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Australian Nuclear Science & Technology Organisation

HIFAR – Australia's Nuclear Research Reactor

**Presented by John Rowling
Manager/Facilities Management
(ex-Reactor Manager / HIFAR)**



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INTRODUCTION

HIFAR has been Australia's longest operating nuclear research reactor.

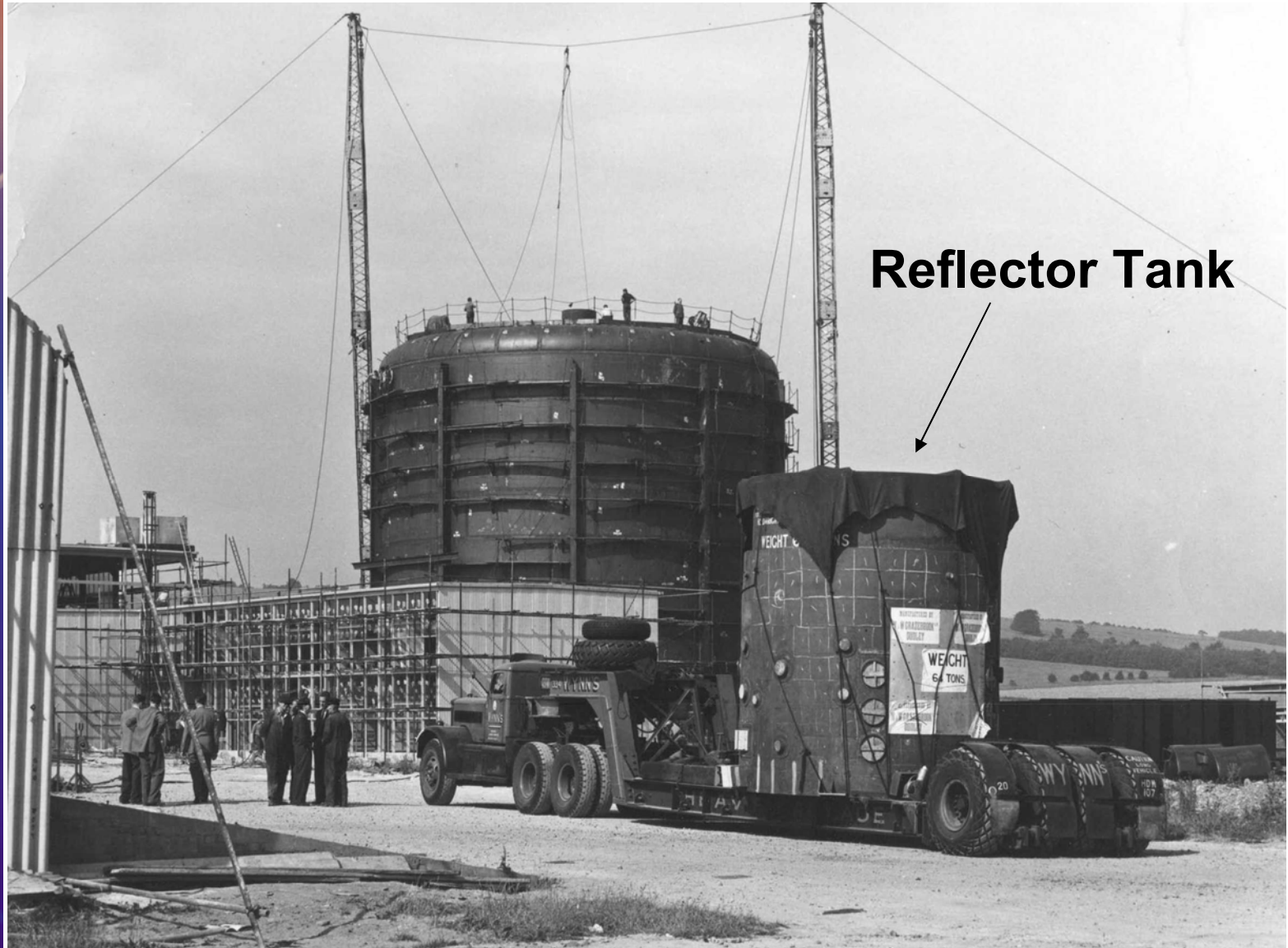
- **It was commissioned 26th January 1958 (first criticality)**
- **There were 5 other reactors of similar design, UK (3), Denmark and Germany**
- **HIFAR is the only reactor of its type still in operation. This is a testament to the previous staff of the old AAEC & now ANSTO.**



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Reactor Building (Harwell / UK)



Reflector Tank





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General Information on HIFAR

Building: 21 metres dia by 21 metres high

Foundations: 3000 tonne of concrete

Reactor: Core 0.75m dia by 0.6m high

Shielding 1.6m thick

Heavy Water 10 tonne (\$600 per litre)

Fuel: 3 kg of U_{235} (Power Station 5 tonne 1000MW)

Neutron Flux 1.4×10^{14} n/cm²/sec

Operating pressure: 1.2bar

Control rods: 6off

Cost \$2,900,000

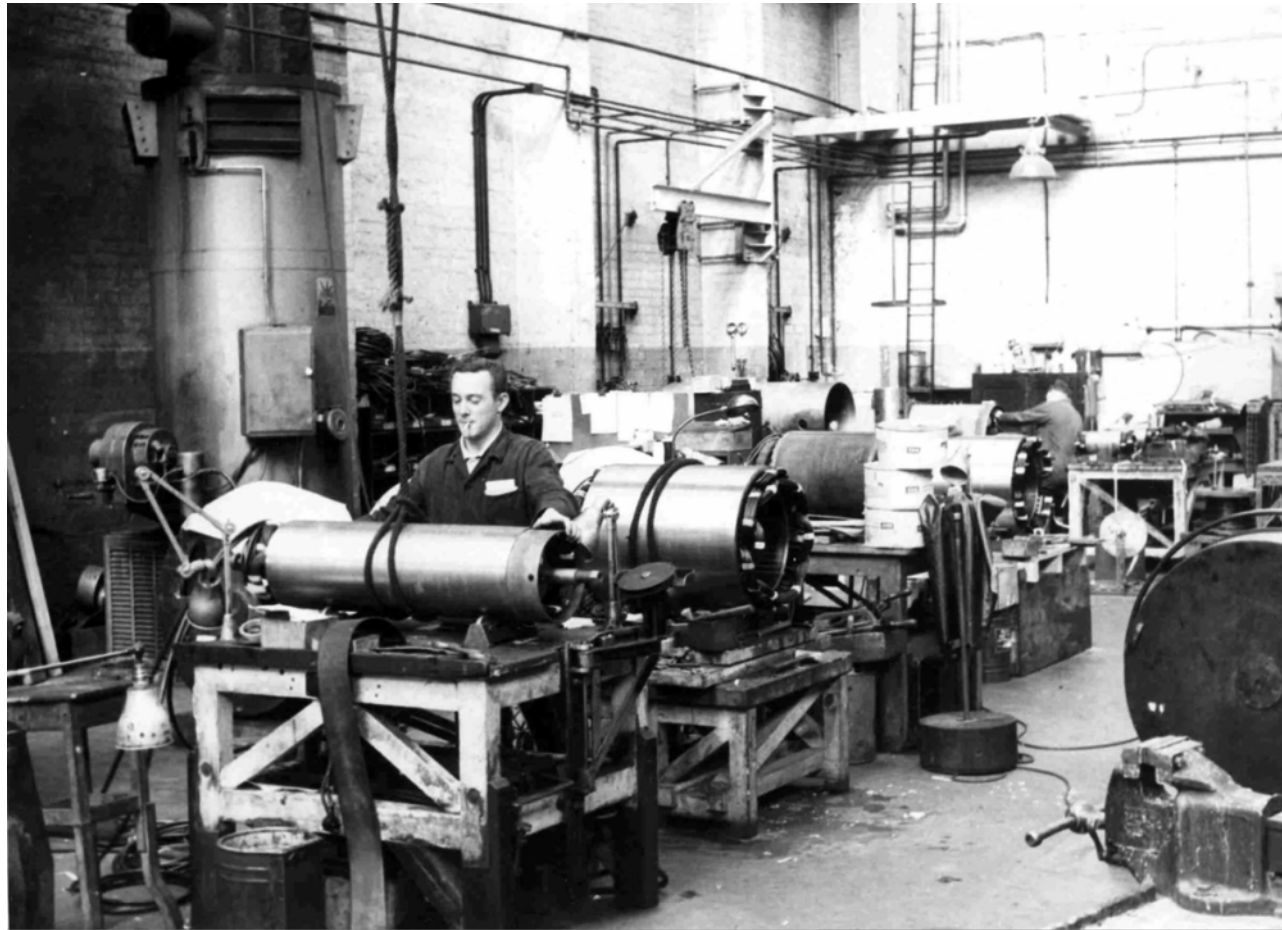
Exclusion Zone 1.6km



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Heavy Water Circulating Pumps in manufacture (400kg/second @ 50Deg C)

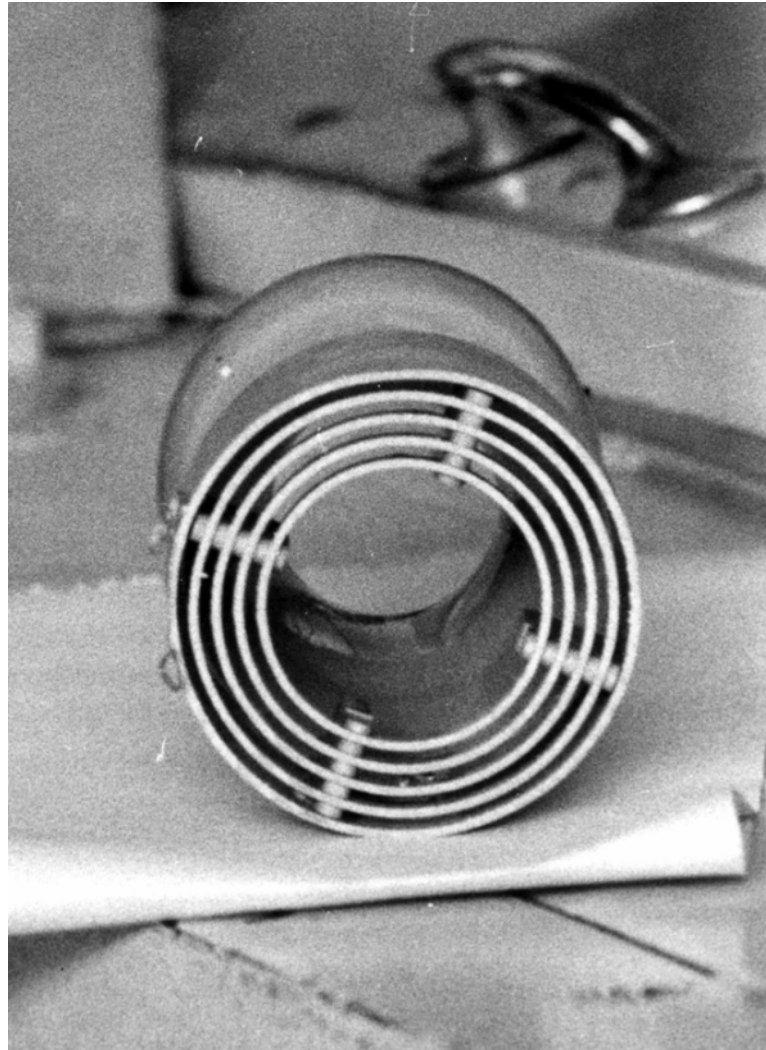




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Cross Section of a Fuel Element

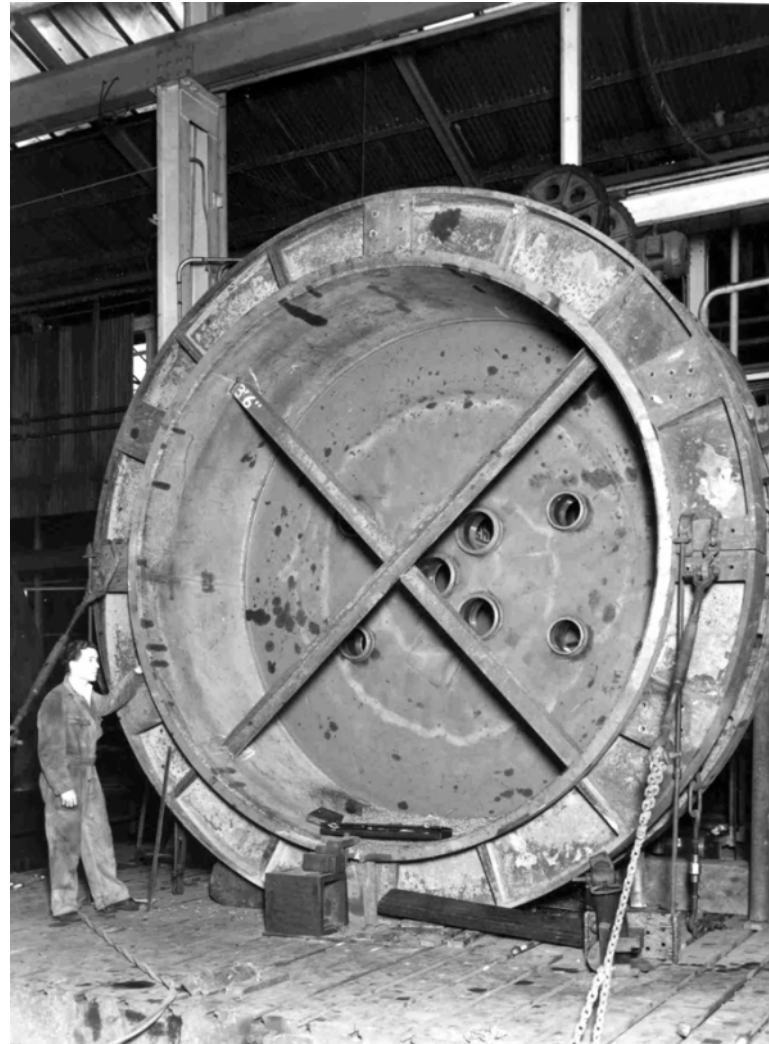




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Machining of the Reactor Steel Tank





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One of Three Heat Exchangers

At 10MWs Two exchangers used, third on standby





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HIFAR Reactor Team (typically)

Team of 56 staff

- 12 Engineers**
- 24 Shift Operators**
- 12 Maintenance Staff,
Mechanical,
Instrument & Electrical,**
- 6 Utilisation staff ,**
- 2 Trainers**



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HIFAR Utilisation

- **15 year Design Life**
- **1960's - Materials Test Reactor**

First medical isotopes Sodium 24 in Dec 1960

- **- Nuclear Science and Research**
 - **Isotope Production (Medical/Industrial)**
 - **NTD Silicon Irradiation**
 - **Neutron Activation Analysis (NAA)**



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Fuel Elements

U235 Enrichment

93% 1958 to 1961

80% 1961 to 1984

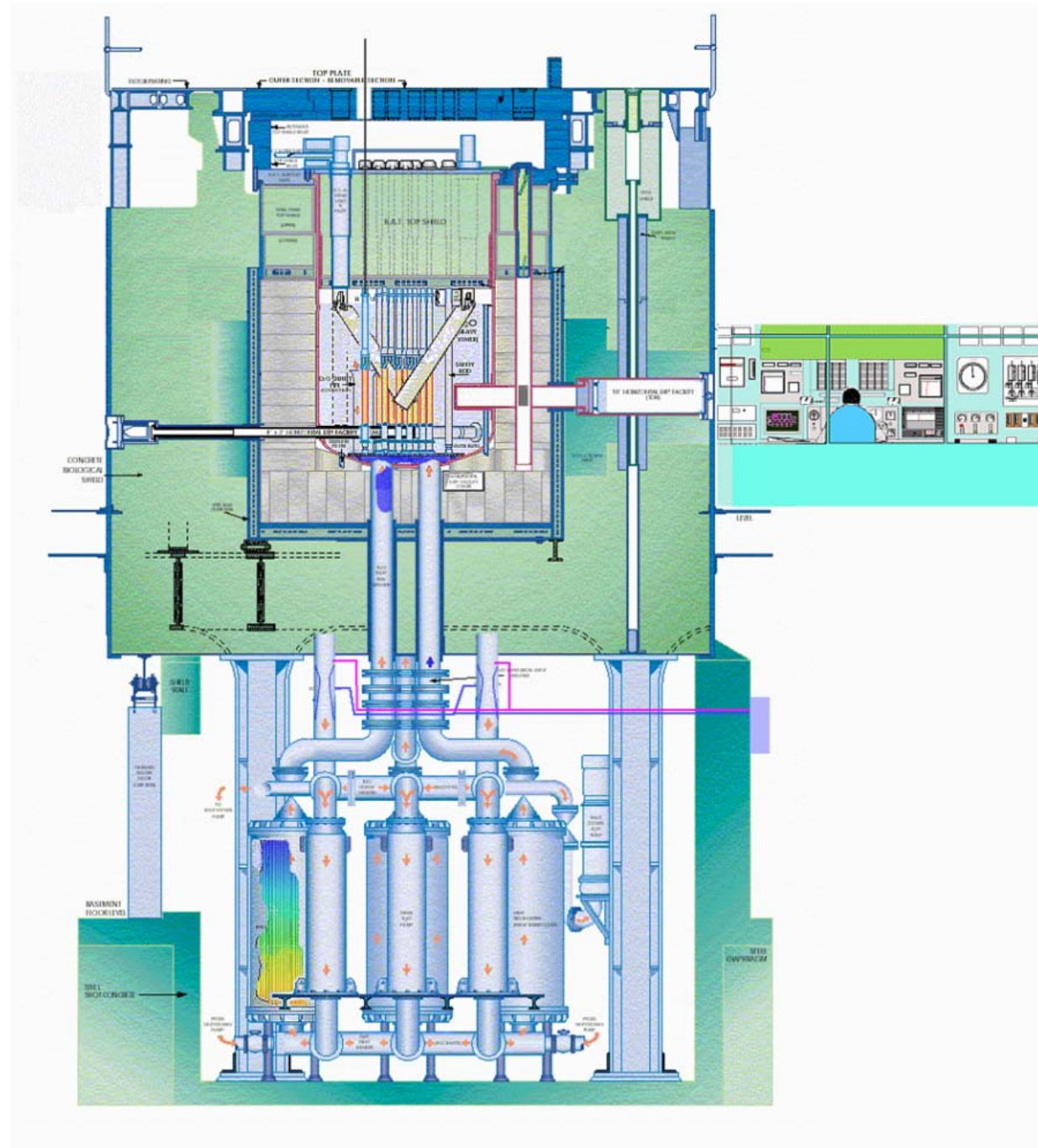
60% 1984 to 2005

19.6% 2005 to now



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HIFAR Operating Cycle

- 1960's - "Ad Hoc"
- 1970's - 28 Day Program
- 5 to 4 day Shutdown for maintenance and re-fuelling
- 2001 – 35 Day Program
 - 3.6 days for re-fuelling and maintenance
 - In 50 years,
 - 1968 fuel elements
 - 96 Course Control Arms



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HIFAR Control Room





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Performance Figures (last 10yrs)

- **Number of Reactor trips in the 80's & early 90's was 20 to 25 per year.**
- **In the last year of operation**
 - **3 trips**
 - **98.4% (Operational availability)**
 - **99% (Ontime delivery of medical isotopes)**



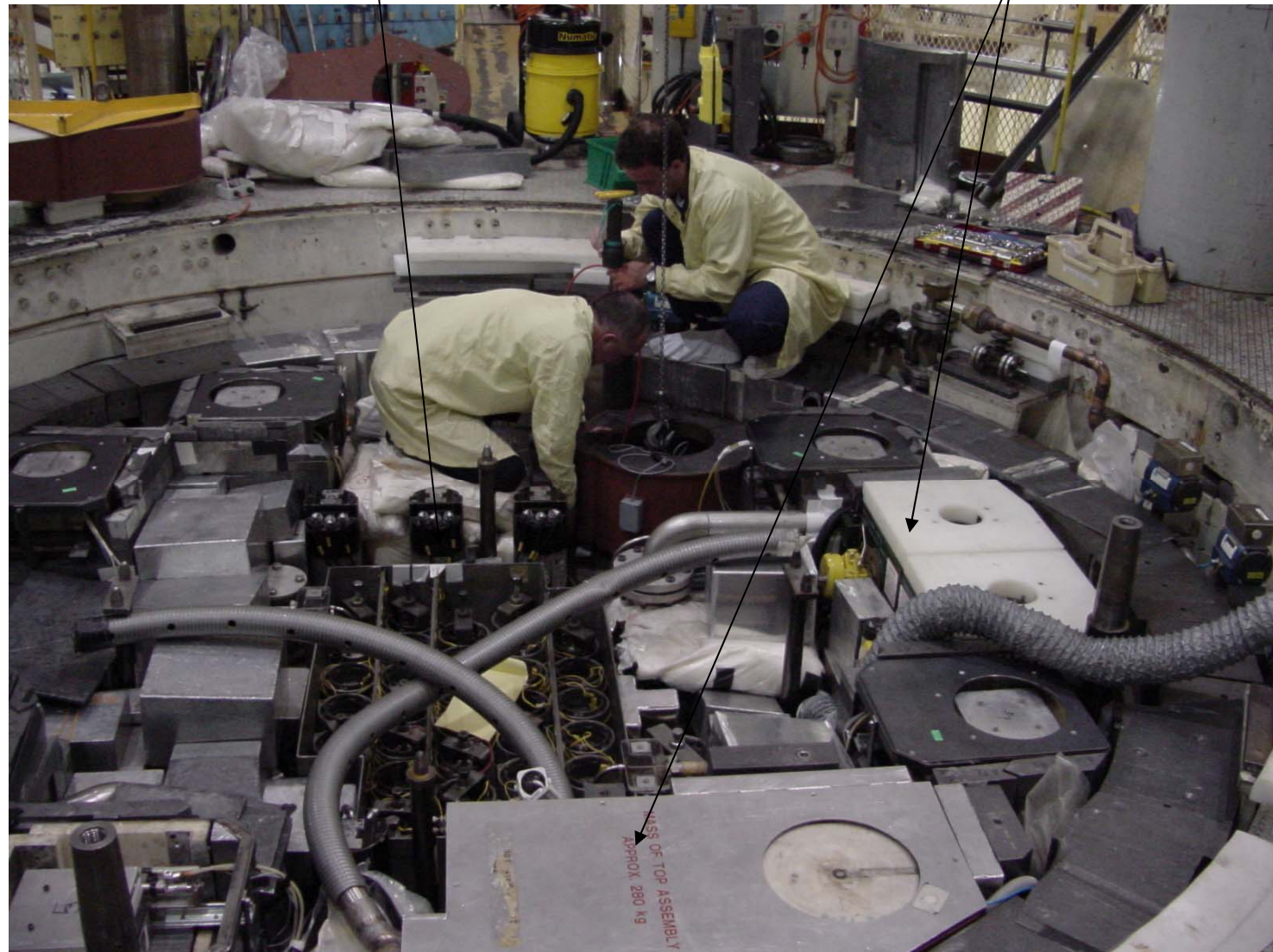
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HIFAR Top Plate

Fuel Element

Silicon rigs





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Neutron Beam

2 Tan





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Neutron Reflectometer test instrument in preparation of OPAL's Neutron Guide Hall





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**Bragg Instruments such
AUSANS will be removed to
OPAL or sold off or scrapped.**



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Triple Axis Spectrometer





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Preparation

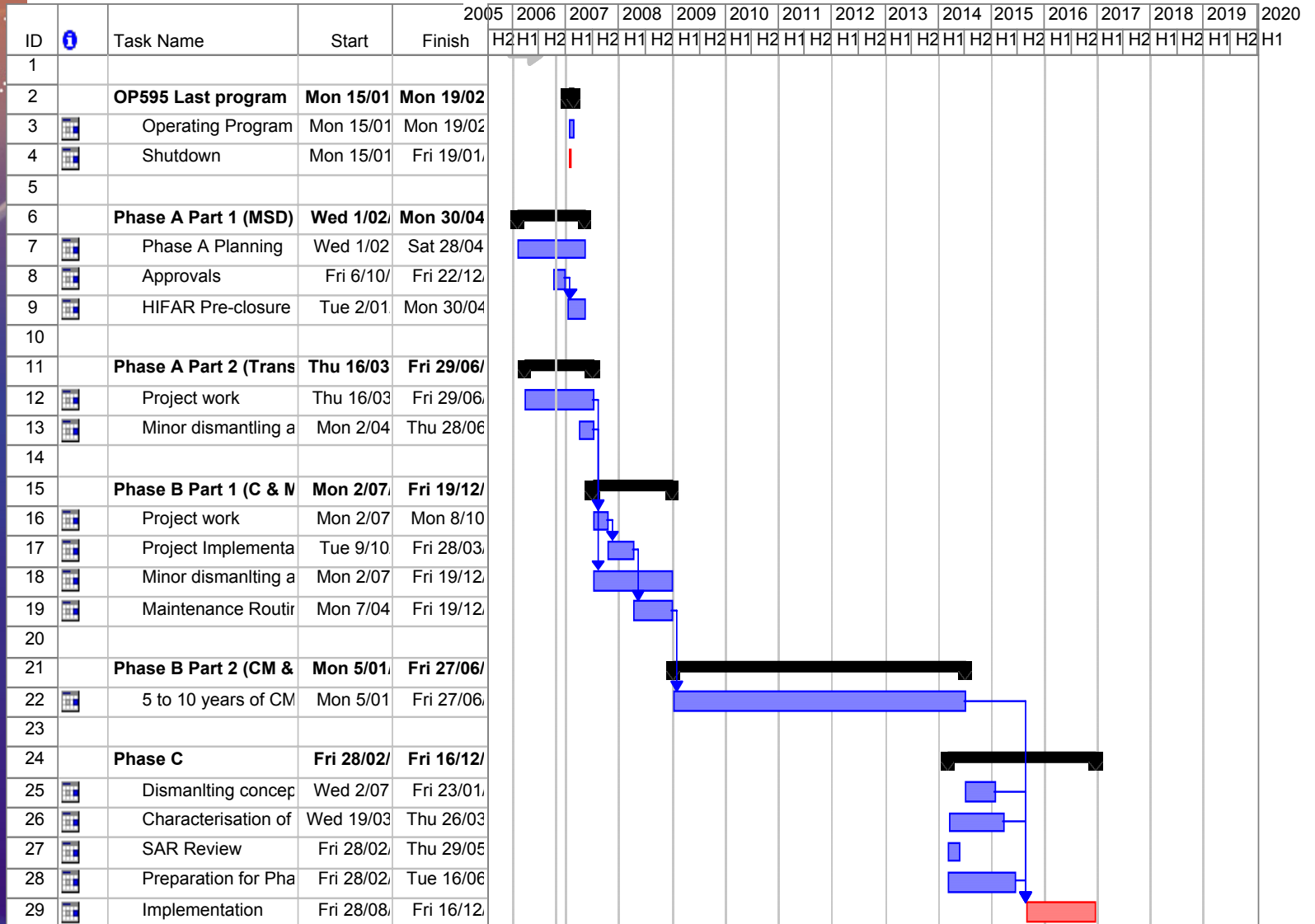
- **Site Requirements for Decommissioning**
- **Collect old operating information**
- **Learn decommissioning experiences from other countries (IAEA & NEA)**
- **Liaise with other groups for decommissioning such as Regulator and Dept of Environment**
- **Planning for HIFAR Decommissioning**



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Closure and Decommissioning Plan





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Auxiliary Plant Room





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Compressors

Space Conditioning System



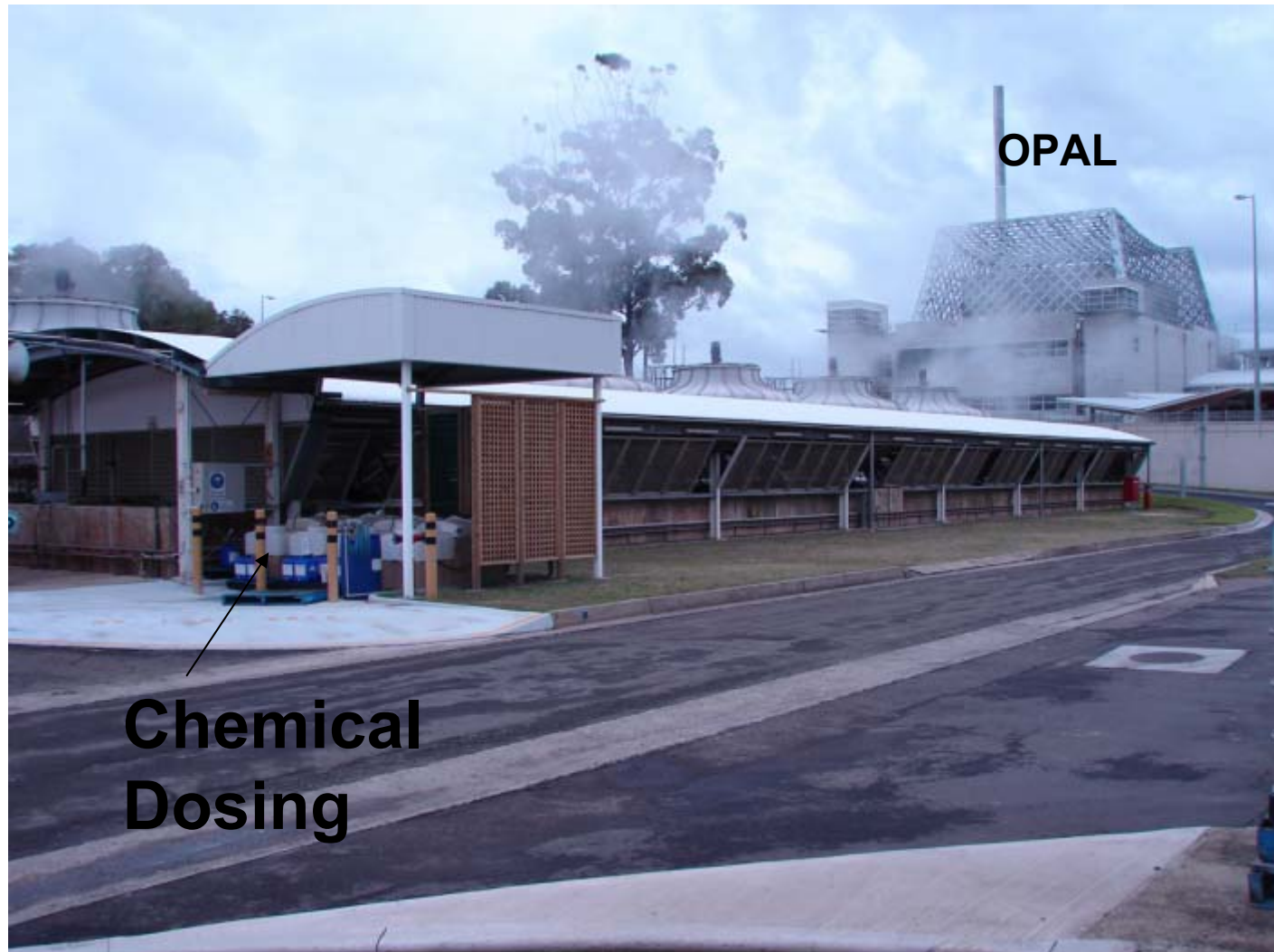
Evaporators



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Cooling Towers & Pond





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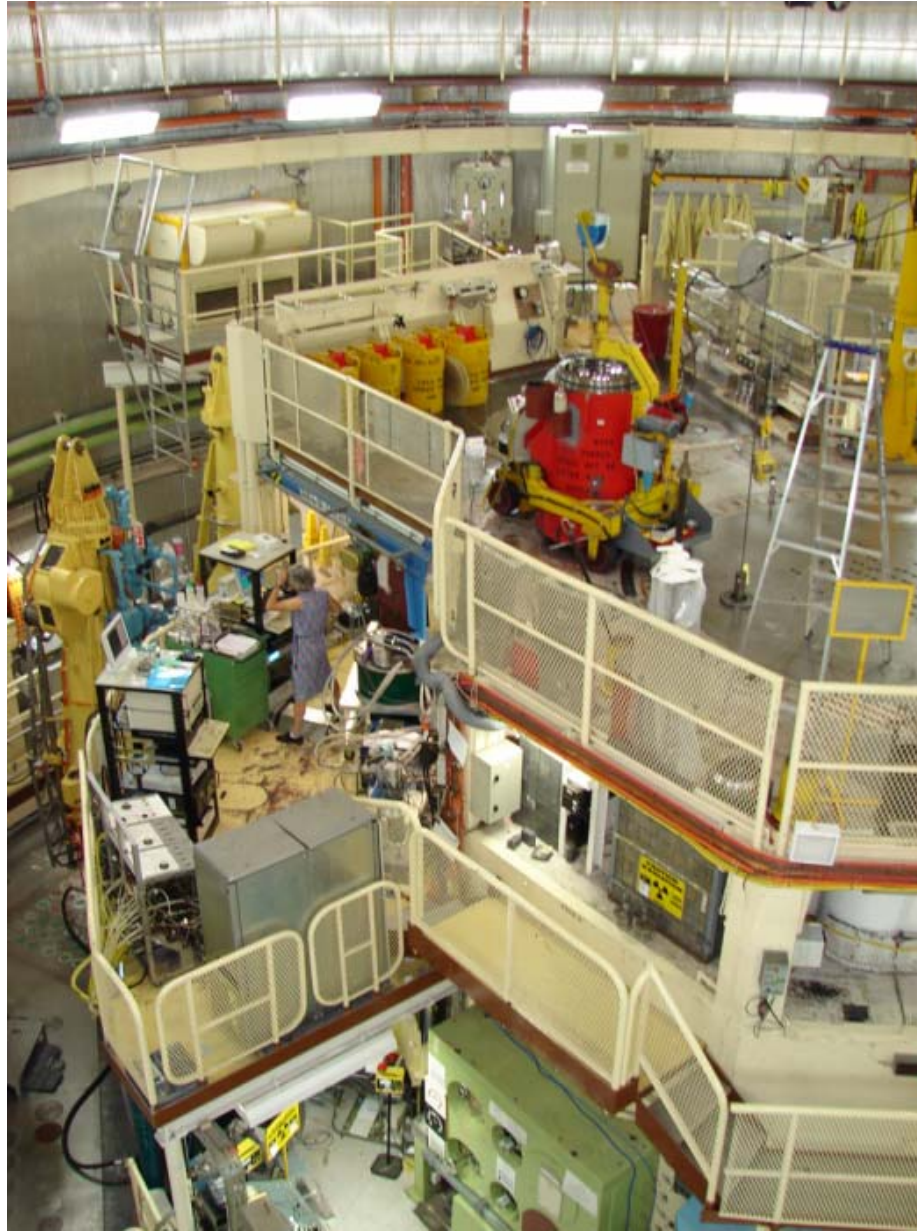
Cooling Water Pump House





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Active Extract System (to remain until decommissioning 2014+)





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For reactor and storage blocks remaining

- **Closure Team (20 to 25 people)**
- **Budget of \$10Mio AUD (est)**
- **Term (2 years) 2007 & 8**

Decommissioning 2014+

Budget of \$40 Mio AUD (est)

Decommissioning Team (20 people)

Data To greenfield site

UKAEA £23 million (act) (AUD \$57Mio)

Denmark DnK300million (est) (AUD \$50Mio)



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Questions?



RCB Before Painting, 24/4/01 [Pic#3]