The World's Reactors
No. 2—CP5

CP5—CHICAGO PILE

TYPE: Thermal, heterogeneous.

PURPOSE: Neutron physics research.

LOCATION: Argonne National Laboratory, Chicago, U.S.A.

OPERATION: Commenced operation February, 1954.

FUEL: 1.15 Kg. of U^{235} (∽ 90%) alloyed with aluminium
Alloy: 10-20 wt.% U, remainder Al, aluminium clad.
Plateform: 2.83 in. wide x 0.060 in. thick x $23\frac{3}{8}$ in. long.
Assembly: in box units of 3.0 in. x 2.4 in. section, 10 plates per box.

CLADDING Aluminium (2S).
Treatment: rolled on and forge-welded to 0.020 in. thick alloy plates.
Wall thickness: 0.020 in. (making 0.060 in. as under fuel).

MODERATOR: Heavy water.
Total investment: 6.8 tons, including reflector and coolant hold-up.
Volume of active core: 2 ft. dia. x 2 ft. high, approx.
Volume normally occupied by D_2O: 6 ft. dia. x 6 ft. 6 in. high.

LATTICE: Units in 6 in. sq. array with centre row displaced 3 in.
Total number of units: 17.
Criticality: achieved with 12 freshly charged.

REFLECTOR: Inner reflector: 2—2.5 ft. D_2O all round core.
Outer reflector: 2 ft. of graphite on sides and bottom only.
Graphite wt.: 29.5 tons.

LATTICE CONSTANTS: Thermal utilization factor—(f)=0.9.
Resonance escape probability—(p)=1.0.
Infinite multiplication factor—(k_∞)=1.85.
Effective multiplication factor—(k_{eff})=1.125.
(Slowing-down length)^2—(L_s)=128 cm.^{2}
(Diffusion length)^2—(L_d)=87.5 cm.^{2}
Critical buckling—(B^2)=3 x 10^{-3} cm.^{2}

COOLANT: Heavy water.
Inlet temperature: 47° C.
Outlet temperature: 51° C.

PUMPING: Equipment: Three 1,000 g.p.m. electric centrifugal pumps.
Full power working: Two operating, one standby.
Coolant flow : 1,000 g.p.m.
Primary (D_2O) cooling circuit power: 10 h.p.
Secondary (H_2O) cooling circuit power: 30 h.p.

POWER: Normal operating power 1 MW heat.

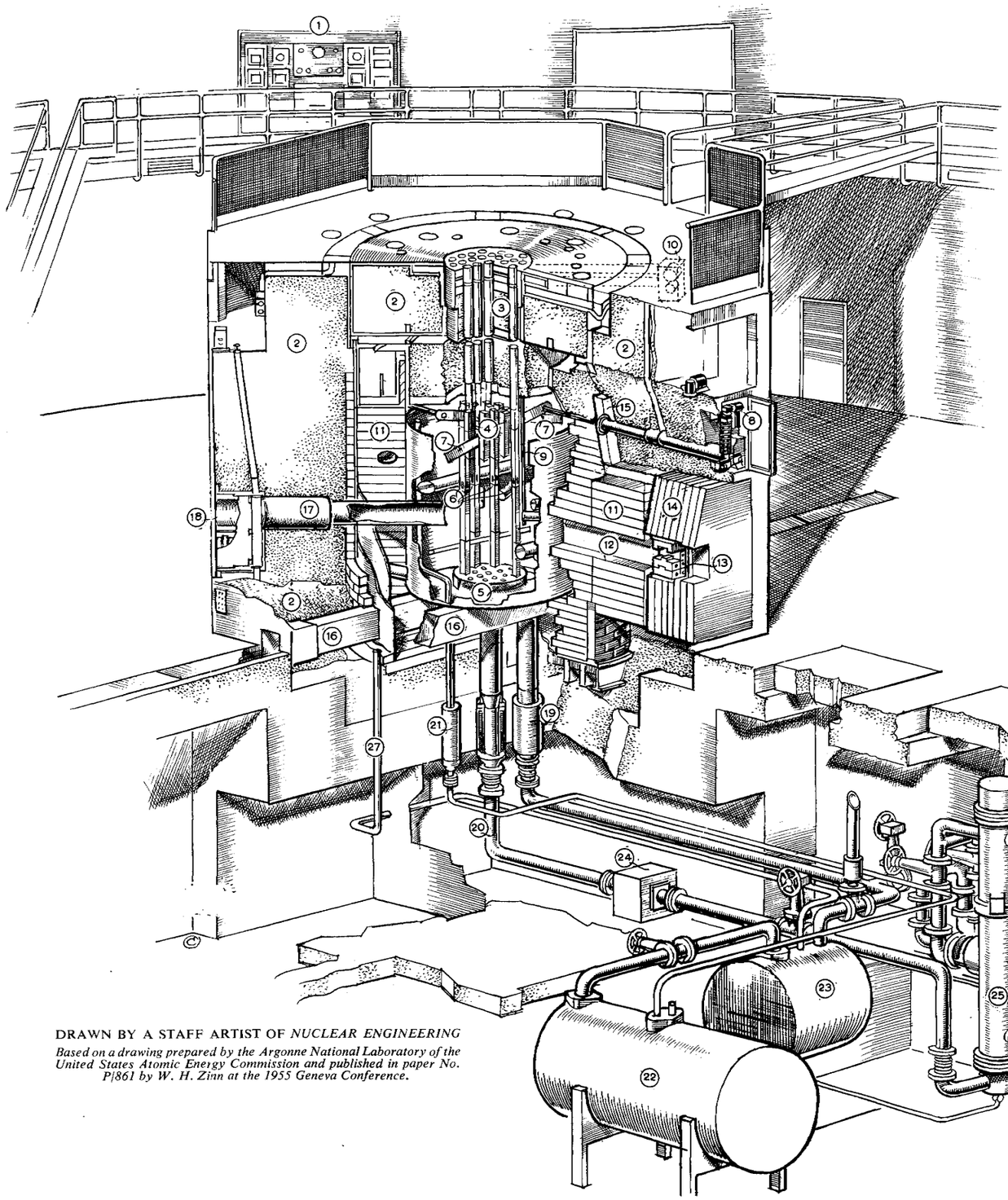
FLUX: Minimum thermal neutron flux: 2.8 x 10^{13} n/cm^2—sec.

CONVERSION: No fertile material apart from ∽ 10% residual U^{238} in fuel.

BURN-UP: About 20% U^{235} converted to fission products before fuel change.
Re-fuelled at about 8 months interval for 1 MW operation.
Consumption: about 0.84 grams/day of U^{235}.

CONTROL: Shut-off shim rods: Four, of signal-arm type.
Material: Cadmium, aluminium clad.
Dimensions: 60 in. x $5\frac{1}{2}$ in. x 1 in.
Control or regulating rod: One, outside core, vertical motion.
Material: Cadmium, aluminium clad.
Dimensions: $28\frac{5}{8}$ in. x $1\frac{1}{2}$ in. dia., 2 ft. travel.
Dumping of reflector: $2\frac{1}{2}$ ft. fall to top of fuel-plates in 30 seconds.
Moderator temperature: May be cooled to provide extra reactivity to compensate for poison build-up during shut-down.

SHIELDING: Thermal shield: $\frac{1}{4}$ in. aluminium plate containing boron carbide.
Inner shield: $3\frac{1}{2}$ in. of lead.
Outer shield: 4 ft. 8 in. of heavy concrete (iron ore+punchings).
Over-all size: 13 ft. $6\frac{1}{2}$ in. high.



DRAWN BY A STAFF ARTIST OF *NUCLEAR ENGINEERING*

Based on a drawing prepared by the Argonne National Laboratory of the United States Atomic Energy Commission and published in paper No. P/861 by W. H. Zinn at the 1955 Geneva Conference.

KEY
1. Control room
2. Concrete shield
3. Top shielding plug
4. Fuel element assemblies
5. Plenum chamber
6. Coolant circulating outlet
7. Shim safety rods
8. Shim safety rods drive
9. Control rod
10. Control-rod mechanism (dotted)
11. Graphite
12. Thermal column
13. Composite lead gate
14. Neutron and gamma shield
15. Radial thermal shield
16. Irradiation channels
17. Experimental hole
18. Rotating plug
19. Coolant discharge
20. Coolant inlet
21. Overflow line
22. Storage tank
23. Dump tank
24. Flow meter
25. Main heat exchanger
26. Pumps
27. Dump-tank vent line