

1. REACTOR BUILDING
2. REACTOR
3. STEAM DRUMS
4. FUELLING MACHINE
5. SERVICE BUILDING
6. CONTROL ROOM
7. ADMINISTRATION BUILDING
8. TURBINE BUILDING
9. GENERATOR
10. TURBINE

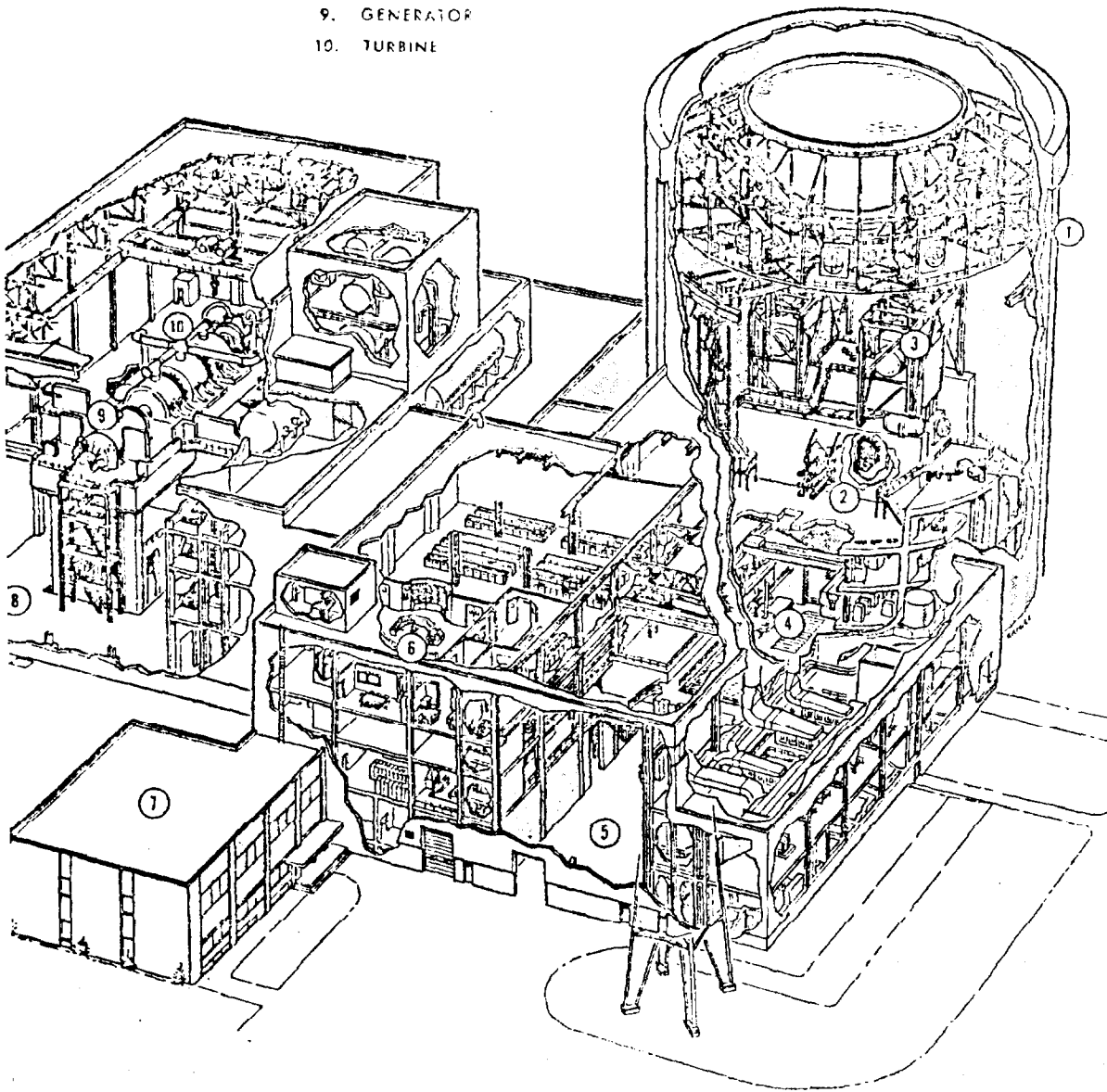


Fig. 10.11: General Arrangement of Buildings - Gentilly G. S.

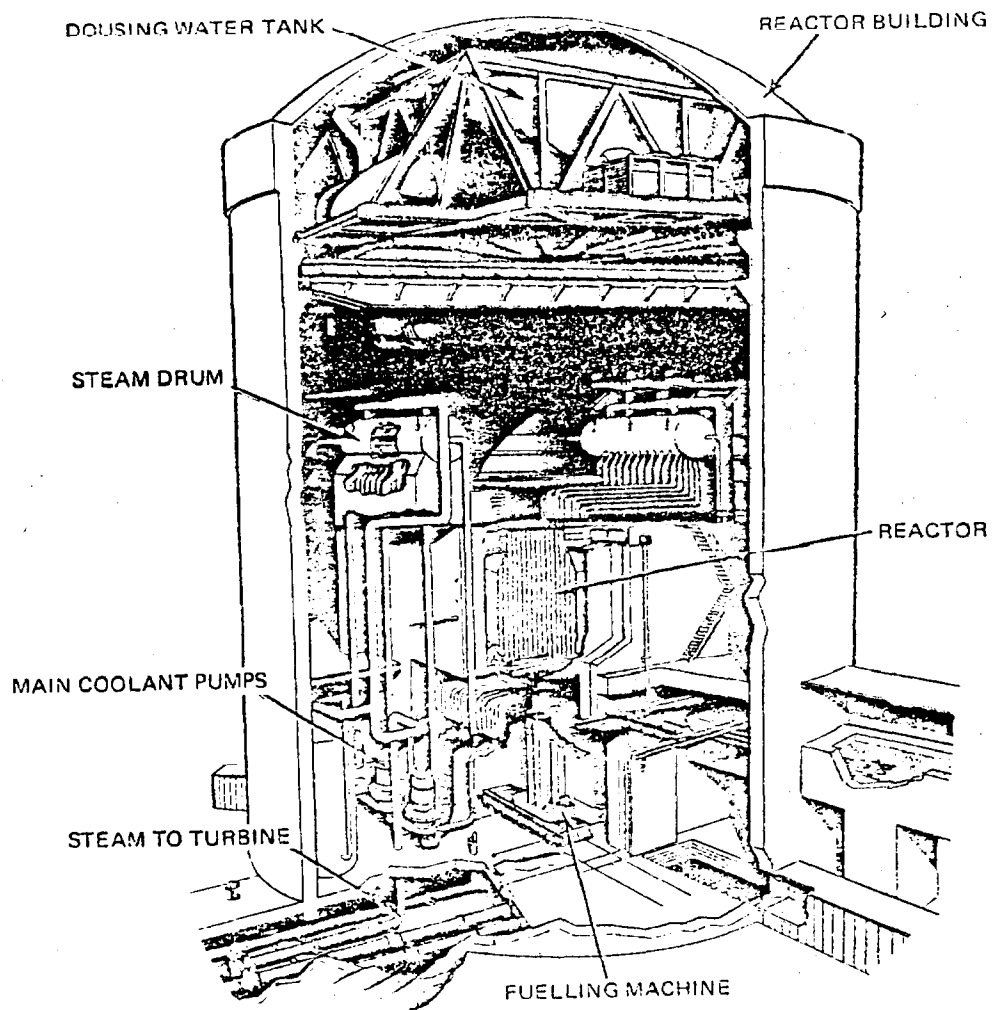


Fig. 10.12: Gentilly Reactor Building

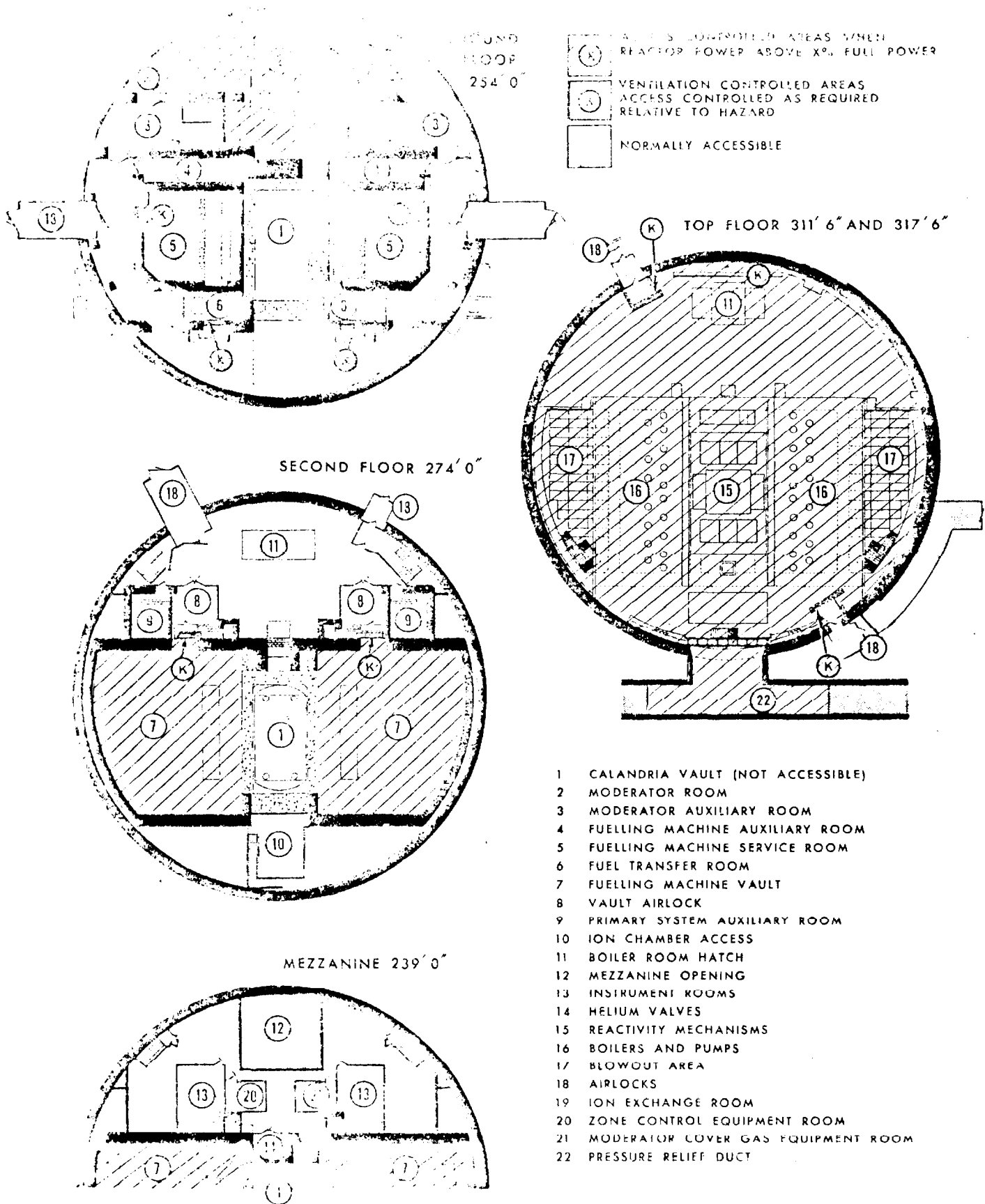
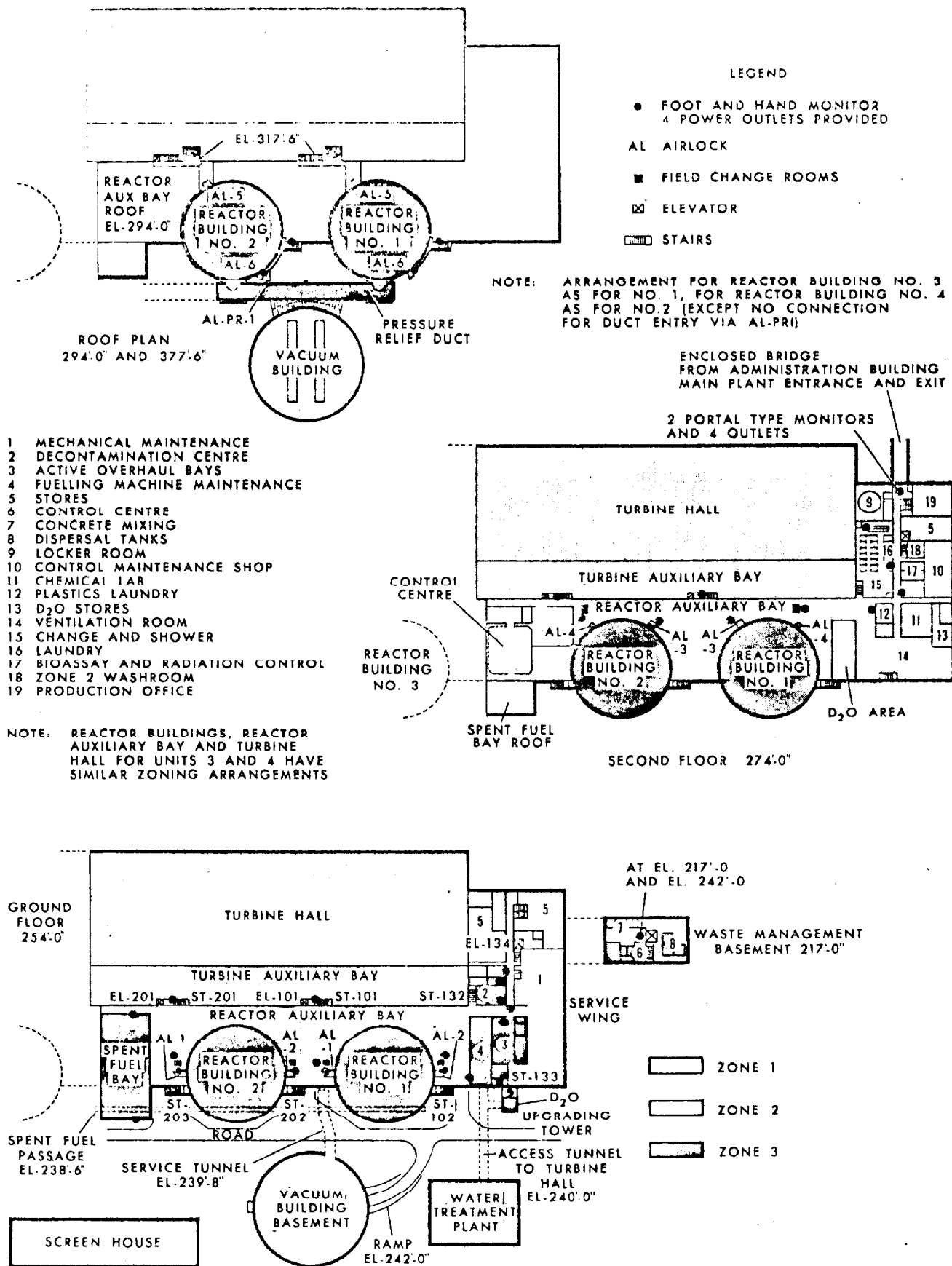


Fig. 10.13: Dickering G.S. - Reactor Building Access Control Diagram



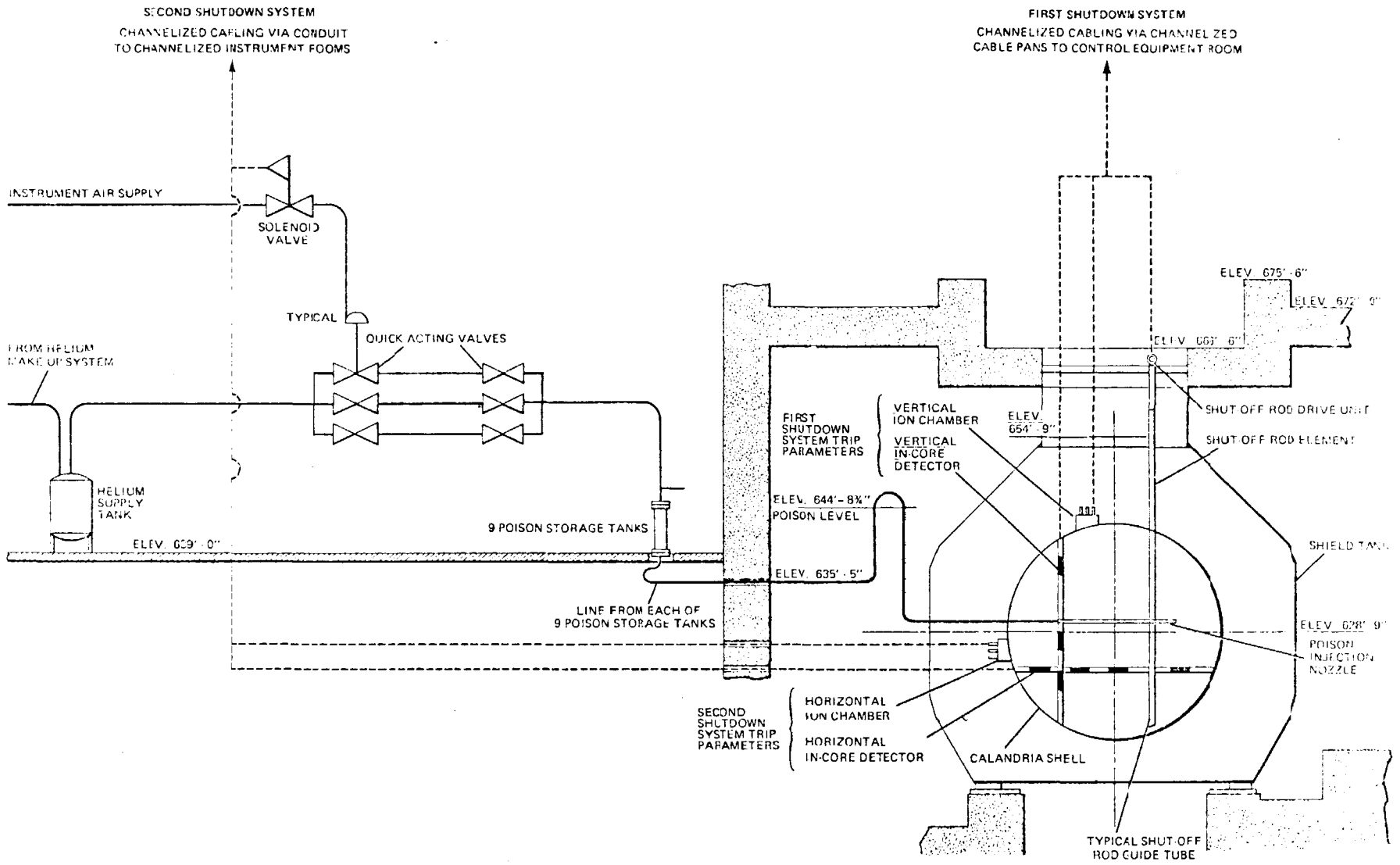


Fig. 10.15: First and Second Shutdown Systems

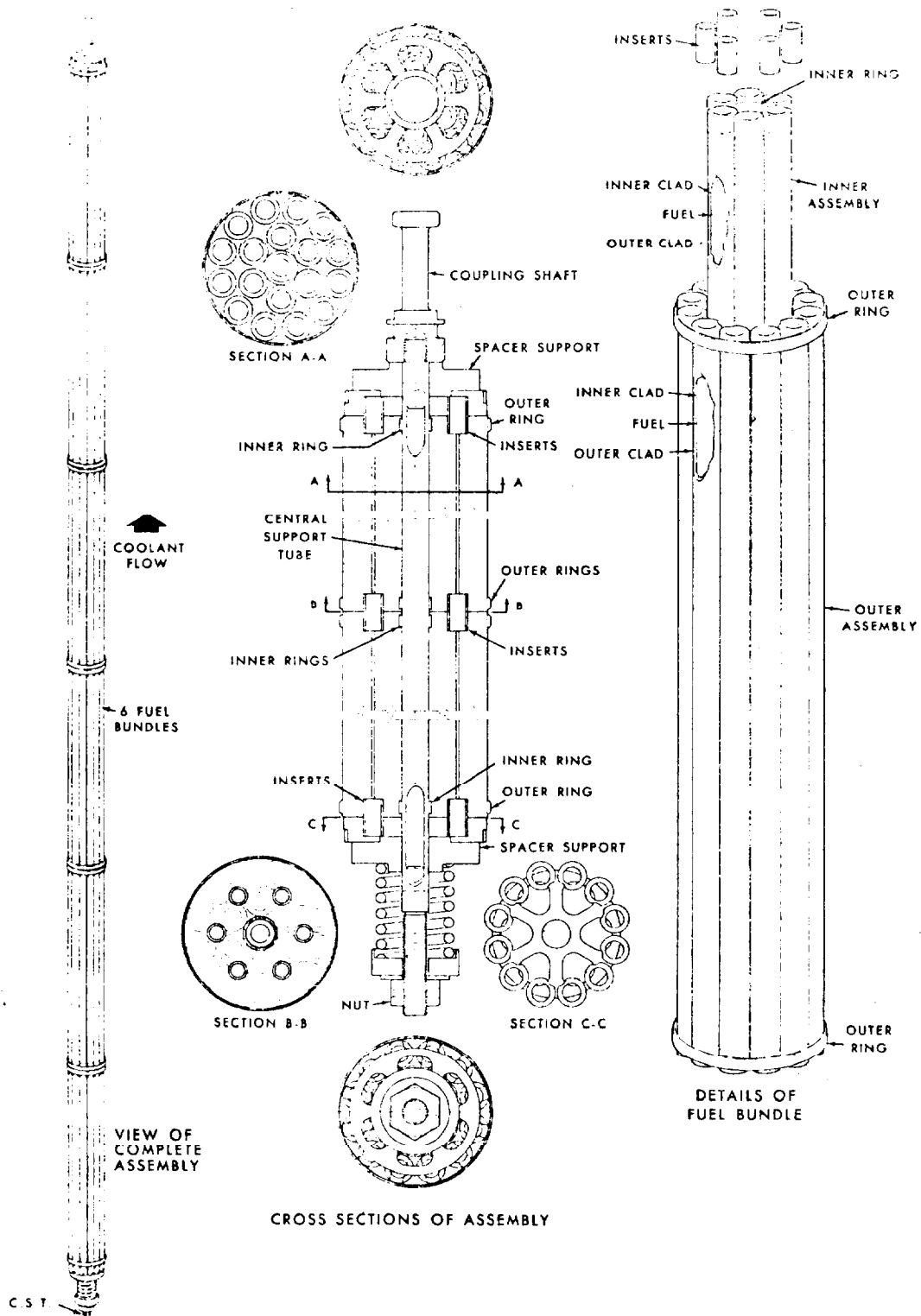


Fig. 10.17: Bruce Booster Fuel String Assembly

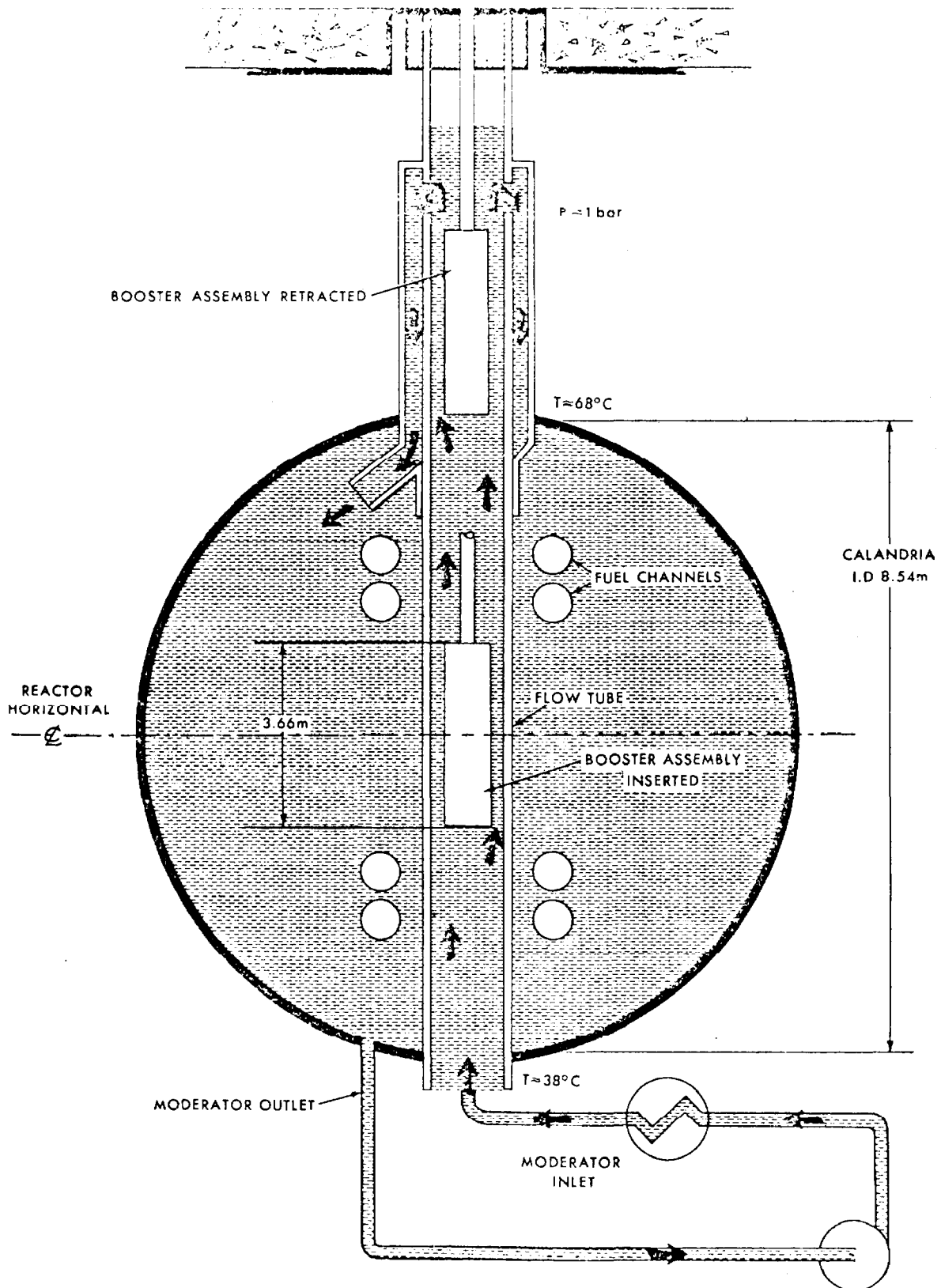


Fig. 10.18: Bruce Booster Channel Schematic

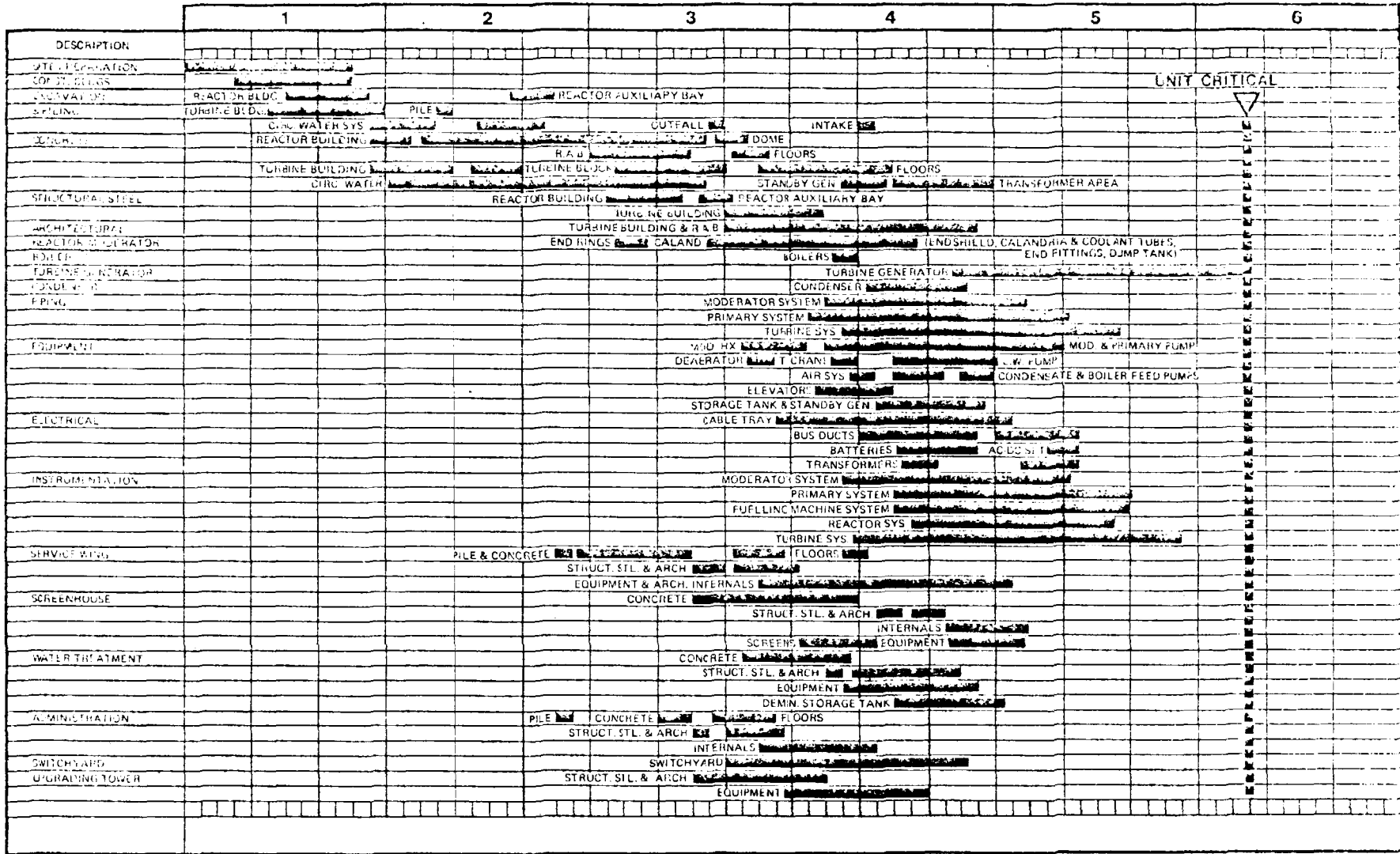


Fig. 10.19: Field Construction Program

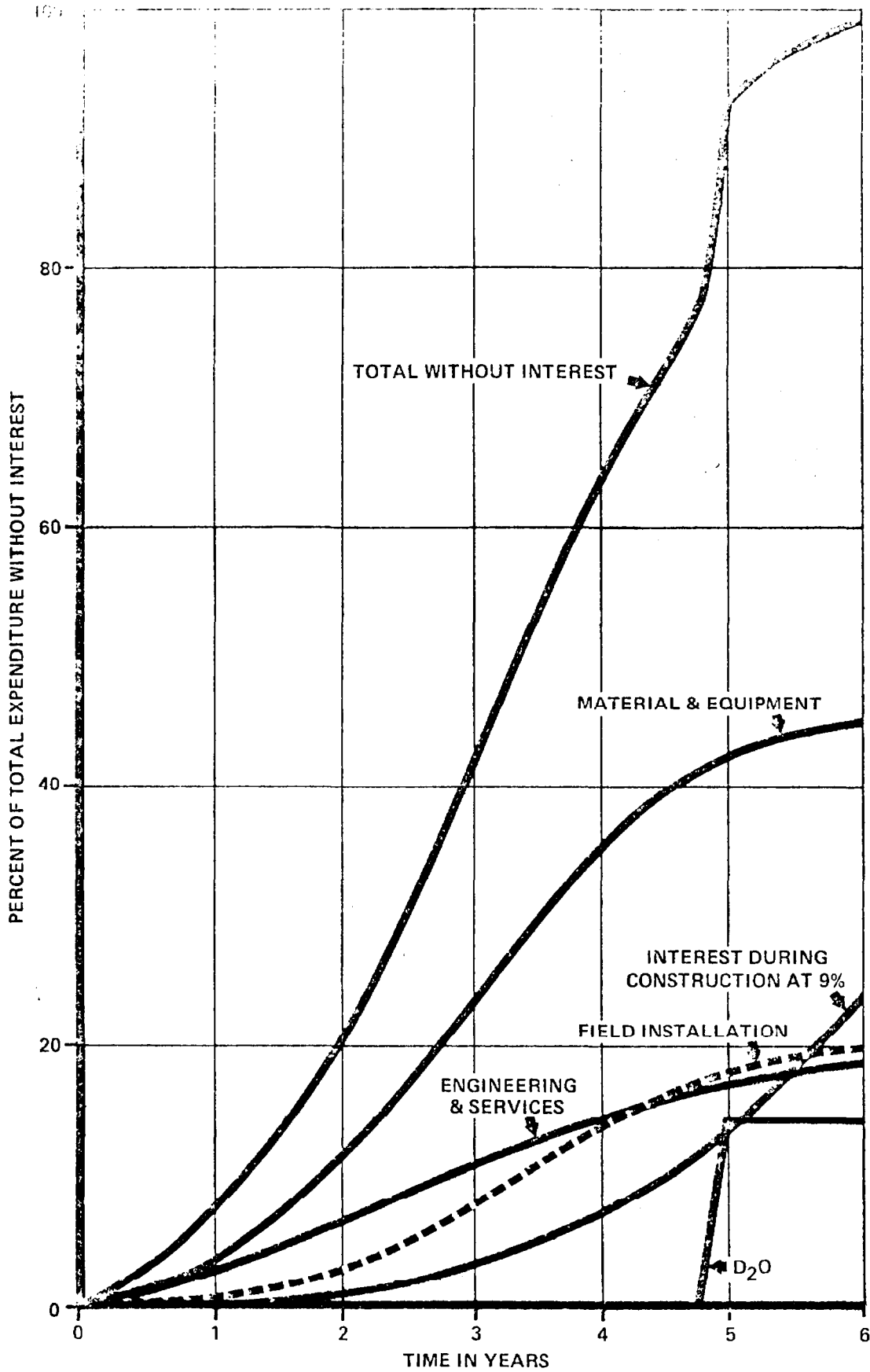


Fig. 10.20: Single Unit 600 MWe CANDU-PIW Plant Cash Flow

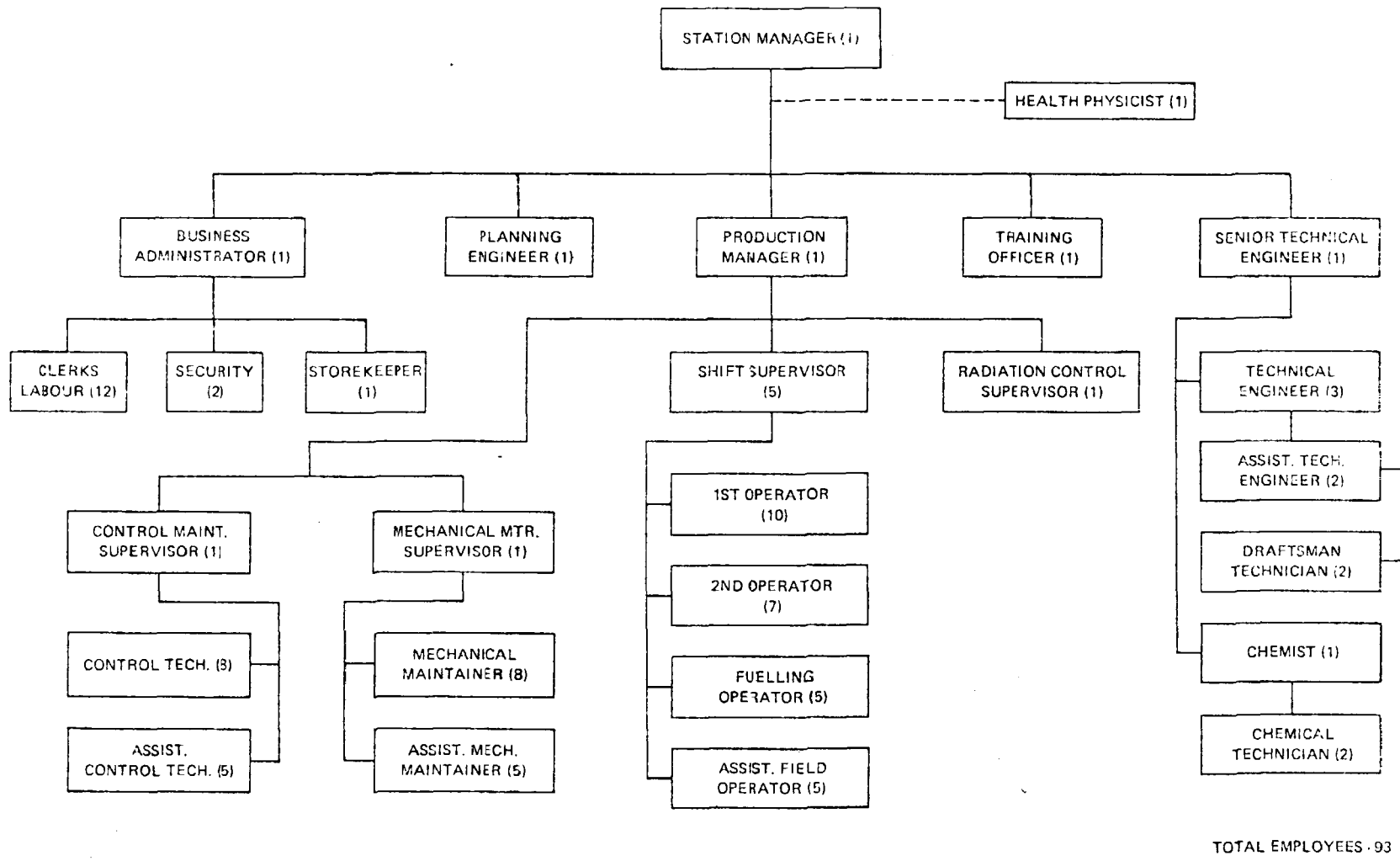
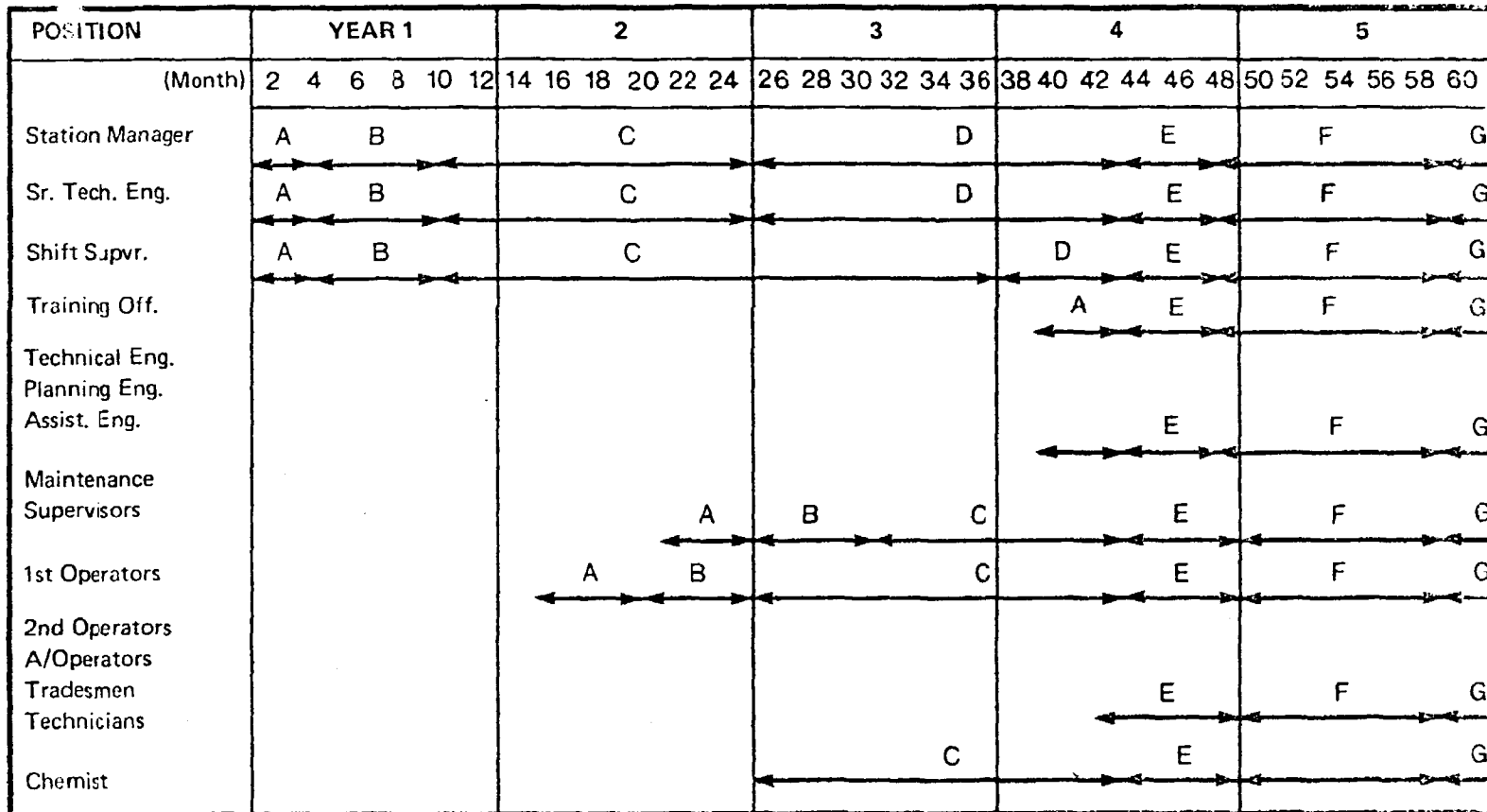


Fig. 10.21: Typical Nuclear Station Organization Chart



A - Hire
 B - Nuclear Technology
 C - Station Training at Nuclear Facility
 D - At Design Site
 E - Station Training
 F - Commissioning
 G - Criticality

Fig. 10.22: Station Training Program for Staff for First Nuclear G.S.

Fig. 10.23: Brief Description of Staff Functions

POSITION	RESPONSIBILITIES
Station Manager	In charge of the entire station.
Production Manager	In charge of execution of all field work including operations, maintenance, improvements, radiation control, chemical control, also acts as Manager in absence of Station Manager.
Technical Supervisor	Head of technical unit: Technical problem solutions, mechanical, electrical, control, fuel scheduling, heavy water accounting, losses, report writing, procedures writing.
A/Technical Supervisor	Assists Technical Supervisor.
Chemist	Chemical problems and analyses.
Planning Superintendent	Overall planning of station work, including overhauls, repairs, installations, using various scheduling techniques and evaluations.
Planning Supervisor	Planning co-ordination and scheduling, set work priorities and monitors work progress.
Planning Analyst A/Planning Analyst	Assists the planning supervisor in preparing critical path schedules or other type, analyze data, to improve planning.
Shift Supervisor	In charge of power production in station on a shift basis.
Shift Operating Supervisor	Assists shift supervisor.
Operators Control Room	In charge of control room.
First Field Operator	Foreman in charge of field operators work for one unit.
Second Operator A/Operator	Carry out field duties.
Mechanical Maintenance Supervisor	In charge of mechanical maintenance.
Control Maintenance Supervisor	In charge of control maintenance.
Commissioning Superintendent	Carries out commissioning of station systems assisted by staff. Prepares all commissioning, operating, training and maintenance manuals. Trains initial staff on station systems and equipment.
Control Technician A/Control Technician	Maintains pneumatic, electronic, electrical instrumentation, controls and equipment, including computers.
Mechanical Maintainer	Maintains mechanical equipment: Welding, machining, pipefitting, millwright work. Control Technician and Mechanical Maintainer both must be skilled in more than one trade.
Business Administrator	In charge of business administration including budget, cost control, union contract, personnel problems, contracts, equipment warranties and station stores.
Training Officer	In charge of station training, schedules and arranging for training assistance from Nuclear Training Centre.

Fig. 10.24: Nuclear Station Staff Requirements

1. PROFESSIONAL ENGINEERS	
Station Manager	1
Production Manager	1
Technical Engineer (including senior and assist.)	6
Planning Engineer	1
Health Physicist	1
Training Officer	1
Shift Supervisor (1 per shift)	5
Business Administrator	1
Chemist	1
	<hr/>
	18
2. TECHNOLOGISTS	
Radiation Control Supervisor	1
Electrical/Mechanical	1
	<hr/>
	2
3. TECHNICIANS	
Chemical	2
Draftsman	1
	<hr/>
	3
4. OPERATORS	
1st Operator (2 per shift)	10
2nd (Field Operator) (1 per shift, 2 on days)	7
Fuelling Operator (1 per shift)	5
Assist. Field Operator (1 per shift)	5
	<hr/>
	27
5. TRADESMEN	
Control Maintainer Supervisor	1
Control Technicians	8
Assistant Control Technicians	5
Mechanical Maintainer Supervisor	1
Mechanical Maintainers	8
Assistant Mechanical Maintainers	5
	<hr/>
	28
6. CLERICAL, LABOUR AND SECURITY	
Station Accountant	1
Clerk/Typist	3
Storekeeper	1
Building Mechanic	1
Security Guard	2
Janitor	2
Utility	5
	<hr/>
	15
	<hr/>
TOTAL	93

In later stages of operation shift supervisor could be made up from ranks of operators.

SAMPLE	FREQUENCY	SAMPLING LOCATION	ANALYSES	WHERE ANALYSED
ADR: (a) Inhalation	Continuous Monthly TLD ¹	Not more than 5 molecular sieve samplers at station boundary	H-3	Health Physics Central Lab
(b) Immersion	TLD dosimeters changed quarterly Integrating dose rate meter	Several at about 1, 5 and 15 km from station At one suitable TLD site	Integrated quarterly gamma dose Integrated quarterly gamma dose	Health Physics Central Lab Station Health Physics Group
PRECIPITATION	Quarterly composite of site buckets	About 5 precipitation buckets at station boundary and 1 at a reference background location	H-3 Gross β	Health Physics Central Lab
MILK	Monthly in summer (April to October)	Composite of not more than 3 farms within 10 km of station	I-131 H-3	Station Health Physics Group Central Health Physics Lab
WATER: (a) Surface Water	Weekly composite Quarterly composite	Station circulating water effluent Station circulating water effluent	Gross β H-3, specific radionuclides	Station Chemical Control Lab Health Physics Central Lab
(b) Drinking Water	Semi-annual composite	Municipal pumphouse if within 10 km of station	H-3; Gross β , (specific radionuclides if 10^{-7} Ci/ml Gross β activity)	Health Physics Central Lab
FISH	Twice a year	Near station outfall	Gamma spectrometric analysis	Health Physics Central Lab

¹ Thermoluminescence Dosimetry

Fig. 10.25: Routine Environmental Monitoring Program

Reactor	NPD	NPD	Douglas Point	Pickering	Bruce	Bruce	PHW 600	BLW Gentilly
NO. OF ELEMENTS PER BUNDLE	7	19	19	28	28	37	28	18
<u>PELLETS</u>								
Density (g/cm ³)	10.3	10.3	10.5	10.6	10.6	10.6	10.6	10.6
Length (mm)	22.6	19.8	20.1	20.9	20.9	19.0	20.9	Optional
<u>ELEMENTS</u>								
Material	Zirc-2	Zirc-2	Zirc-2	Zirc-4	Zirc-4	Zirc-4	Zirc-4	Zirc-4
Outside Dia.(mm)	25.4	15.2	15.2	15.2	15.2	13.1	15.2	19.7
Min. Cladding Thickness (mm)	0.64	0.38	0.38	0.38	0.38	0.38	0.38	0.49
<u>BUNDLES</u>								
Length (mm)	495	495	495	495	495	495	495	500
Max. Dia. (mm)	82.0	82.0	81.7	102.4	102.4	102.4	102.4	102.4
No. per Channel	9	9	12	12	13	13	13	10
<u>OPERATING CONDITIONS</u>								
Max. Sheath Temperature °C	288	284	301	304	302	302	307	286
Max. Linear Element Power(kW/m)	43.4	24.6	50.3	52.8	60.3	46.5	60.3	60.5
Average Burnup (MWh/kg)	164	164	192	168	210	204	209	168
Average Fuel Life (year)	4.0	2.2	2.3	1.46	2.34	2.24	1.63	1.85
Max. Fuel Life (year)	6.2	2.6	2.6	2.48	3.79	3.63	2.28	2.4
Max. Surface Flux (kW/m ²)	544	536	1090	1150	1265	1090	1265	975

TABLE 10.3: Design and Operating Data of Some Nuclear Fuels.

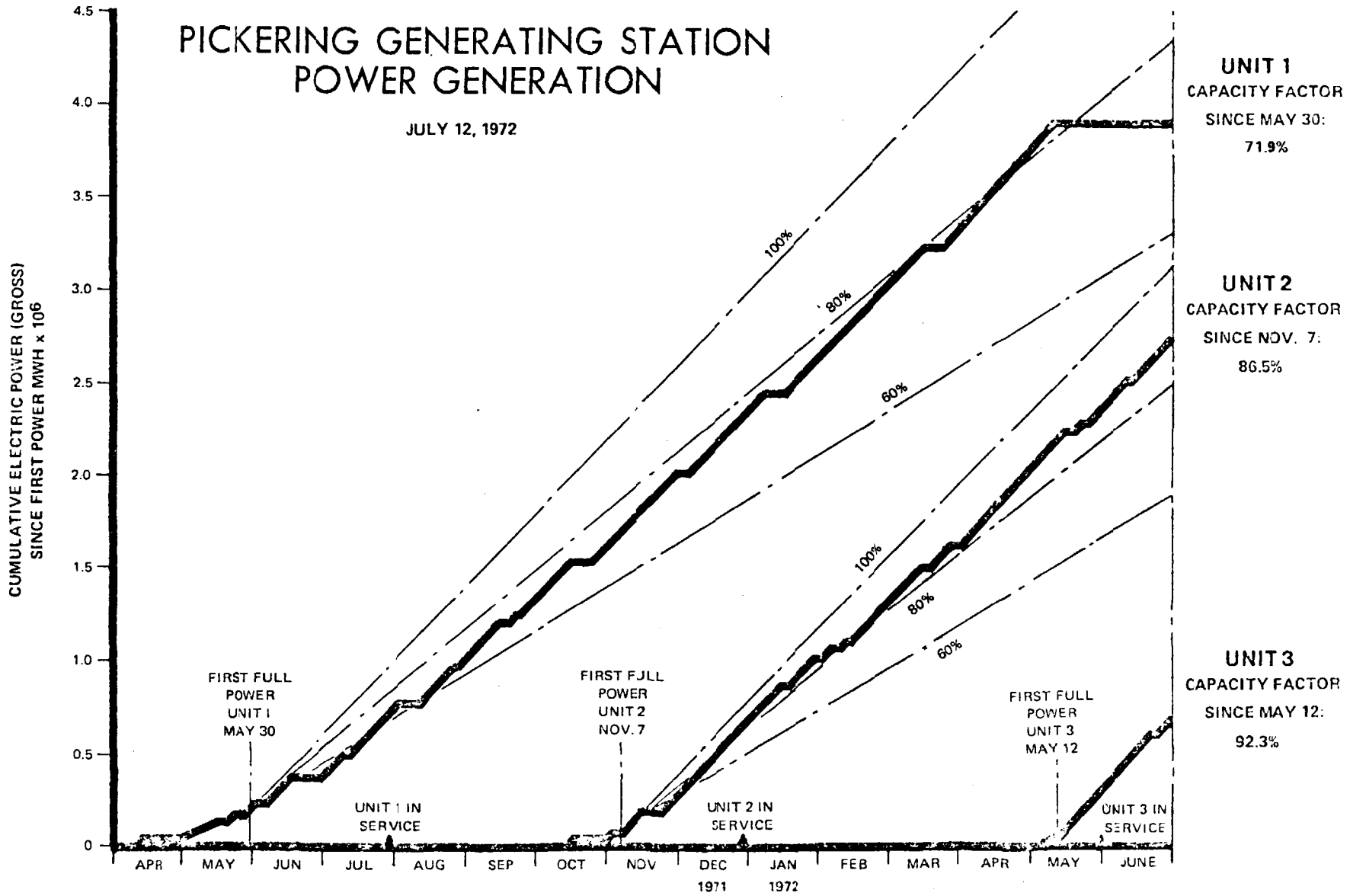


Fig. 10.26: Pickering Reliability

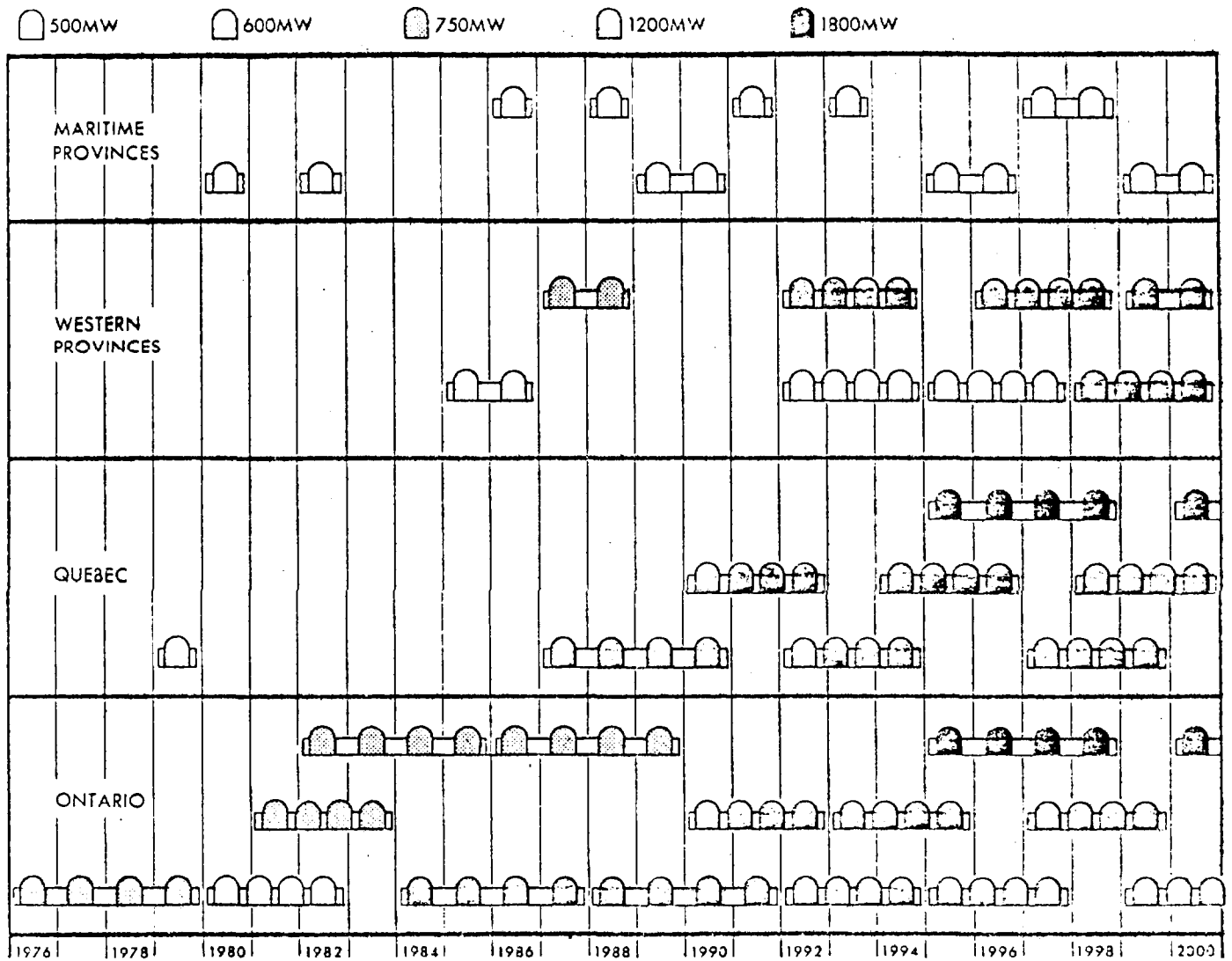


Fig. 10.27: PROSPECTIVE CANADIAN NUCLEAR PLANTS THIS CENTURY