The World's Reactors

No. 11 - BRADWELL-ON-SEA POWER STATION

DESIGN AND CONSTRUCTION
The Nuclear Power Plant Co., Ltd.
C. A. Parsons and Co. Ltd.
A. Reynolds and Co. Ltd.
Head, Wrightson and Co. Ltd.
Sir Robert McAlpine and Sons Ltd.
Whitney Ltd.
Strachan and Henshaw Ltd.
Alvey Construction and Co. Ltd.
Clarke, Chapman and Co. Ltd.
Paralle Electrical Plant Co. Ltd.

KEY
1. Fuel preparation room
2. Fuel storage
3. Plant room
4. Reactor 1
5. Reactor 2
6. Biological shield
7. Secondary biological shield
8. Pressure vessel
9. Core
10. Charge standpipes
11. Control rod
12. Diaphragm
13. Tidal shield
14. Baffle
15. Support frames
16. Access duct
17. Inlet duct
18. Ductless duct
19. Charge machine
20. 20-ton crane
21. Main duct valve
22. Expansion joint
23. Boiler
24. L.P. drum
25. H.P. drum
26. By-pass circuit
27. Main circulator
28. Circulator drive
29. Pony motor
30. Circulator control panel
31. Crane rails
32. Goliath crane
33. Discharge wall
34. Discharge chute
35. Cooling pond
36. Pond crane
37. Loading bay
38. Auxiliary Diesels
39. Turbine house
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TYPE: Thermal heterogeneous.

PURPOSE: Power production.

LOCATION: Bradwell-on-Sea, Essex.

OPERATION: Ground broken: January 18, 1957.
Second reactor completed: end of 1965.

CAPACITY: Station installed capacity: 328 MW + 61 MW auxiliaries.
Guaranteed net output: 300 MW.
Reactor heat ratings: 510 MW.

FUEL:
Material: natural uranium.
Dimensions: 11.5 in. diameter, 36 in. long.
Density: 187 g/cm³.
Weight of U per reactor: 240 tonnes.
Number of elements per channel: 8.
Number of fuel-element channels: 2,620.
Diameter of channels: uniform through reactor.

CANNING:
Material: magnesium alloy, A-12.
Construction: machined or extruded extended surface.
Method of element support: stacked.

MODERATOR:
Material: Graphite.
Core size: 40 ft. dia. x 25 ft. 8 in. high.
Overall: 24-sided polygon, 45 ft. x 31 ft.
Total weight per reactor: 1,910 tonnes.
Method of support: ball bearings.

LATTICE:
Shape and dimension: spheres 66 ft. 9 in. mean dia.
Thickness of shell: 3 in. nominal.
Support: 24 frames under grid frame ends.

PRESSURE VESSEL:
Carbon dioxide at 10 atm. pressure.
Inlet temperature: 180°C.
Outlet temperature: 390°C.
Number of ducts: six inlet and outlet.
Diameter of ducts: 5 ft.

COOLANT:

PUMPING:
Number and type: six axial blowers.
Driver: Variable-frequency induction motors fed from turbo-
alternator.
Running speed: 400/1,300 r.p.m.
Turbo-alternator power: 20.5 MW.
One turbo-alternator per station standby.

FLUX:
Maximum thermal neutron flux: 2.76 x 10¹⁴/cm²-sec.
Method of flattening: steel rods in channels.
0.85

CONVERSION:

BURN-UP:

REACTIVITY:
Excess in cold, unprompted state: 4.9%.
Negative temperature coefficients: moderator: 4.4 x 10⁻³/°C.
 Uranium: 2.19 x 10⁻³/°C.

CONTROL:
Number of channels per reactor: 120.
Diameter: as fuel elements.
Control rods: 108.
Skirt-off: 12.
Drivers: variable-frequency induction motors.

SHIELDING:
Biological: 9-10 ft. concrete.
Cooling: induced draught, air.

BOILERS:
Number per reactor: six.
Main shell dimensions: 19 ft. dia. x 87 ft. long.
Element construction: Inconel finned tubes.
H.P. steam temperature: 375°C (704°F).
H.P. steam pressure: 770 p.s.i.a.
L.P. steam temperature: 375°C (704°F).
L.P. steam pressure: 210 p.s.i.a.

TURBO-ALTERNATORS:
Number and type: six impulse reaction.
Maximum continuous rating: 32 MW at 5% margin.
Speed: 3,000 r.p.m.
Generator voltage: 11.8 kV.
H.P. steam temperature at T.S.V.: 375°C (700°F).
H.P. steam pressure at T.S.V.: 745 p.s.i.a.
L.P. steam temperature at T.S.V.: 311°C (600°F).
L.P. steam pressure at T.S.V.: 193 p.s.i.a.

STEAM DUMPING:
Maximum cooling water temperature rise: 8.5°C (15°F).
Station capacity: 20%; heat from each reactor.

Arrangement of turbine house.