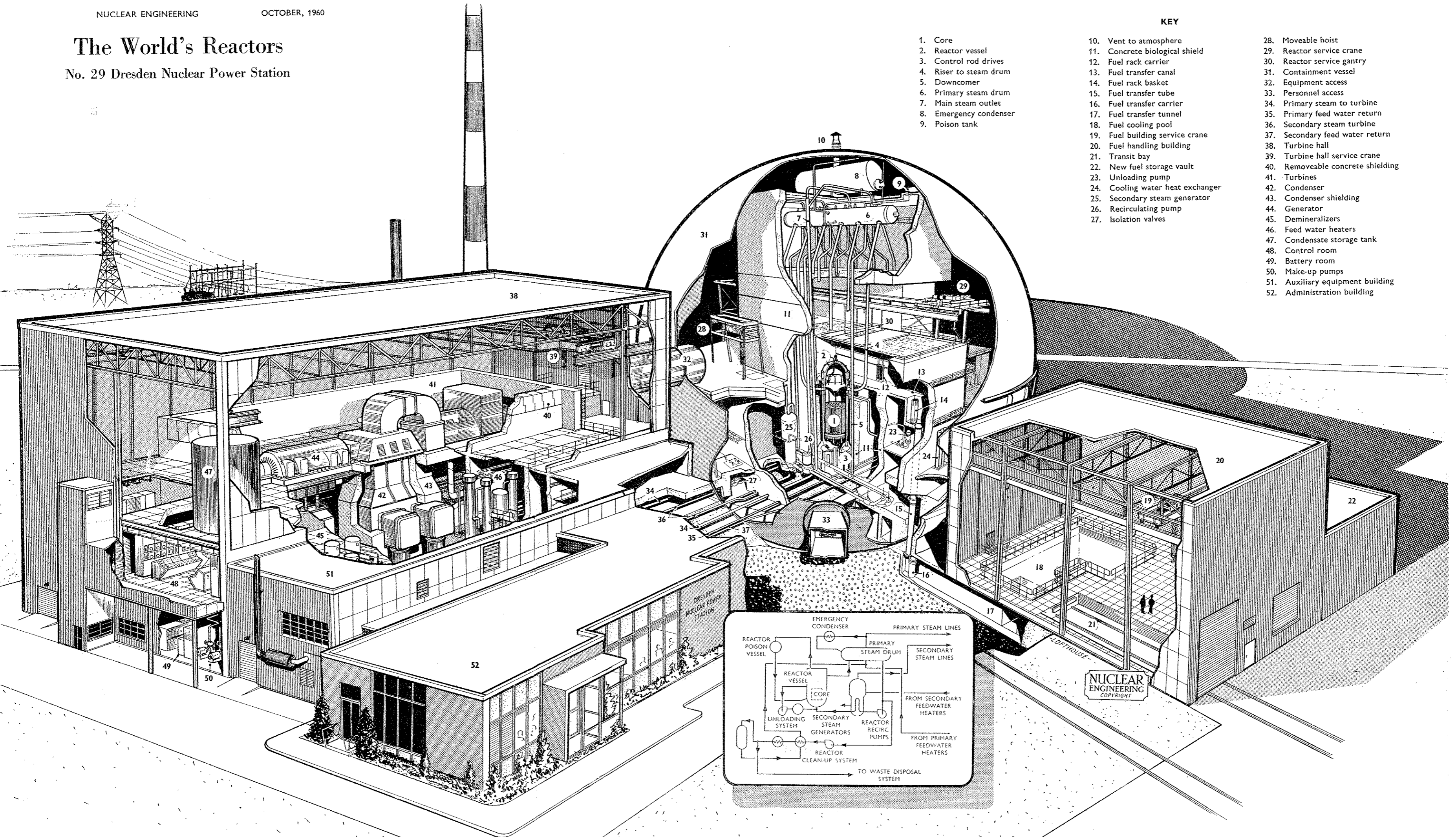


# The World's Reactors

## No. 29 Dresden Nuclear Power Station

**KEY**

- |                        |                                  |                                   |
|------------------------|----------------------------------|-----------------------------------|
| 1. Core                | 10. Vent to atmosphere           | 28. Moveable hoist                |
| 2. Reactor vessel      | 11. Concrete biological shield   | 29. Reactor service crane         |
| 3. Control rod drives  | 12. Fuel rack carrier            | 30. Reactor service gantry        |
| 4. Riser to steam drum | 13. Fuel transfer canal          | 31. Containment vessel            |
| 5. Downcomer           | 14. Fuel rack basket             | 32. Equipment access              |
| 6. Primary steam drum  | 15. Fuel transfer tube           | 33. Personnel access              |
| 7. Main steam outlet   | 16. Fuel transfer carrier        | 34. Primary steam to turbine      |
| 8. Emergency condenser | 17. Fuel transfer tunnel         | 35. Primary feed water return     |
| 9. Poison tank         | 18. Fuel cooling pool            | 36. Secondary steam turbine       |
|                        | 19. Fuel building service crane  | 37. Secondary feed water return   |
|                        | 20. Fuel handling building       | 38. Turbine hall                  |
|                        | 21. Transit bay                  | 39. Turbine hall service crane    |
|                        | 22. New fuel storage vault       | 40. Removeable concrete shielding |
|                        | 23. Unloading pump               | 41. Turbines                      |
|                        | 24. Cooling water heat exchanger | 42. Condenser                     |
|                        | 25. Secondary steam generator    | 43. Condenser shielding           |
|                        | 26. Recirculating pump           | 44. Generator                     |
|                        | 27. Isolation valves             | 45. Demineralizers                |
|                        |                                  | 46. Feed water heaters            |
|                        |                                  | 47. Condensate storage tank       |
|                        |                                  | 48. Control room                  |
|                        |                                  | 49. Battery room                  |
|                        |                                  | 50. Make-up pumps                 |
|                        |                                  | 51. Auxiliary equipment building  |
|                        |                                  | 52. Administration building       |



# The World's Reactors

## No. 29 Dresden Nuclear Power Station

TYPE:	Thermal, heterogeneous (BWR).																		
LOCATION:	Morris, Illinois.																		
PURPOSE:	Power production.																		
OWNER:	Commonwealth Edison Company.																		
DESIGNER:	General Electric Company.																		
ENGINEER-CONSTRUCTOR:	Bechtel Corporation.																		
STATUS:	Critical October 15, 1959; full power June 29, 1960.																		
OUTPUT:	625.9 MWt, 180 MWe.																		
FUEL:	Enriched uranium oxide (1.5%). Total loading 760 kg U <sup>235</sup> .																		
CORE:	Cylindrical prism 10.7 ft (3.26 m) diameter, 11.2 ft (3.41 m) high, with 452 fuel assemblies. Average power density: 29 kW/litre. Excess reactivity for: <table> <tr> <td><math>\epsilon</math> = cold: 1.03; hot: 1.04.</td> <td>Burn-up</td> <td>7.5%</td> </tr> <tr> <td><math>\rho</math> = cold: 0.85; hot: 0.77.</td> <td>Xe and Sm</td> <td>4%</td> </tr> <tr> <td><math>k_{\infty}</math> = cold: 1.135; hot: 1.15.</td> <td>Temp.</td> <td>-0.5%</td> </tr> <tr> <td><math>\tau</math> cold: 40 cm<sup>2</sup>; hot: 70 cm<sup>2</sup>.</td> <td>Voids</td> <td>1%</td> </tr> <tr> <td></td> <td>Shutdown margin</td> <td>3%</td> </tr> <tr> <td></td> <td>Total</td> <td>15% <math>\Delta k/k</math>.</td> </tr> </table> Neutron flux: Thermal, average: $3.15 \times 10^{13}$ n/cm <sup>2</sup> , sec. Fast, typical: $1 \times 10^{14}$ n/cm <sup>2</sup> , sec.	$\epsilon$ = cold: 1.03; hot: 1.04.	Burn-up	7.5%	$\rho$ = cold: 0.85; hot: 0.77.	Xe and Sm	4%	$k_{\infty}$ = cold: 1.135; hot: 1.15.	Temp.	-0.5%	$\tau$ cold: 40 cm <sup>2</sup> ; hot: 70 cm <sup>2</sup> .	Voids	1%		Shutdown margin	3%		Total	15% $\Delta k/k$ .
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	Shutdown margin	3%																	
	Total	15% $\Delta k/k$ .																	
FUEL ELEMENTS:	Rod bundle; 36 rods (6 x 6) per element, at 0.71 in. (18 mm) centres. Oxide pellets 0.494 in. (12.54 mm) diameter, clad in Zircaloy-2, 0.03 in. (0.076 mm) thick. Outside diameter of rod: 0.563 in. (14.3 mm). Active length 105.2 in. (2.67 m).																		
CONVERSION FACTOR:	0.6.																		
BURN-UP:	10,000 MWd/t (equilibrium core).																		
CONTROL:	Boron stainless steel cruciform rods, 6.5 in. (165 mm) square x 0.375 in. (9.52 mm) thick. Total number of rods: 80. Total rod worth: 15% $\Delta k/k$ . Withdrawal rate: 6 in./sec (152 mm/sec). Scram time: 10% travel: 0.6 sec; 90% travel: 2.5 sec.																		
COOLANT:	Light water, dual cycle. Inlet temperature: 505°F (262.75°C). Outlet temperature: 547°F (286°C). Reactor pressure (average): 1,010 p.s.i. (71.0 kg/cm <sup>2</sup> ). Drum pressure: 1,010 p.s.i. (71.0 kg/cm <sup>2</sup> ). Mass flow through reactor: $25.7 \times 10^6$ lb/h (11.66 x 10 <sup>6</sup> kg/h). Heat transfer area: 21,500 ft <sup>2</sup> (2,000 m <sup>2</sup> ). Velocity in channel: inlet 4.5 ft/sec (1.35 m/sec). Outlet (wet steam): 11 ft/sec (3.4 m/sec). Heat transfer: (average) 99,200 B.t.u./ft <sup>2</sup> , h (269,000 k cal/m <sup>2</sup> , h), (maximum rated) 280,000 B.t.u./ft <sup>2</sup> , h (759,000 k cal/m <sup>2</sup> , h). Maximum element temperatures: Fuel: 4,000°F (2,205°C). Internal cladding: 675°F (357.2°C). External cladding: 580°F (304°C).																		
PRESSURE VESSEL:	Carbon steel clad with stainless steel. Height: 40.88 ft (12.46 m). Inside diameter: 12.17 ft (3.71 m). Thickness: 5.25-5.625 in. (133.3-143 mm). Cladding thickness: 0.375 in. (9.5 mm) nominal. Design pressure: 1,250 p.s.i. (87.9 kg/cm <sup>2</sup> ).																		

STEAM RAISING:	Primary steam flow to turbine: $1.4 \times 10^6$ lb/h. Secondary steam generated in four heat exchangers with inverted U-tube primary circuit and shell secondaries. Height: 27 ft 9 in. (8.46 m). Diameter (internal): 5 ft 3 in. (1.6 m). Secondary steam generated: $1.19 \times 10^6$ lb/h (541 te/h). Secondary steam pressure: 475 p.s.i. (33.4 kg/cm <sup>2</sup> ).
SHIELDING:	2 in. steel thermal shield. 11 ft concrete biological shield at sides.
CONTAINMENT:	Steel sphere. Diameter: 190 ft (57.912 m). Thickness: 1.25-1.4 in. (31.7-35.5 mm). Design pressure: 29.5 p.s.i. (2.075 kg/cm <sup>2</sup> ) at 250° F (121.1°C).

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