Australian Government

Australian Nuclear Science & **Technology** Organisation

Cost Estimation, Funding for both HIFAR – MOATA Research Reactors

Presented by John Rowling
Manager / Facilities Management

Australian Government

ansto

INTRODUCTION

- Strategy & Approach
- Cost calculations
- Funding arrangement
  - Focusing of "TRANSITION"

There were 5 other reactors of similar design, UK (3), Denmark and Germany

Australian Government

ansto

Strategy and Approach

How to make up the costings?

- Labour team for the total project (Time & Cost)
- Particular Projects
- Map the Stages
- List the Activities
- Special Equipment requirements
- Contingency
- Neglect the cost savings (May not happen)

When?

Where is the origin of the funding?

Why – Justification?

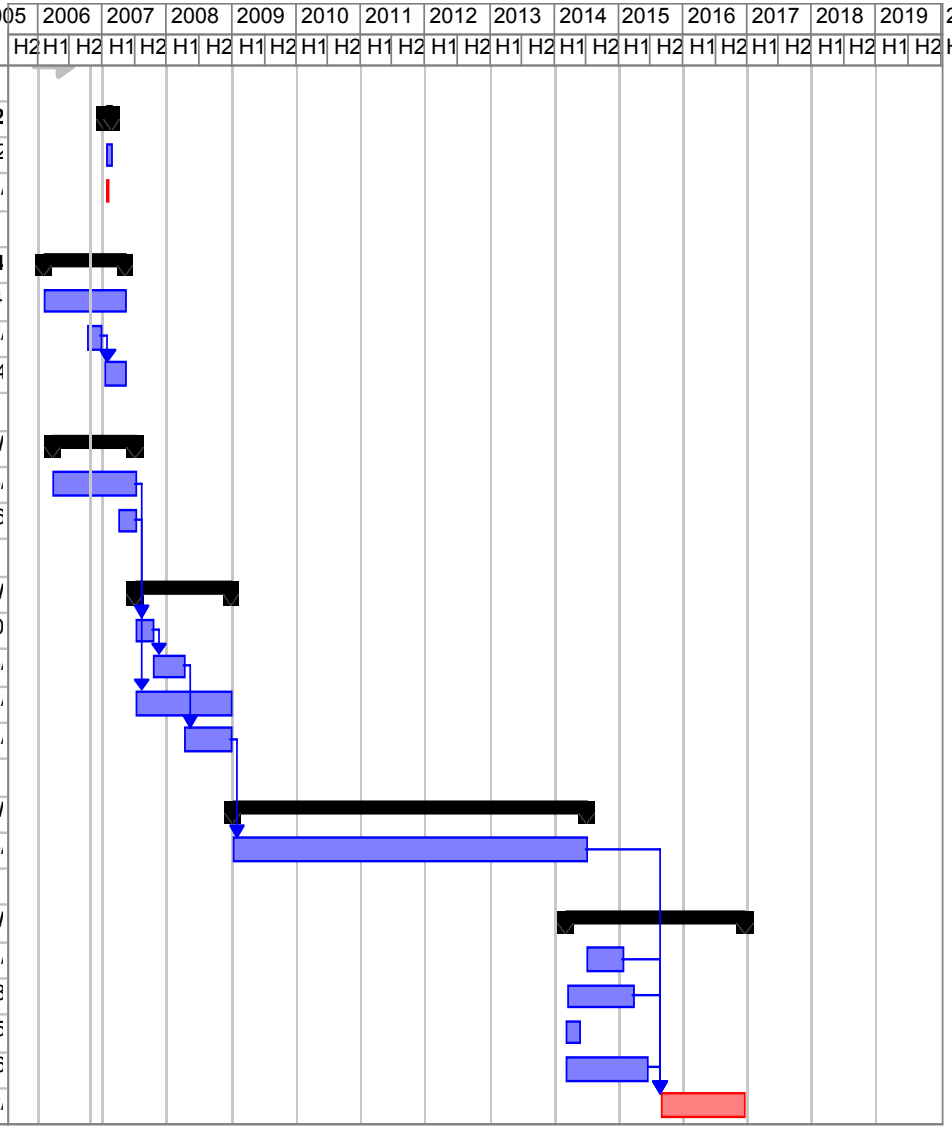
What is the process?

Closure and Decommissioning Plan

Australian Government

ansto

ID	Task Name	Start	Finish
1			
2	**OP595 Last program**	**Mon 15/01**	**Mon 19/02**
3	Operating Program	Mon 15/01	Mon 19/02
4	Shutdown	Mon 15/01	Fri 19/01
5			
6	**Phase A Part 1 (MSD)**	**Wed 1/02**	**Mon 30/04**
7	Phase A Planning	Wed 1/02	Sat 28/04
8	Approvals	Fri 6/10/	Fri 22/12
9	HIFAR Pre-closure	Tue 2/01	Mon 30/04
10			
11	**Phase A Part 2 (Trans**	**Thu 16/03**	**Fri 29/06/**
12	Project work	Thu 16/03	Fri 29/06
13	Minor dismantling a	Mon 2/04	Thu 28/06
14			
15	**Phase B Part 1 (C & M**	**Mon 2/07**	**Fri 19/12/**
16	Project work	Mon 2/07	Mon 8/10
17	Project Implementa	Tue 9/10	Fri 28/03
18	Minor dismanlting a	Mon 2/07	Fri 19/12
19	Maintenance Routir	Mon 7/04	Fri 19/12
20			
21	**Phase B Part 2 (CM &**	**Mon 5/01**	**Fri 27/06/**
22	5 to 10 years of CM	Mon 5/01	Fri 27/06
23			
24	**Phase C**	**Fri 28/02/**	**Fri 16/12/**
25	Dismanlting concep	Wed 2/07	Fri 23/01
26	Characterisation of	Wed 19/03	Thu 26/03
27	SAR Review	Fri 28/02	Thu 29/05
28	Preparation for Pha	Fri 28/02	Tue 16/06
29	Implementation	Fri 28/08	Fri 16/12



HIFAR Decommissioning Team

Project Manager

- Planner
- 2 Engineers
- 2 Contractor Engineers
- 2 Operators (1 Trainer)
- Active Handling Supervisor
- 4 Active Handlers (Labouring)
- 1 QA & Document person
- 2 Health Physics Surveyors
- 2 Maintenance Staff (Mechanical & Electrical p/t)

Team of 20 staff

Australian Government

ansto

Major Decommissioning Projects

- Electrical Distribution Board
- Active Ventilation & HVAC Systems
- Security & Access System
- Communication System
- Lighting System
- Fire Alarm System
- Radiation Instrumentation
- Monitoring System

HIFAR Shell (Non nuclear)

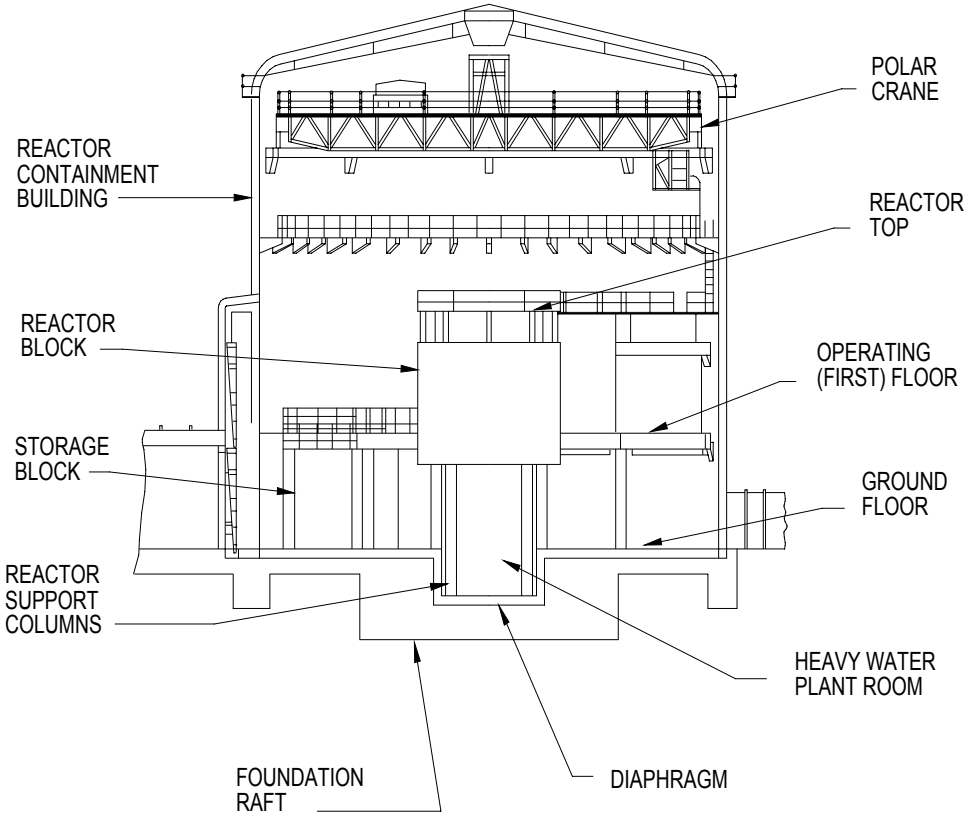


FIGURE 1.1-2 REACTOR STRUCTURE

- Strip out all electrical & Instrumentation wiring
- Strip out all light water pipework
- Install AC
- Remove SCS & ductwork
- Removal all non-active material

HIFAR Shell (Nuclear)

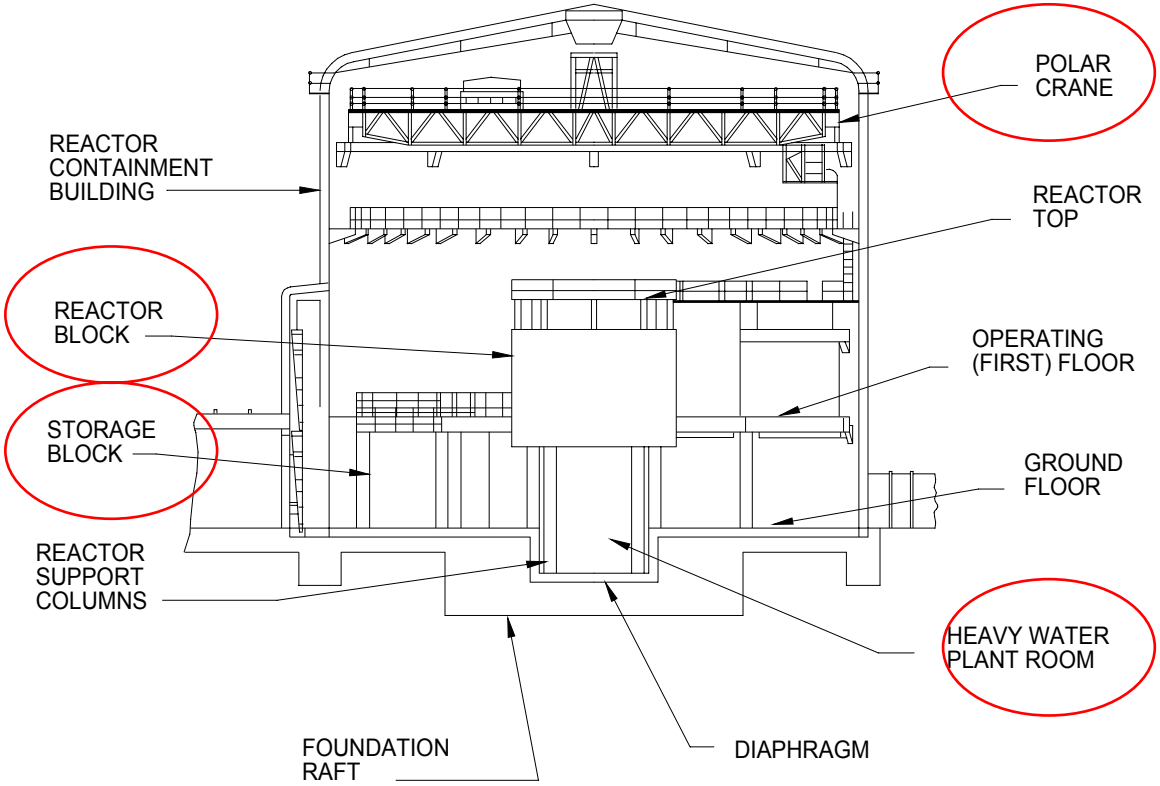
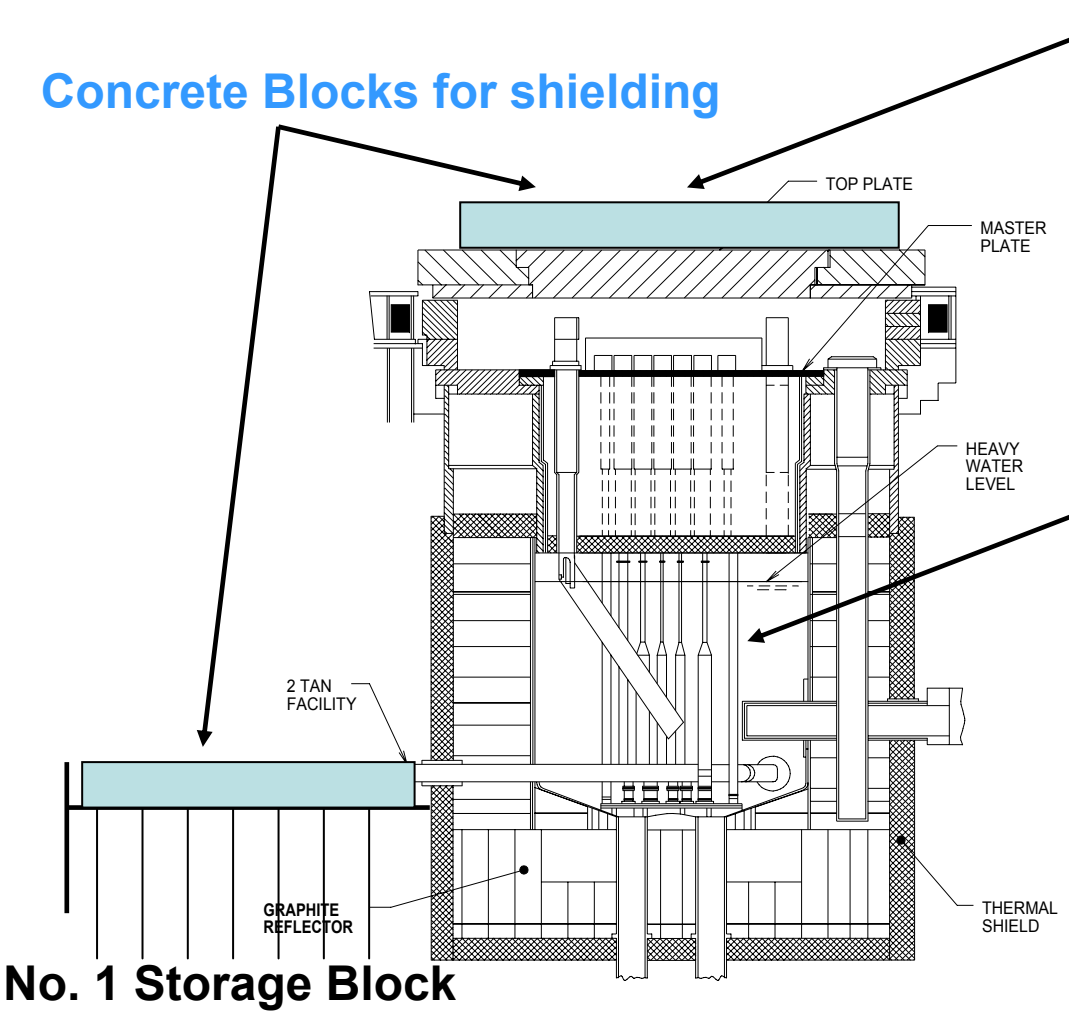


FIGURE 1.1-2 REACTOR STRUCTURE

- **Strip out all Helium circuit pipework (02 cct)**
- **Strip out all small heavy water pipework (01 cct)**
- **Removal all pumps**
- **Maintain Active extract system**
- **Maintain Crane**
- **Cover top plate and storage block**

DIDO / UK



Less than 1uSv/hr

All fuel, CCA's, D_2O and Safety Rods removed.

NOTE: Some horizontal and vertical rigs still in pile.

Just too hot or jammed.

Australian Government

ansto

Transitioning

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

Decommissioning 2014+

- Budget of $40 Mio AUD (est)
- Decommissioning Team (20 people)

Australian Government

ansto

Data To Other Similar Reactors

UKAEA £23 million (act) (AUD $57Mio)

Denmark DnK300million (est) (AUD $50Mio)

Dismantling Plan & Estimates

Phase 1: Preparation	**Phase 2: Dismantling (Ref 4.1.2)**	**Phase 3: Post Dismantling**
Duration: **9 months (50% effort)** Cost: **$900K + 10% contingency** **Procedures:** •Prepare project plans & procedures •Procure resources, contractors, etc. •Survey radiation (non-destructive) •Update characterisation •Update radioactive inventory lists •Prepare Env. Impact Studies (EIS) •Obtain approval (the EPBC Act) •Revise project cost estimate •Prepare submissions (SAC, etc.) •Obtain ARPANSA approval	Duration: **3 months (100% effort)** Cost: **$2,000K + 10% contingency** **Procedures:** •Survey radiation (core sampling) •Establish boundary of active zones •Set up temporary containment •Set up active ventilation & control •Remove detachable components •Remove metal core components •Remove fuel storage pits •Drill 80 holes into non-active zone •Fill holes with 'expanding grout' •Control dust with recycled water •Jack-hammer non-active zones •Contain & demolish active zone •Segregate waste into LLW & ILW •Truck Free-Release waste to the tip •Contain and seal LLW and ILW	Duration: **6 months (50% effort)** Cost: **$900K+ 10% contingency** **Procedures:** •Carry out final surveys •Validate 'greenfield' status •Make good the site •Hand over active waste for storage •Submit for de-licensing •Hand over the site: unrestricted use •Complete documentation •Review and close the project

ARGONAUT Reactors

Reactor	Power	Dismantled	Contractor	Cost (Approx.)
Virginia P, USA	100 kW	1988		US$0.6M
UCLA R1, USA	100 kW	1992	NES Inc.*	US$1.7M
THAR, Taiwan	10 kW	1993		US$0.5M
The Universities Research Reactor, Risley, UK	300 kW	1996	BNFL	£4M comprising; •£2M (dismantling) •£1M (waste) •£1M (fuel removal)
JASON Reactor*, Greenwich, UK	10 kW	6/1999 Visited by S. Kim, ANSTO [Ref 4.1.3]	AEA Tech.*	£7M comprising; •£2M (management) •£2M (dismantling) •£1M (waste) •£2M (fuel removal)
University of Washington*, USA	100 kW	Delayed	NES Inc.*	US$1.7M ('94 value) plus US$0.5M for decontaminating spills
Iowa State University*, USA	10 kW	8/2000 Observed & assisted by S. Kim, [Ref 4.1.2]	Duke Eng. & Services*	US$1M comprising; •US$0.2M – Planning •US$0.6M – Dismantling •US$0.2M – Final survey
Moata	100 kW	Proposed 2008/9		*Estimated (See ER111484)* (a)ANSTO: **$3.8M**+ (b)DES: US$2M+** (c)NES: US$3M+** (d)AEA Tech.: £5M

Project Planning (1 of 2)

- Breakdown the work into stages or phases
- Breakdown the stages into activities

1.1 Pre-decommissioning Stage

1.2 Decommissioning Planning

1.3 Authorisation

  - Licensing
  - SAR

2.1 Shutdown Stage

  - Plant Shutdown
  - Fuel Removal
  - Heavy Water Drainage

Australian Government

ansto

Project Planning (2 of 2)

3.1 Project Stage

4.1 Dismantling Stage

4.2 Decontamination of Equipment

5.1 Safe Enclosure Stage

- Demolition of Associated Buildings
- Removal of unnecessary Structures

6.1 Decommissioning Stage

6.2 Dismantling of operating Equipment

- Primary & secondary circuits
- Redundant Pumps and Pipework

6.3 Dismantling of Reactor Block & Building

Australian Government

ansto

WASTE VOLUMES

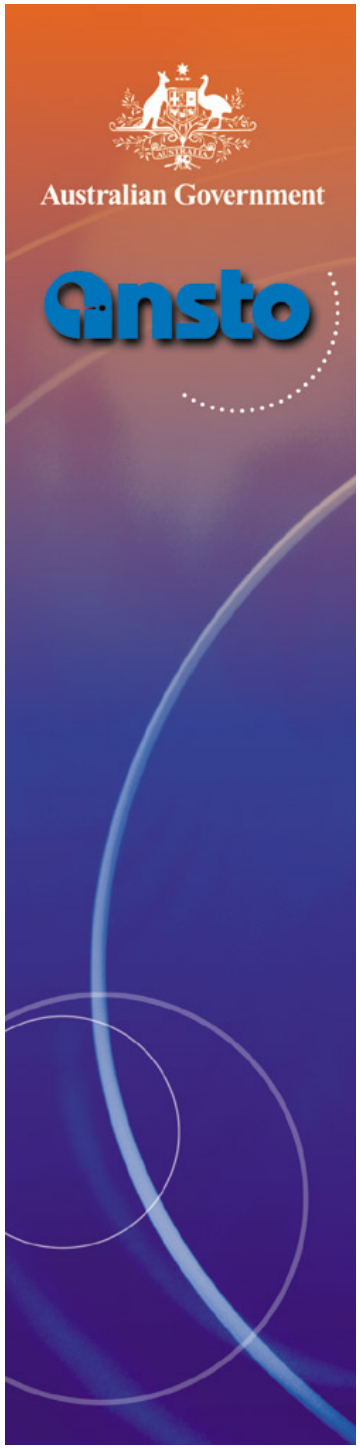
Description of Item / Building / Facility / Equipment / Plant	Estimated Value of D & R Incl. Transport of Waste (Items 1 to 8)	Estimated weight	Estimated Volume	Cost/ m3	Estimated Cost of Disposal charges only	Expected Date of D & R	Notes
	$	tonne	m^3		$		
Nuclear							
- HIFAR and ancillary Buildings	$ 50,180,000	1000	500	**$ 4,000**	**$ 2,000,000**	2007 to 2020	Three stage decommissioning process to a greenfield site.
- Moata	$ 5,805,093	60	120	**$ 4,000**	**$ 480,000**	2012	Decommissioning costs based on US experience for similar reactor.

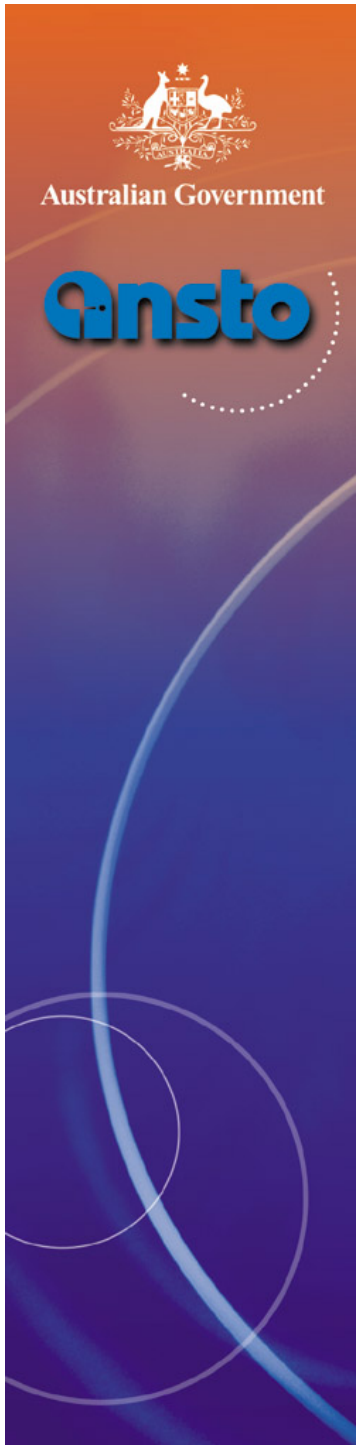
Australian Government

Ansto

Questions?

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


Australian Government
ansto


Australian Government
ansto