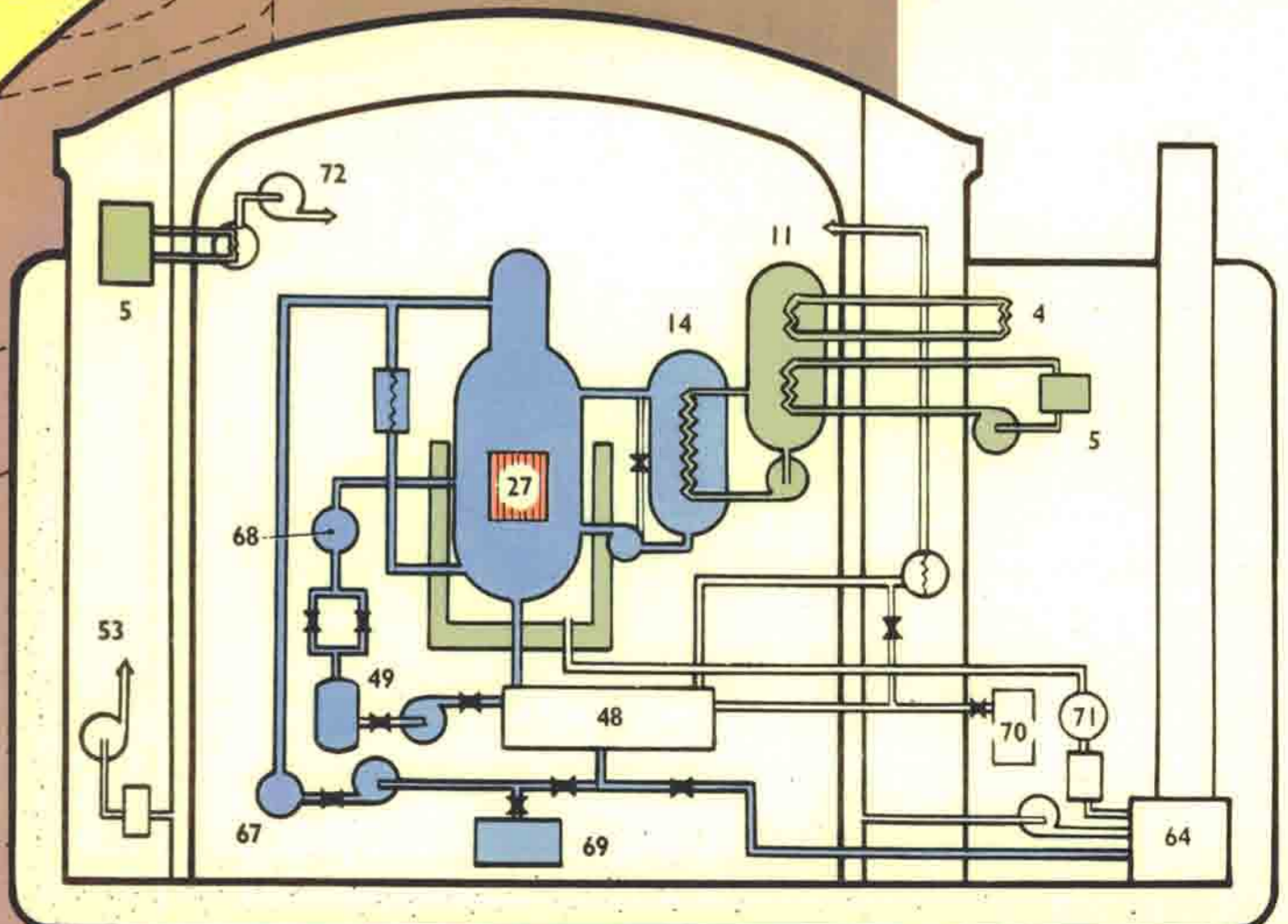
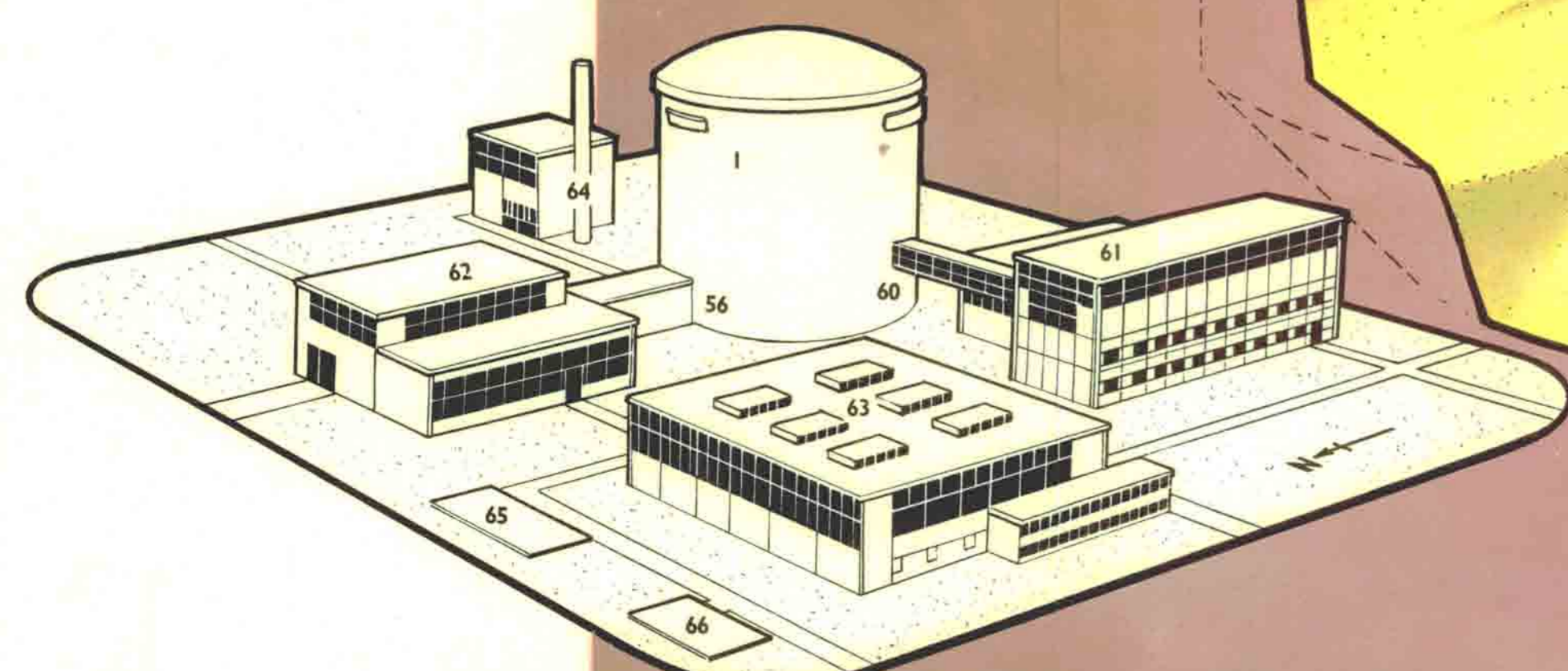
**PRESSURE VESSEL:** Overall height: 58 ft 1 in. (17.7 m). External diameter over core: 11 ft 6 in. (3.5 m). Internal diameter of lower neck: 6 ft 3 in. (1.9 m). Internal diameter of upper neck: 2 ft (0.61 m). Plate thickness: main vessel: 2.25 in. (57.2 mm); lower neck: 1.5 in. (38.1 mm); upper neck: 0.625 in. (15.9 mm). Weight: 45.8 tons (45,533 kg).

**SHIELDING:** 1 in. thick thermal shield inside pressure vessel. External shielding composed of alternate layers of steel and water 1 in. thick, the total thickness around main portion of pressure vessel is 8 in. steel and 7 in. water, with 5 ft 9 in. (1.753 m) concrete.

**CONTAINMENT:** Inner shell: 66 ft (20.2 m) i.d. x 80 ft (24.4 m) high, designed to withstand 10 p.s.i. internal pressure. Outer shell: 110 ft (33.4 m) o.d. x 86 ft (25.2 m) high, designed to withstand 3 p.s.i. internal pressure.



- DRAGON REACTOR KEY**
- 1. Outer concrete containment
- 2. Inner concrete wall
- 3. Inner containment steel shell
- 4. Shut-down coolers
- 5. Water storage tanks
- 6. Nitrogen storage tanks
- 7. Charge machine control room
- 8. Crane control room
- 9. Observation window
- 10. 25-ton rotating crane
- 11. Secondary heat exchangers
- 12. Secondary coolant dump tank
- 13. Secondary coolant control valves
- 14. Primary heat exchangers
- 15. Primary circulator
- 16. By-pass valve and drive
- 17. Charge machine drives
- 18. Charge machine
- 19. Charge machine in test area. (Available for storage during major modifications)
- 20. Charge machine viewing facility
- 21. Main pressure vessel
- 22. Main pressure vessel support skirt
- 23. Main shield plugs
- 24. Structural steel forming outlet plenum (and duct to control rods)
- 25. Absorber rod drive
- 26. Absorber rods
- 27. Core
- 28. Reflector
- 29. Core bedplate
- 30. Fission product pipes
- 31. Bottom neutron shield
- 32. Side neutron shield
- 33. Reserve control branches
- 34. Ion chambers
- 35. Bottom biological shield
- 36. Iron-water thermal shield
- 37. Loose shield blocks
- 38. Charge machine storage turntable drive
- 39. Storage can on c.m. turntable
- 40. Load facility transfer flask
- 41. Canning induction furnace
- 42. Can washing tank
- 43. Fuel element discharge chute
- 44. Fuel element charge chute
- 45. Fuel element storage roundabout
- 46. Transit flask
- 47. Eccentric plug
- 48. Fission product removal plant
- 49. Helium dump tanks
- 50. Reactor pit area
- 51. Support columns
- 52. Main ventilation inlet and filters
- 53. Circulating ventilation plant
- 54. Ventilation exhaust filters
- 55. Ventilation exhaust to stack
- 56. Vehicle airlock entrance
- 57. Personnel airlock access
- 58. Emergency personnel airlock access
- 59. Electrical supplies
- 60. Personnel walkway
- 61. Control block
- 62. Active storage block
- 63. Services block
- 64. Cooler block and stack
- 65. Delay tanks
- 66. Fuel oil storage tanks
- 67. Helium make up
- 68. Heat sink
- 69. Helium supply and purification plant
- 70. Liquid nitrogen supply
- 71. Nitrogen cooler and filter
- 72. Nitrogen recirculator and cooler



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