RELOCATION OF A RESEARCH REACTOR

S. Fabbri – H. Blaumann – G. Vega – R. Versaci

National Commission of Atomic Energy
ARGENTINA

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Introduction

- **Name:** RA-8 (critical facility)
- **Reactor:** pool type
- **Moderator:** light water
- **Fuel:** enriched uranium
- **Thermal power:** maximum 100W, nominal 10W
- **First time critical:** June 1997
- **Out of operation:** March 1999
- **Area:** 200 m^2 (reactor building + control room)
- **Location:** Pilcaniyeu Technological Centre (PTC), Río Negro province, 70 km East from Bariloche city.

ARGENTINA

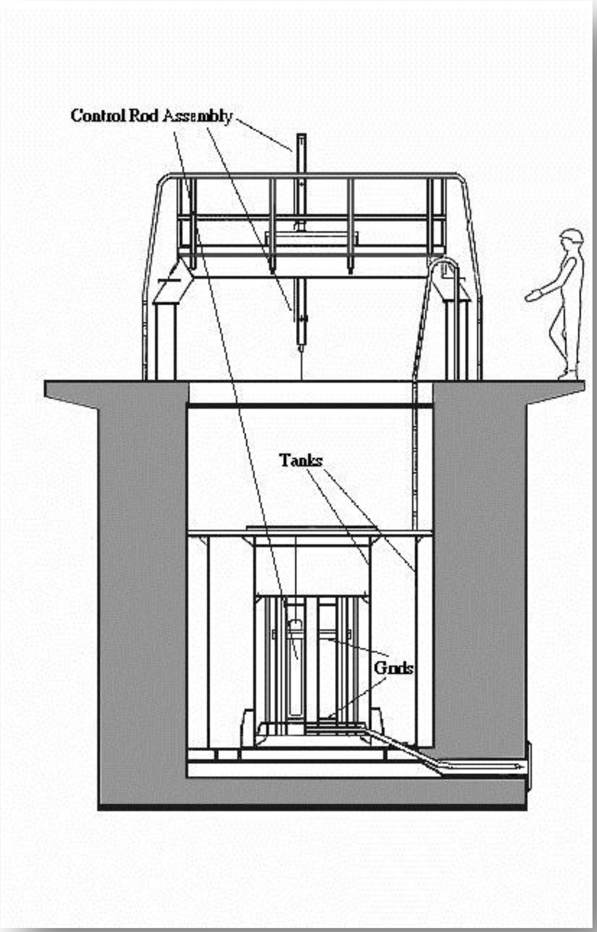
- Surface: 2,7 millions km²
- Population: 39 millions
- 6 RRs in operation
- 2 NPPs → 5 % total energy
- 1 NPP under construction
- 1 NPP under study
- 1 prototype reactor under construction
- 1 multipurpose reactor under study

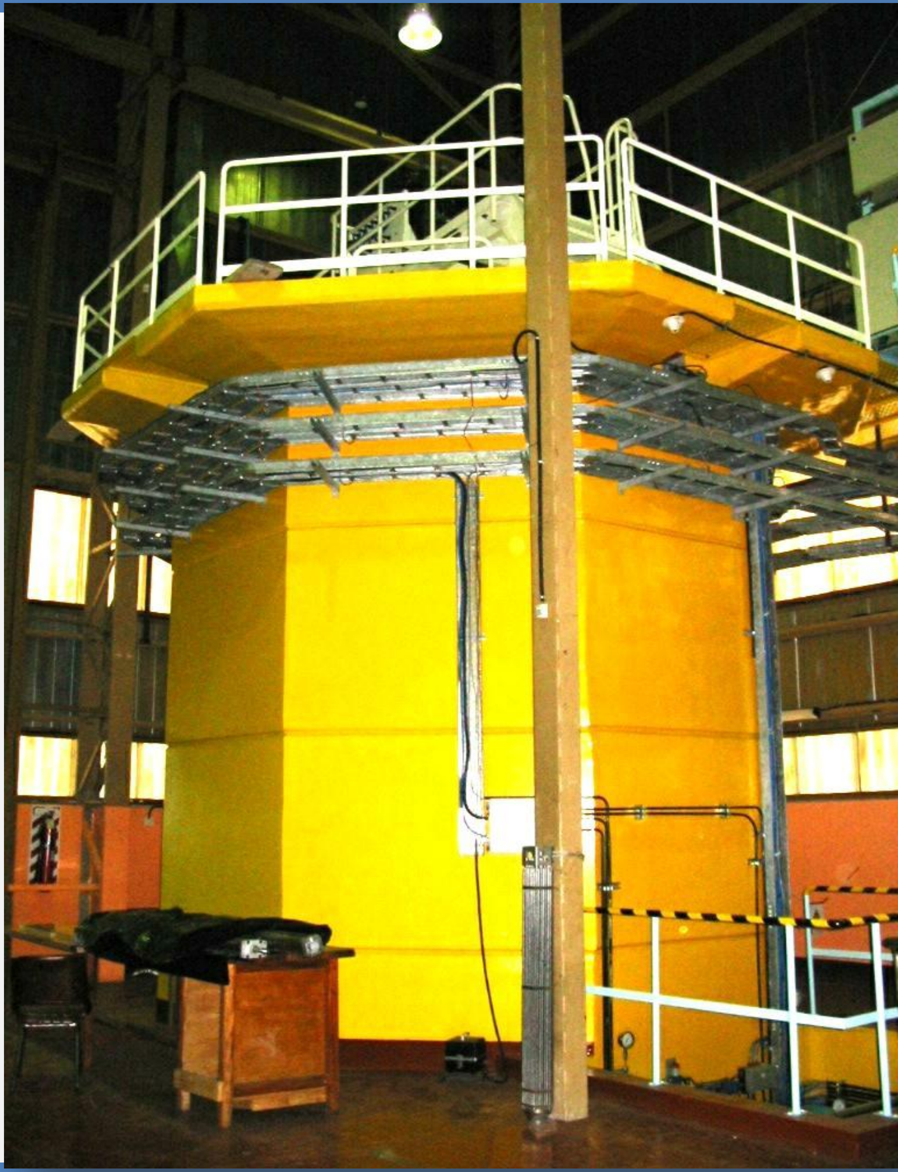
RA-8
PILCANIYEU

Pilacaniyeu Technological Centre

RA-8 reactor

RA-8 reactor





RA - 8

Why relocation ?

To reduce costs, time and difficulties in the transport of personnel (operators, researcher, students) to Pilcaniyeu allowing the performance of nuclear research as well as academic application.

Scope

Technical and economical feasibility for the disassembly and transport from Pilcaniyeu Technological Centre (PTC) to Bariloche Atomic Centre (BAC).

Licensing and Regulatory Issues

- Compliance with regulatory requirements
- Modification of operating license
- Transport the fuel elements and neutron source to Bariloche Atomic Centre
- Radiological Characterization Plan
- Radiological Protection Plan
- Disassembly the control room desk and cables
- Address any issues

Technical Feasibility

❖ Radiological Characterization (RC) of the facility

RC will provide a database of information including:

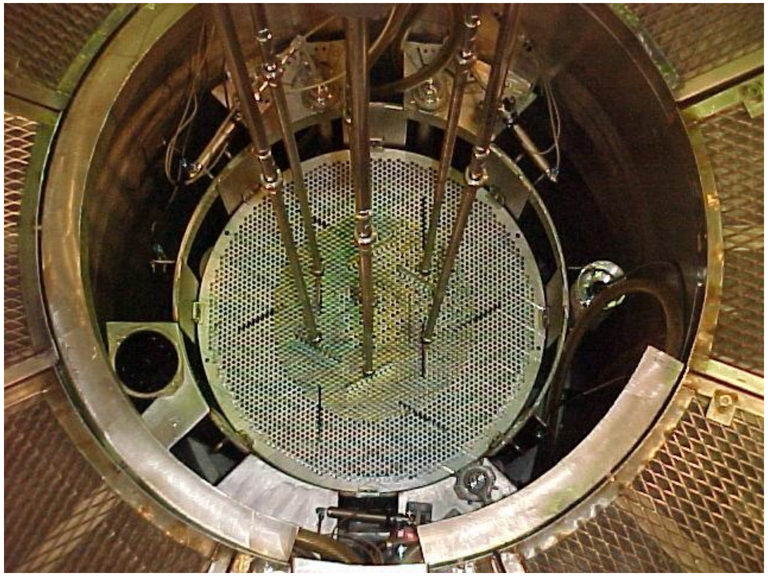
- Quantity and type of radionuclides
- Distribution of contaminants in the areas
- Physical and chemical state of contaminants
- Decontamination plan

"Nothing detectable was found in water samples from pipes of the pumps' well".

❖ Visual Inspection of Systems, Structures and Components (SSCs)

- SSCs present in general good condition of preservation that would allow and justify its operation in another site.
- No external degradation was observed.
- Components that were assayed worked correctly.

Technical Feasibility



Reactor Core

Control Room

Pumps' Well

Technical Feasibility

Reactor Staircase

Bridge Crane

Neutron Source

Reactor Discharge Valves

Reactor Mechanisms

Technical Feasibility

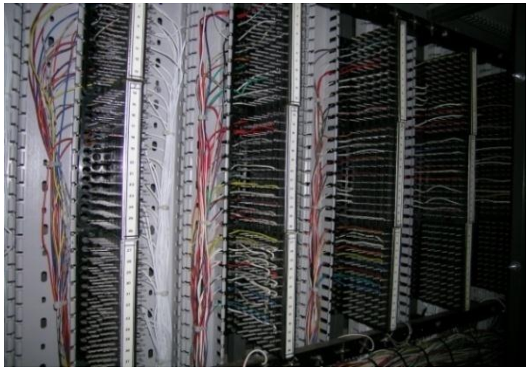
❖ Disassembly Plan (DP)

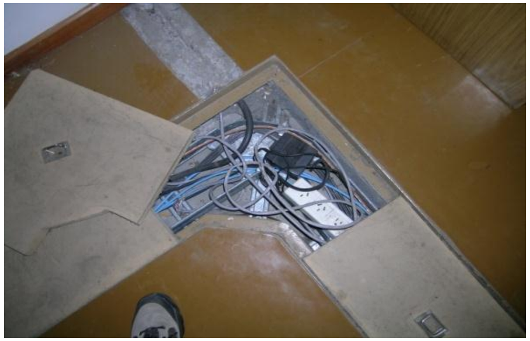
- Preparation of supporting documents: working plan, mechanical and electrical/electronic disassembly procedures, work instructions, quality assurance plan, etc.
- Structures and systems description
- Staff and manpower requirements
- Heavy equipment and small tools purchase
- Facility and site preparations
- Identify modifications to the SSCs necessary for disassembly
- Proposed disassembly activities and schedule (no demolition)
- Waste management plan
- Use of contractors
- Facility release and reporting

"DP should be consistent with regulatory requirements and is the key document needed "

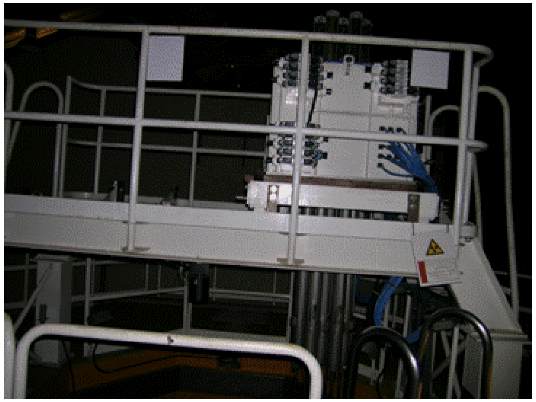
Technical Feasibility

❖ Critical issues in DP





- 23000 electrical ending of wiring connections
- Identification of origin and destine of each connection
- Limited space for personnel
- Limited space for scaffoldings and tools
- Difficult to perform tasks in parallel
- Sequence of activities should be precise



Technical Feasibility

❖ **Packaging**

- Preparation of all the documents
- Appropriates containers to avoid damage during transport
- Right identification for the reassemble (electrical connexions)
- Clean environmental conditions

❖ **Transport**

- Route/road plan must be done prior the first trip
- Get the approvals and permits from the local authorities
- Take in account the climate factor
- 5 trips estimated from PTC to BAC
- In accordance with regulatory transportation requirements

❖ **Storage and conservation in BAC**

- Necessary indoor area = 160 m^2
- Height $\geq$ 8 m
- Appropriated environmental conditions inside the building

Inventory of SSCs for Disassembly and Transport

RA-8	Mass (kg)
Cables (10 km)	4000
Pipes and valves	500
Bridge crane and structures	7600
Electrical switchboards and racks	6000
Control room equipment	600
Cable trays	3500
Heaters and pipes	600
Compressor, pumps and electrical engines	600
Reactor vessel	4500
Reactor internals components	1200
Neutron source	300
Control rods and mechanisms	1400
Monorail	700
Water tanks	300
Structures and platforms	1100
Others	1000
TOTAL	~ 34000

Economical Feasibility

Estimated Execution Time

20.000 man-hours

minimum 9 months

Major factors affecting time: distance, dirt road and the winter.

Estimated Costs

~ 1 million US dollar

Major factors affecting costs: planning and documentation, man power, tools and equipments purchase, packaging, containers, transport, contractors and insurances.

"Relocation costs depend on the complexity of the facility, its physical and radiological inventory, transport, distance and local factors"

Conclusions

- *The SSCs present in general a good condition of preservation that would allow and justify its operation in another site.*

- *No external degradation was observed in inspected components, and those that were essayed worked correctly.*

- *Absence of contamination and/or activation facilitates the disassembly and transport of the reactor.*

- *The total mass was calculated in approximately 34 t that could be transported in 5 trips from PTC to the BAC.*

- *A minimum period of 9 months was estimated for the accomplishment of the project.*

- *Around a million U.S. dollar was the total cost estimated for disassembly and transport the RA-8 from PTC to BAC.*

Record of Research Reactors Relocated (IAEA TRS-446)

Country	Reactor	Type	Thermal power	Operation	Transfer to	Operation
France	Aquilon	Heavy water	0,1 kW	1956-1967	Italy	1971-1989
Great Britain	Nero	Critical Facility	0 kW	1959-1960	Winfrith GB	1960-1963
Great Britain	ZETR	Homogeneous	0 kW	1952-1957	Dounreay GB	1957-1958
USA	CP-11 Reactor	Argonaut	10 kW	1957-1972	Taiwán	1974-1991
USA	AGN-201 Argonne	Homogeneous	0 kW	1957-1972	Menphis University USA	1977-1985
USA	CWRR-Curtiss-Wright	Pool	1 MW	1958-1959	Pennsylvania USA	1960-1971
USA	Susie	Pool	2 kW	1961-1961	Sandia USA	1965-1966
Puerto Rico	Triga Puerto Rico	Triga	2 MW	1960-1976	USA	1977-1989
USA	Univ. of Akron	Homogeneous	0 kW	1957-1967	Georgia Tech. USA	1967-1967
USA	Univ. of California	Homogeneous	0 kW	1957-1966	Nuevo México University. USA	1966-1966
USA	U.S Naval P.G School	Homogeneous	0 kW	1957-1971	California University USA	1971-1972
USA	U.S. Navy Hospital	Homogeneous	0,005 kW	1957-1962	Poly Inst. NY. USA	1962-1965

Many Thanks