NPP PROJECT ATUCHA II - ARGENTINE
(Current situation May 2008)

LAS/ANS SYMPOSIUM 2008
Reactivation of Nuclear Power Plants Construction in Latin America

16-20 June 2008
Rio de Janeiro, Brazil

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CONTENT

- General overview
- The original Project
- Life Cycle of Atucha II
- The Project today
- Annex: Atucha II General Description

Panoramic view of Atucha I and II site

THE ORIGINAL PROJECT

PHWR NPP 745 MWe (gross) - 692 MWe (net)

- **Signature of Contracts:** **May 9 - 1980**
- **Parties:** **CNEA/KWU**
- **Construction Period:** **7 years**
- **Cost estimation:** **U$S 1800 MM**

First of a program of 4 NPP's

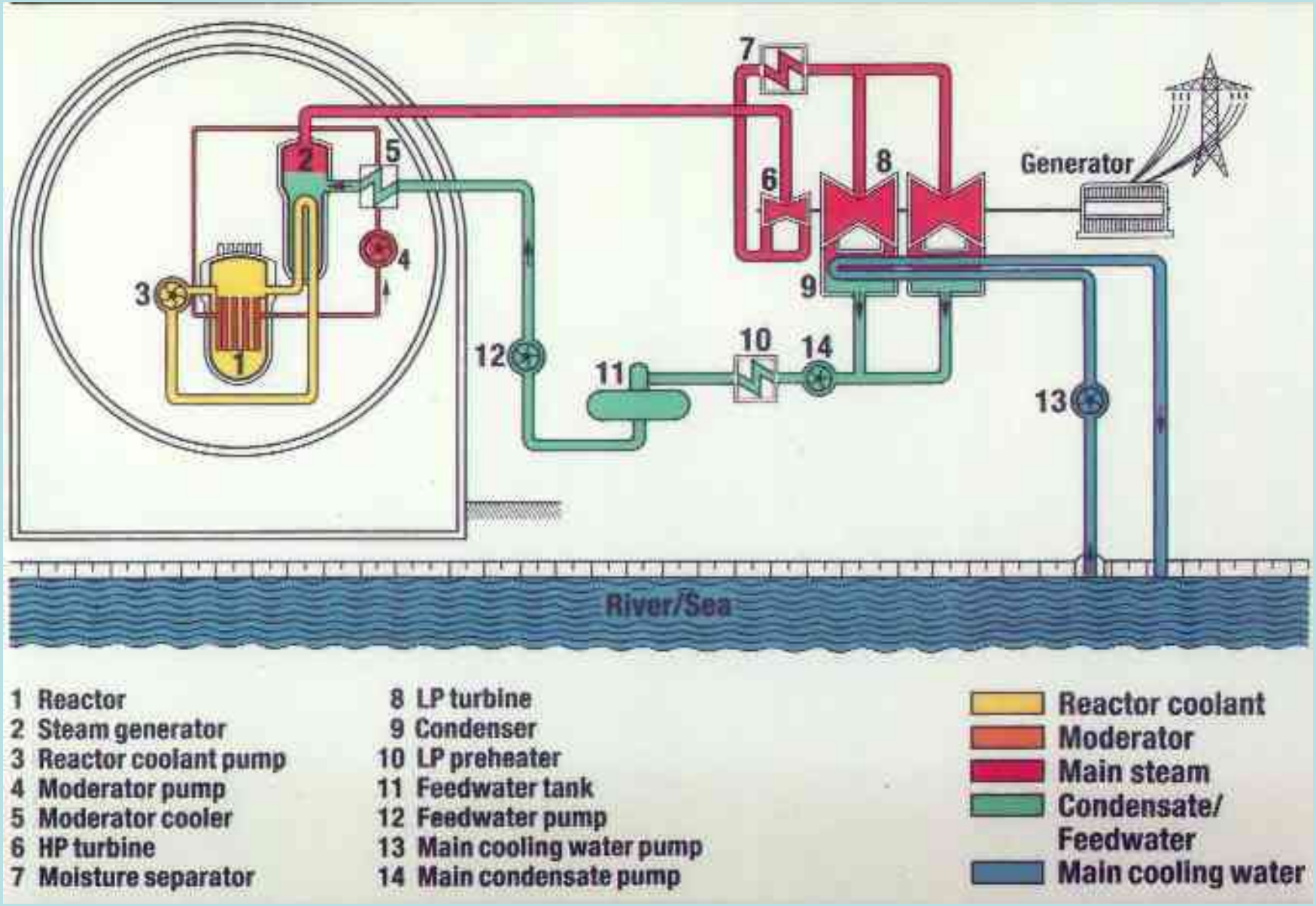
THE ORIGINAL PROJECT

Siemens-KWU Main Contracts (Not Turn Key):

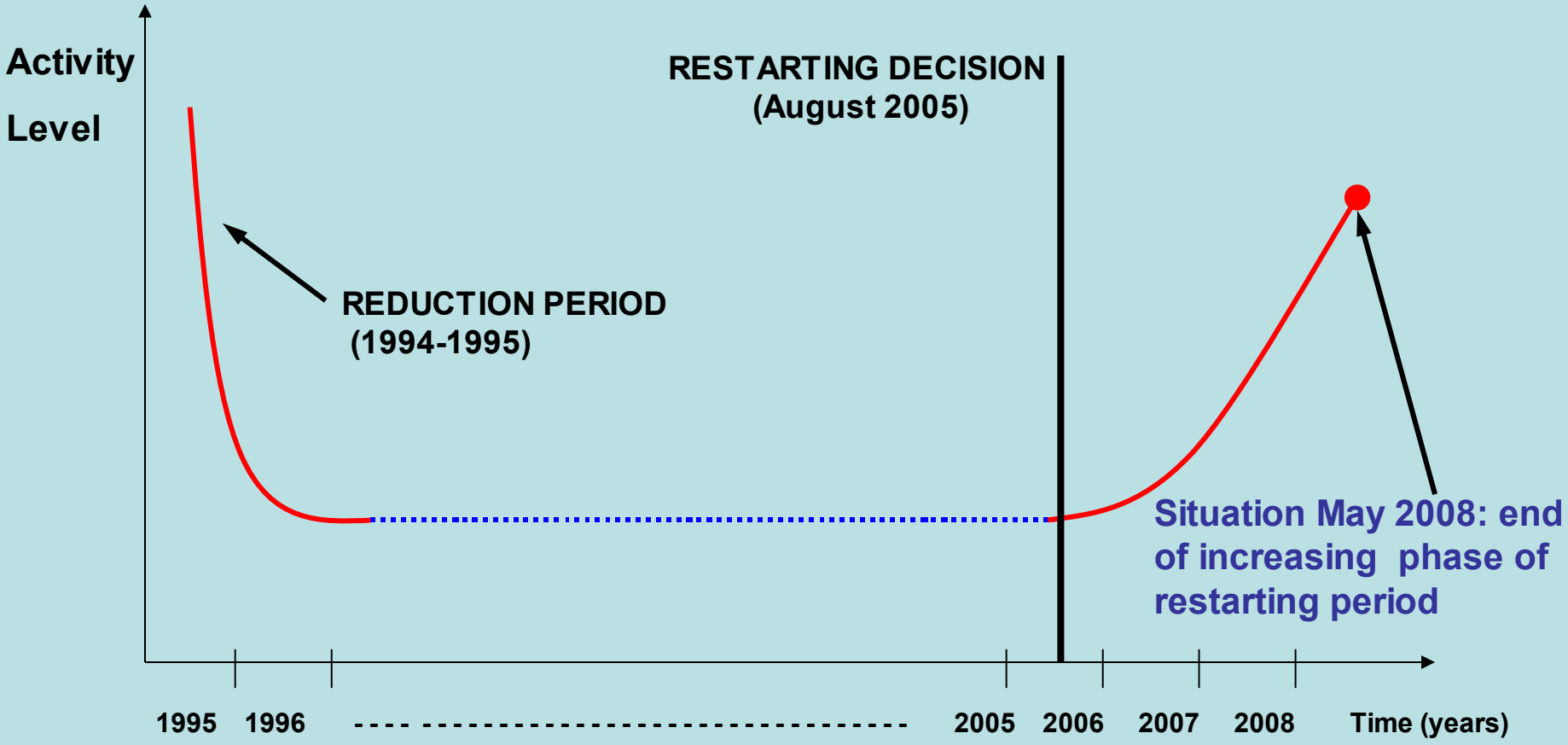
- **Supplies**
- **Services**
- **Warranties**
- **Transfer of technology**
- **Fuel design**

Jointly Owned Co. (ENACE) = Architect-Engineer

SIMPLIFIED FLOW DIAGRAM



LIFE CICLE OF ATUCHA II



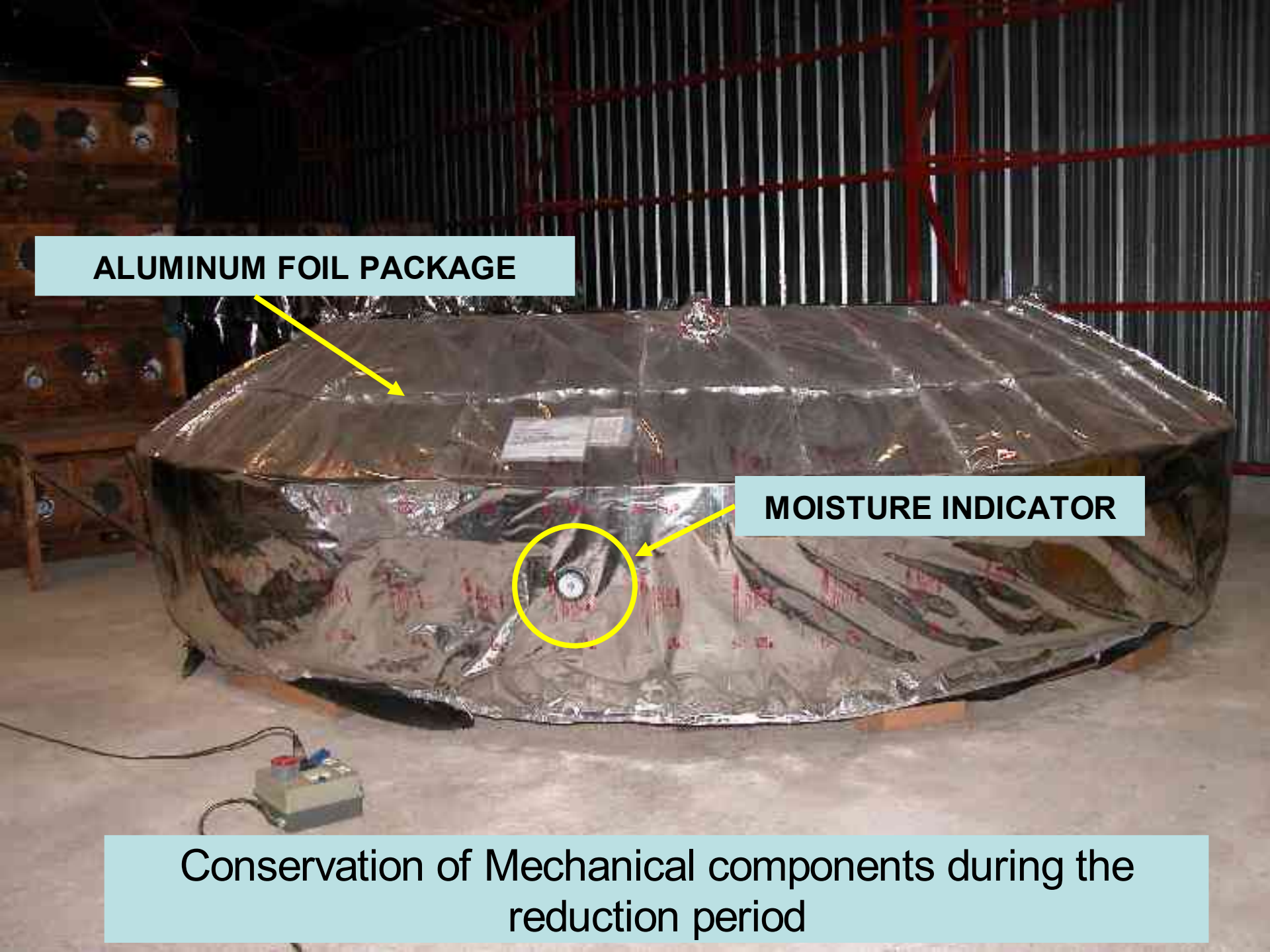
COMPLETION OF ATUCHA II

Why?

- **Argentine needs to re-balance energy source matrix (demand is growing and natural gas restrictions)**
- **Cost of fossil fuels**
- **CO2 emissions**
- **Decision to continue with NPP's**

PROGRESS STATUS AT THE MOMENT OF RESTARTING THE PROJECT

ITEM	PERCENTAGE INCIDENCE	ITEM PROGRESS	GLOBAL ADVANCE
	%	%	%
CIVIL WORKS	10,43	83	9
LOCAL SUPPLIES	8,92	91	8
IMPORTED SUPPLIES	38,00	96	36
LOCAL SERVICES	25,79	54	14
FOREIGN SERVICES	16,86	84	14
TOTAL	100		81



Conservation of Mechanical components during the reduction period

THE PROJECT TODAY

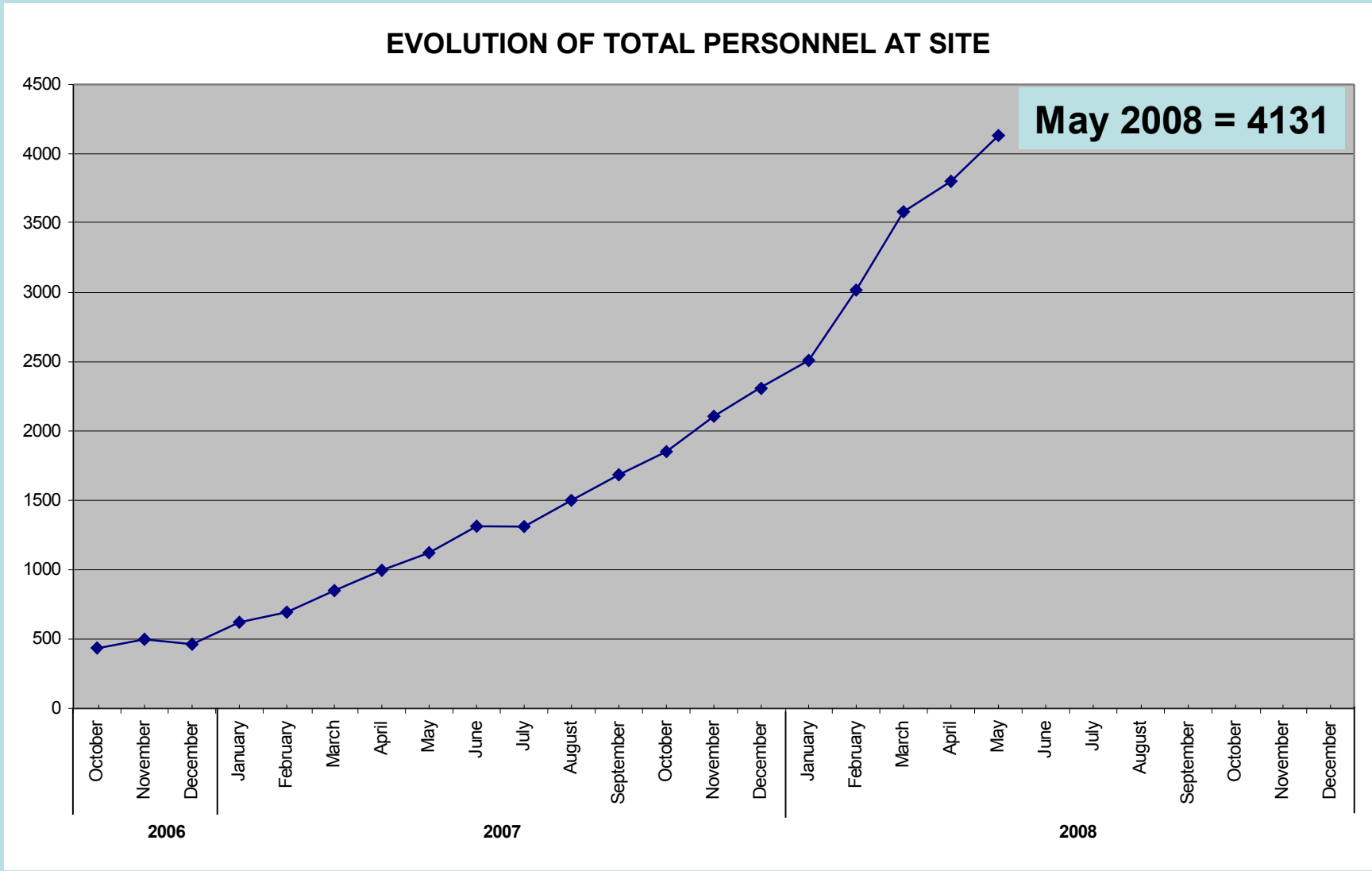
Siemens-KWU: 1980 Main Contracts cancelled by mutual agreement. New Memorandum of Understanding signed on July 14, 2006:

- **Delivery of all Project documents, including basic design and IP**
- **Final reception of former supplies and services**
- **Performance Guarantees for the Plant (Net output and heat rate)**
- **Siemens full support for conventional sector of NPP**
- **Assistance for obtaining some AREVA services**

NASA fully responsible (as originally not Turn Key) for completion of Project

PROJECT MILESTONES

AGREEMENT WITH SIEMENS 2006	July
RESTARTING CIVIL WORKS 2006	November
RESTARTING E. M. ERECTION 2007	July
PRIMARY SYSTEM PRESSURE TEST	July 2009
FIRST CRITICALITY 2010	March
GRID CONNECTION December 2010	

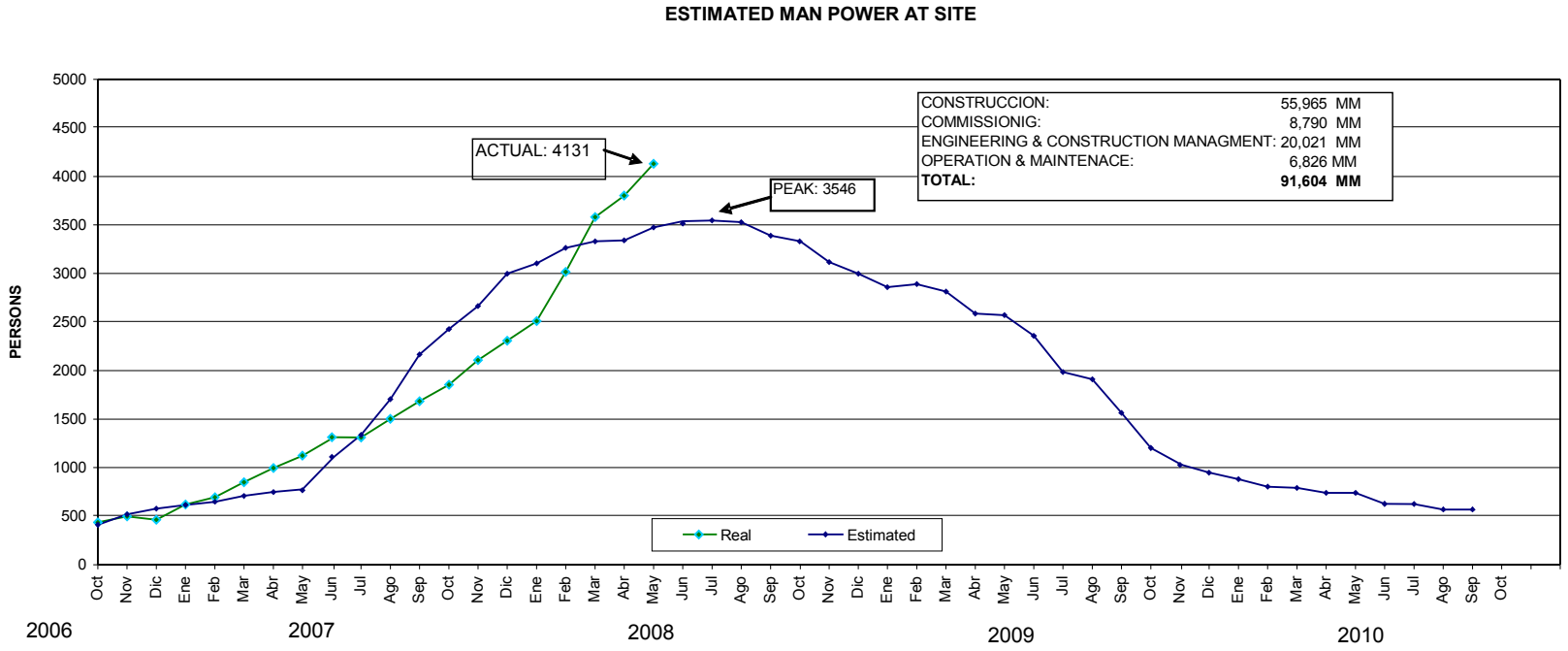

EVOLUTION OF TOTAL PERSONNEL AT SITE
May 2008 = 4131
4500
4000
3500
3000
2500
2000
1500
1000
500
0
October
November
December
January
February
March
April
May
June
July
August
September
October
November
December
January
February
March
April
May
June
July
August
September
October
November
December
2006
2007
2008

EVOLUTION OF TOTAL PERSONNEL AT SITE

ATUCHA II NUCLEAR POWER PLANT

	2007												2008												2009												2010											
	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
	-4	-3	-2	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
MAIN MILESTONES							Restart Commissioning												Switchgear Ready for System Commissioning												500 kv Ready	Primary Pressure Test	First Warm Proof																	

Channels and Control Rods
Auxiliary Boiler
Disconnection Diesel CNA I
(PPP **Fuel Loading**
Controlled Area
First Criticallity
Hand Over Date 70%



TOTAL PER MONTH	219	253	314	358	412	519	577	616	649	709	750	768	1112	1337	1706	2166	2426	2665	2997	3103	3264	3332	3342	3476	3516	3546	3529	3390	3332	3118	2997	2859	2889	2816	2586	2570	2359	1986	1911	1565	1202	1028	949	882	804	792	741	739
	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic	Ene	Feb	Mar	Abr	May	Jun
							1						2						3						4																							
TOTAL PER MONTH				436	498	463	621	695	851	996	1124	1314	1311	1501	1685	1853	2108	2308	2510	3018	3582	3801	4131																										

Actual distribution of total personnel at site (End of May 2008)

Organization	Quantity
NASA (Project Management Organization)	337
CNEA (National Atomic Energy Commission)	76
ARN (Nuclear Regulatory Authority)	7
Sub Total	420
CONTRACTORS (Including Infrastructure)	3711
Total	4131

MAIN LICENSING AND ENGINEERING ACTIVITIES

- Licensing review and completion of related activities
- Preliminary Safety Analysis
- Thermal-hydraulic and neutronic calculations
- Experimental determinations
- Evaluation of future fuel strategy
- Fractomechanics updating and verification
- Safety systems response to LOCA review
- Stress analysis completion
- Design review and completion in certain areas
- Detailed engineering completion

MAIN CONSTRUCTION AND RELATED ACTIVITIES

- Recovery and development of local suppliers
- Civil Works
- Technical Revision of materials and components
- Electromechanical erection (Example piping)
- Integration of Analog and Digital I&C Systems
- 500 kV Switchyard
- Remaining supplies
- Heavy water production
- First fuel load fabrication
- Phase A commissioning
- Operation and maintenance

Program for Technical Revision of Electromechanical Components

Agreements and/or contracts were implemented up to now with the following suppliers and/or organizations in order to perform activities related with inspection and eventual refurbishment of stored and/or installed components:

- **Main Turbine and Generator (Siemens during assembly).**
- **Main Cranes (Pescarmona, Cesin, Bureau Veritas).**
- **Generator Leads (Siemens during assembly).**
- **Generator Load Breaker (ABB).**
- **Main Transformers (Siemens).**
- **Main Coolant Pumps (Andritz).**
- **Process Pumps and Compressors (Sterling, KSB).**
- **Valves (CCI-Sulzer-Herion, Tecnatom, MMA).**
- **Fire Dampers of ventilation systems (Trox).**
- **Nuclear I&C Hardware (AREVA).**
- **In-core instrumentation Hardware (CNEA).**
- **Conventional I&C Hardware (Siemens).**
- **Electrical Components (University of San Juan).**
- **Steam Generators (NASA pre-service group).**
- **Moderator Heat Exchangers (NASA pre-service group).**
- **Hydraulic Turbine (Pescarmona).**
- **Fuel Handling Components (AREVA, Noell).**
- **Filtering and cleaning systems for refrigeration service water (Lockwood during assembly).**
- **Elastic piping supports (Dinatecnica-Lisega).**

Important infrastructure of facilities, calibration lab and workshops were constructed in order to perform part of these activities. Availability of personnel from the suppliers is the most critical issue. Very good results were obtained up to now with mechanical components (most of discoveries were related with necessary changes of parts affected by ageing like gaskets, greases and lubricants).

Inspection of bearings of installed equipment is starting now, results not yet known.

Inspection of Main Turbine parts performed by Siemens

Supplier: Siemens (Germany)

Repeating load and functional tests of Main Crane in Turbine Building in order to evaluate actual performance

Supplier: Pescarmona (Argentine)

Inspection of Emergency Power Transformers performed by University of San Juan

Supplier: Trafo Union (Germany)

Inspection of Main Coolant Pumps performed by Andritz

Supplier: Andritz (Austria)

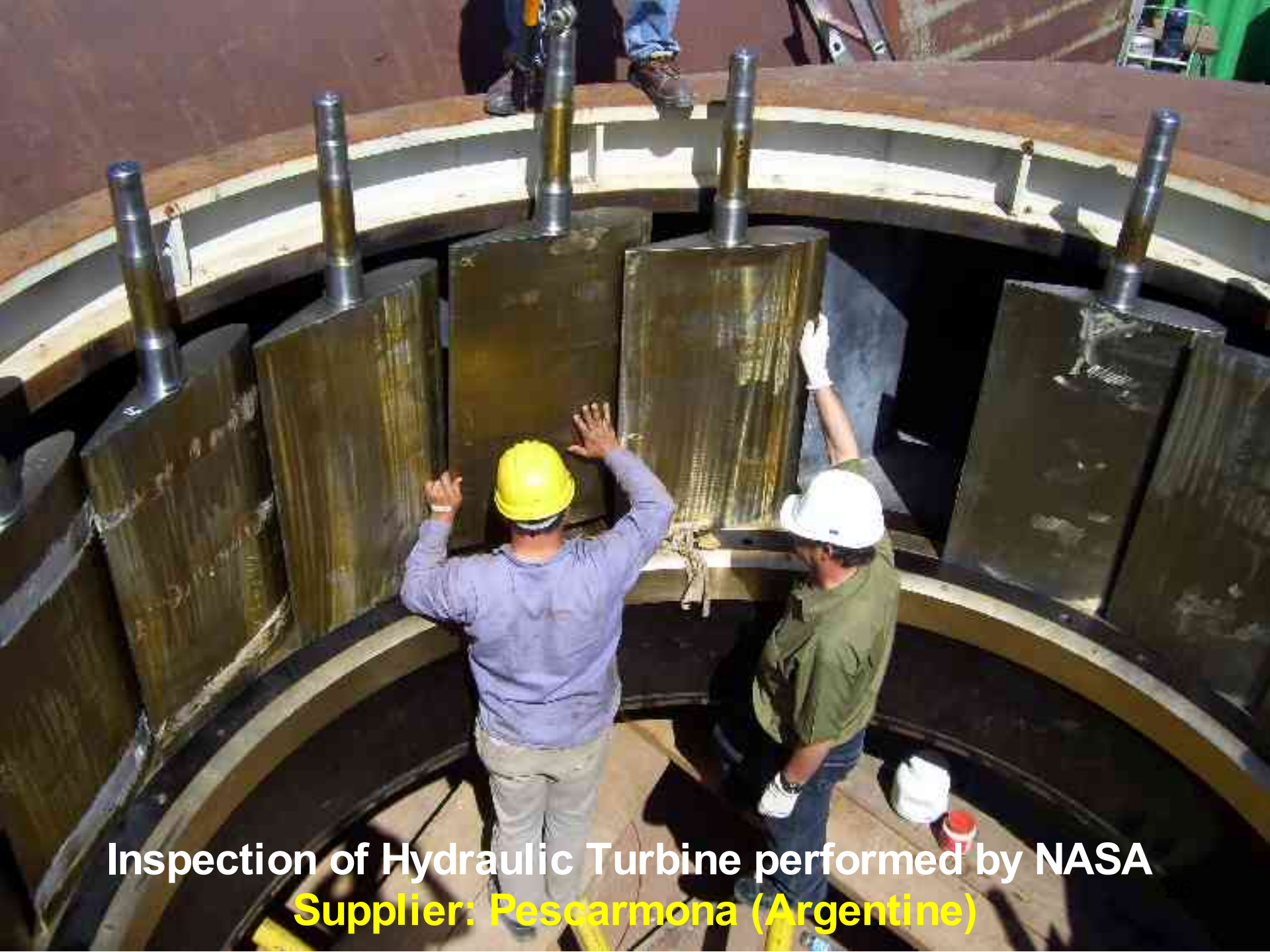
Inspection of ELMO Vacuum Pumps performed by NASA

Supplier: Siemens (Germany)

Inspection of valves performed by CCI
Supplier: Sulzer (Swiss)

Inspection of Moderator Heat Exchangers performed by NASA

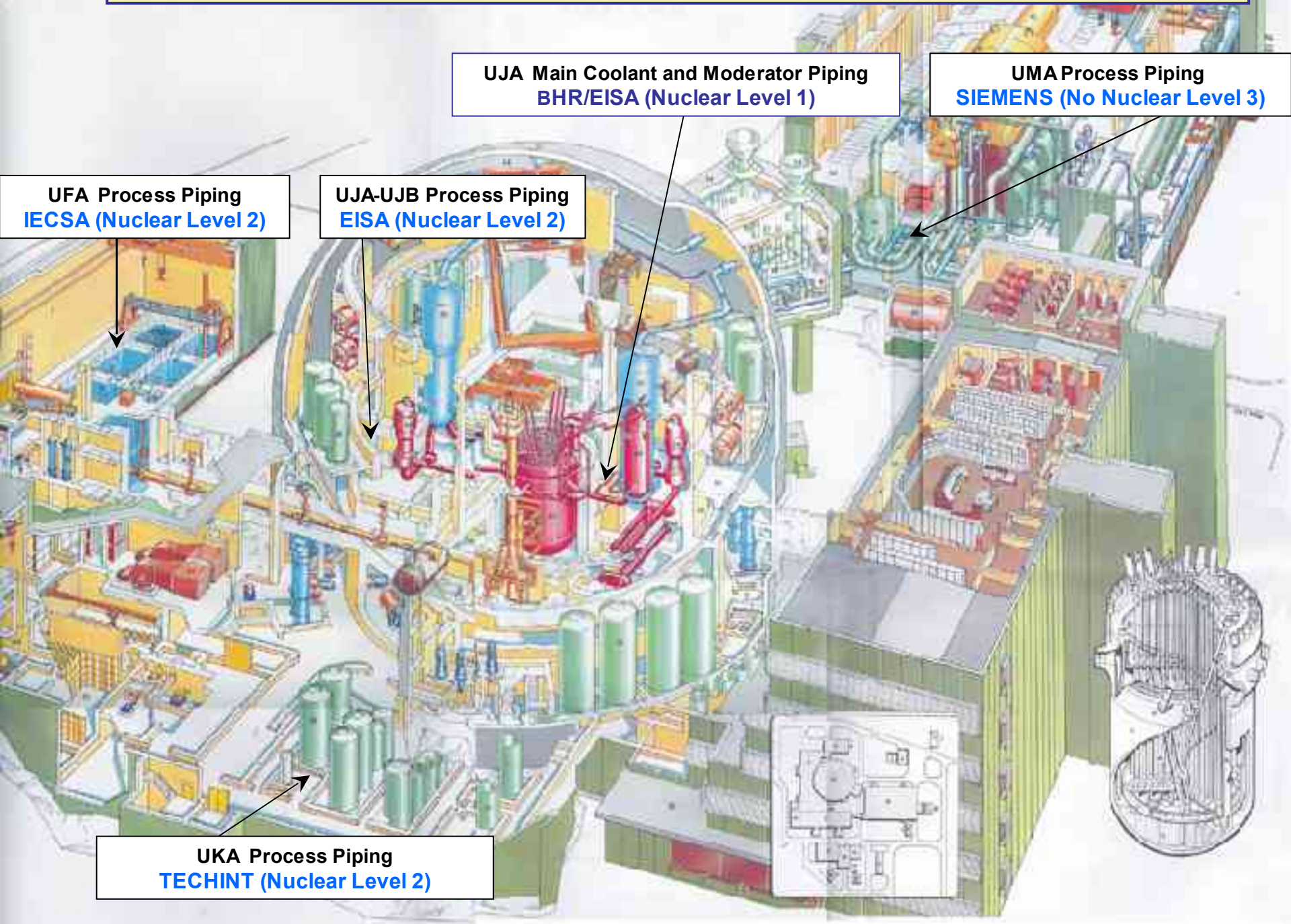
Supplier: Pescarmona (Argentine)



Inspection of Hydraulic Turbine performed by NASA

Supplier: Pescarmona (Argentine)

ATUCHA II PIPING INSTALLATION – ALLOCATION OF MAIN WORK SUB-PACKAGES



Nuclear Level 1 (Primary Heat Transport System):
Essener Hochdruck-Rohrleitungsbau GMBH from Germany with the supply of resources from local company EISA

Nuclear Level 1 (Primary Heat Transport System):
Essener Hochdruck-Rohrleitungsbau GMBH from Germany with the supply of resources from local company EISA

Nuclear Level 1 (Primary Heat Transport System):
Essener Hochdruck-Rohrleitungsbau GMBH from Germany with the supply of resources from local company EISA

Nuclear Level 1 (Moderator System):

Essener Hochdruck-Rohrleitungsbau GMBH from Germany with the supply of resources from local company EISA

Nuclear Level 1 (Moderator System):
Essener Hochdruck-Rohrleitungsbau GMBH from Germany with the supply of resources from local company EISA

Nuclear Level 2 (Process systems in reactor building UJA and reactor building annulus UJB): local company EISA.

Nuclear Level 2 (Process systems in reactor auxiliary building UKA): local company TECHINT.

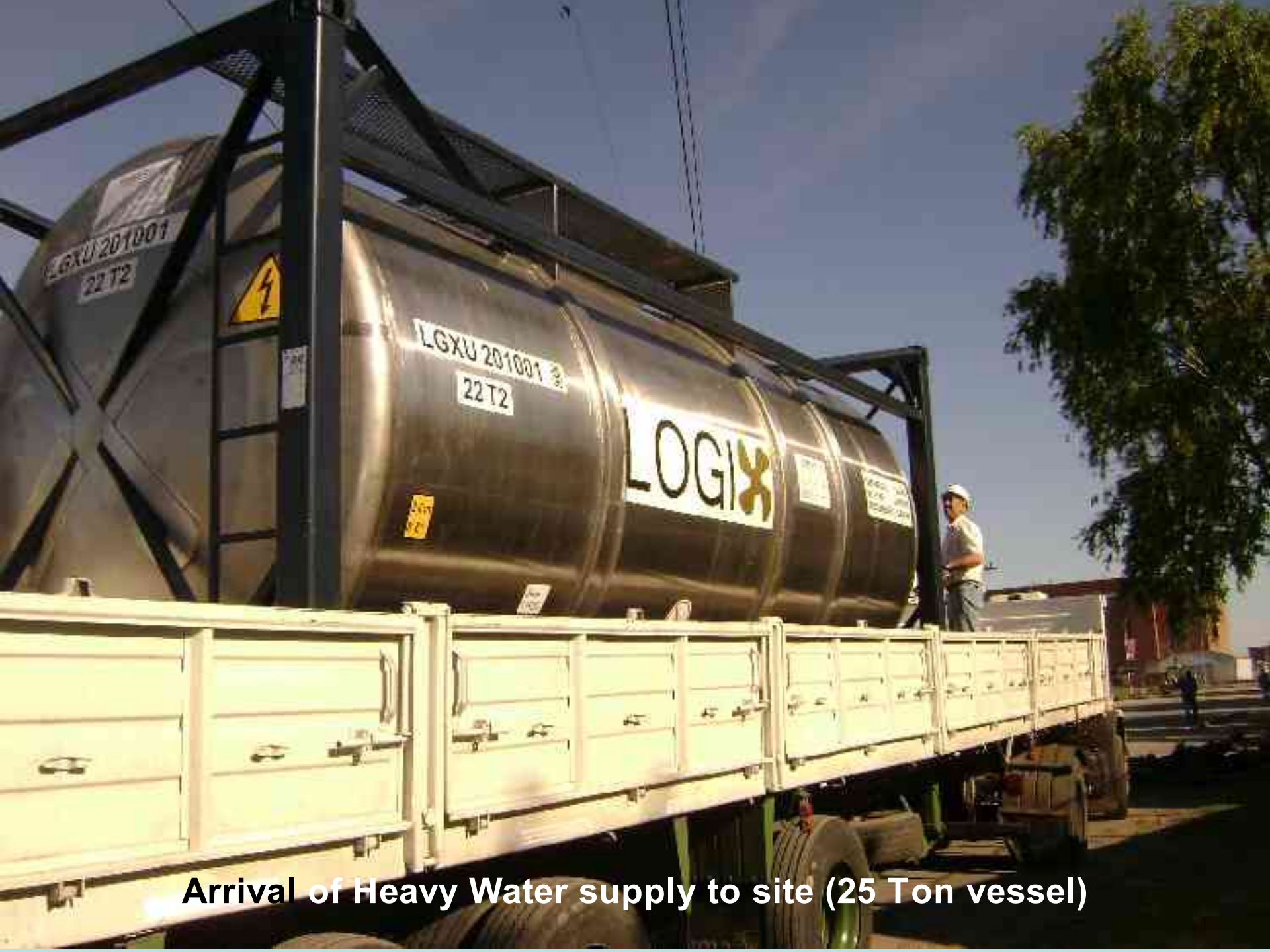
No nuclear high qualification Level 3 (Turbine building UMA): local branch of SIEMENS with technical support of SIEMENS USA and Germany. Direct man power provided by local companies.

No nuclear high qualification Level 3 (Condenser assembly in Turbine building UMA): local branch of SIEMENS with technical support of SIEMENS USA and Germany. Direct man power provided by local companies.

No nuclear standard qualification Level (Hydraulic Turbine building UME): NA-SA Mechanical Construction Department. Direct man power provided by local companies.

Installation of Reactor Pressure Vessel

Civil painting application in Reactor Room



Arrival of Heavy Water supply to site (25 Ton vessel)

Integration of Analog and Digital I&C Systems

Because of the technological evolution in these aspects, the modernization of I&C systems is a normal situation in operating and DNPP`s.

After a detailed status assessment of the project situation and the definition of the scope of changes to be done in this field, the main Strategies and Management Measures adopted were:

- To replace some functional complexes actually using Analog systems like Iskamatic B and Teleperm C with Digital systems like Teleperm XP and Teleperm XS. This is going to be done in a first step before starting the plant.

- For the implementation of this modifications purchase orders were placed to SIEMENS for conventional systems including engineering tasks, hardware and tools supply and training of NASA personnel.

Main activities arising from these Strategies and Measures are:

- The organization of a specific task force with an important training effort.

- A considerable effort in planning the engineering, construction and commissioning activities is being done in order to produce minimal impacts in the general schedule of the project.

- Participation of NASA experts in technical meetings organized by IAEA, complemented by visits to NPP`s were similar tasks are or were performed.

Integration of Analog and Digital I&C Systems

In this first step the functional complexes to be changed (with the respective influence in the already installed and wired Cabinets and converting the Main Control Room in a hybrid analog-digital Control Room), are the following:

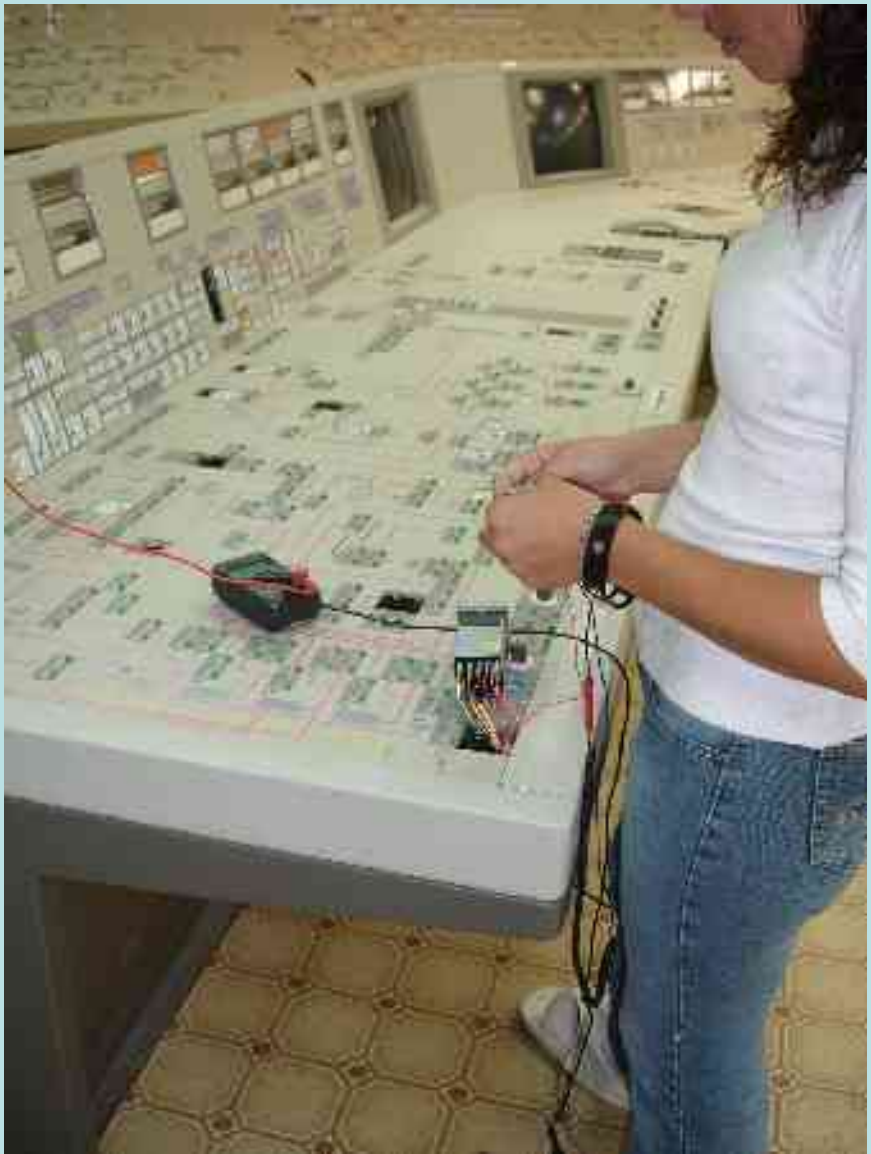
- Coolant treatment.
- Heating and Ventilation in controlled areas.
- Water and Steam Cycle.
- Auxiliary Plant Water and Steam Cycle.
- Main Cooling Water.
- Conventional Service Water Systems.

The more important benefits obtained from the replacement strategy are:

- Filling the gap of missing hardware out of fabrication.
- Providing spare parts for the remaining functional complexes.
- Existing cabinets and cabling to the field can be used.
- Do not affecting safety related functions.
- The new technology is future oriented providing long term support.

Cabinet wiring modifications previous to integration of Analog and Digital Systems

Main Control Room wiring modifications previous to integration of Analog and Digital Systems




END
THANK YOU VERY MUCH FOR YOUR ATTENTION
NA-SA
Atucha II NA-SA Welding school
NA·SA

ANNEX: Atucha II NPP General Description

Notes

As main references about Restarting of Atucha II DNPP the following Documents should be consulted:

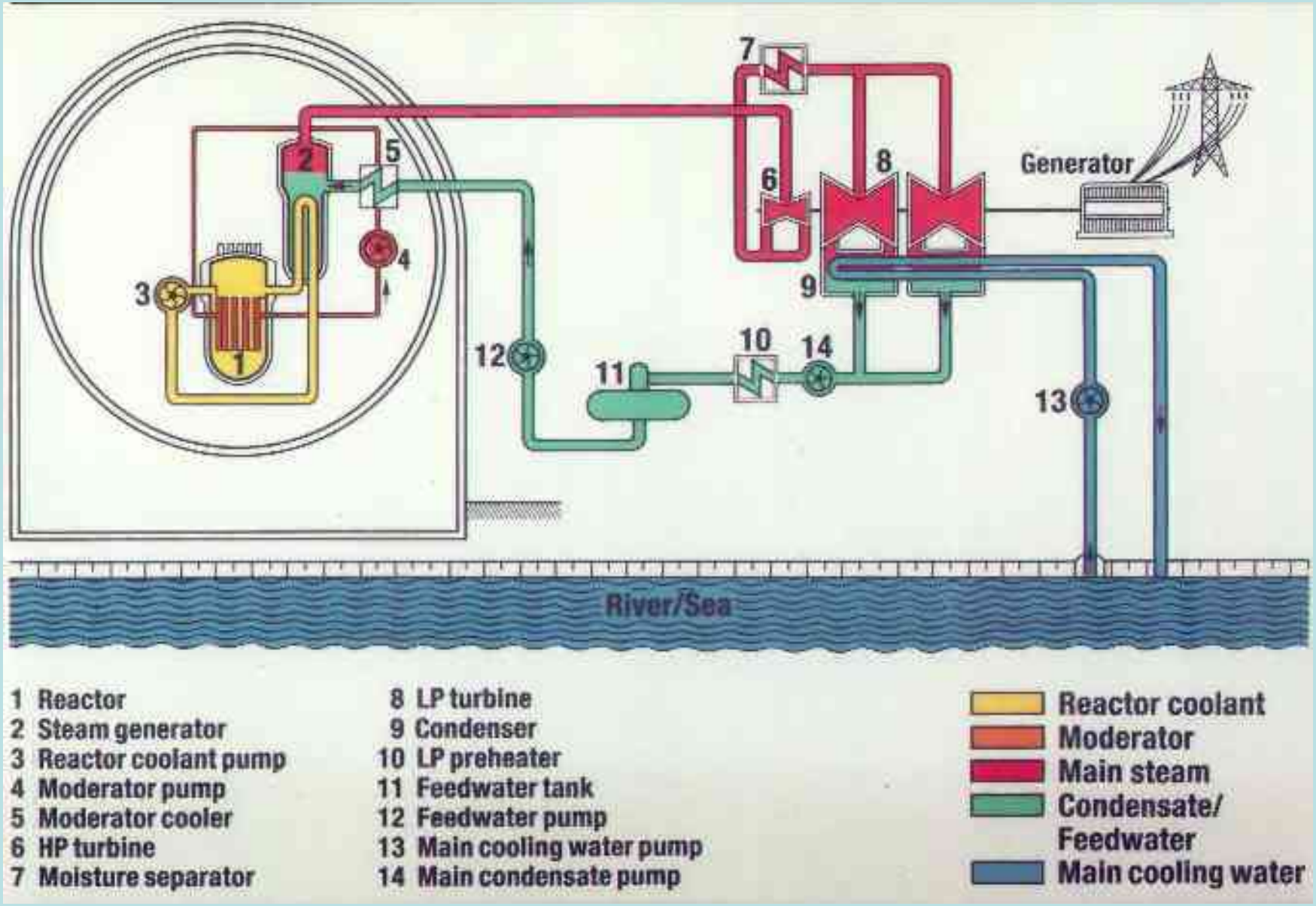
- **Argentine Presentation performed in the Regional Management Workshop for DNPP`s developed in Constanta Mamaia, Romania 7-11 Nov. 2005.**
- **Restarting DNPP`s - IAEA NE Series NP-T-3.4 (Annex I).**

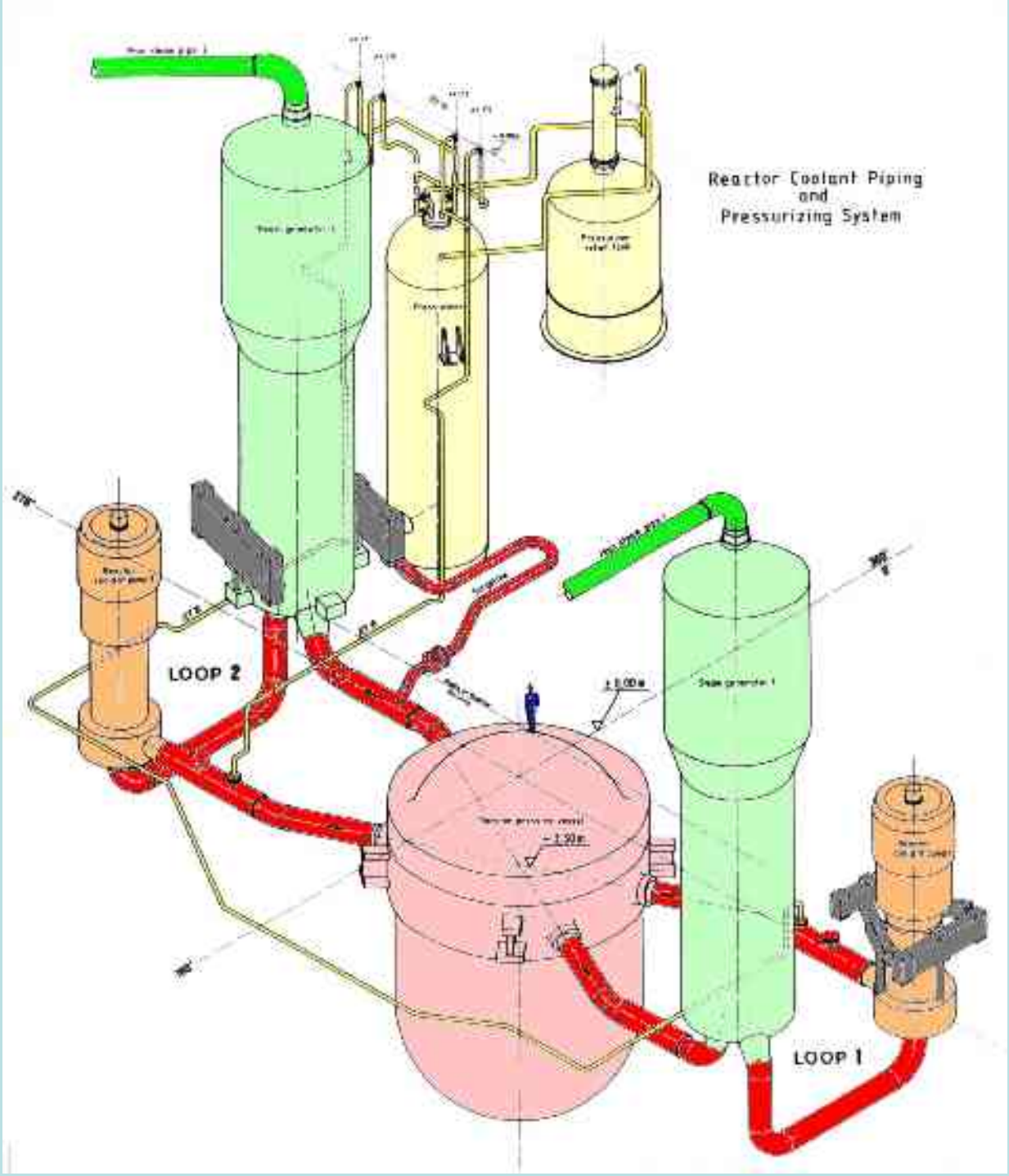
Technical Data

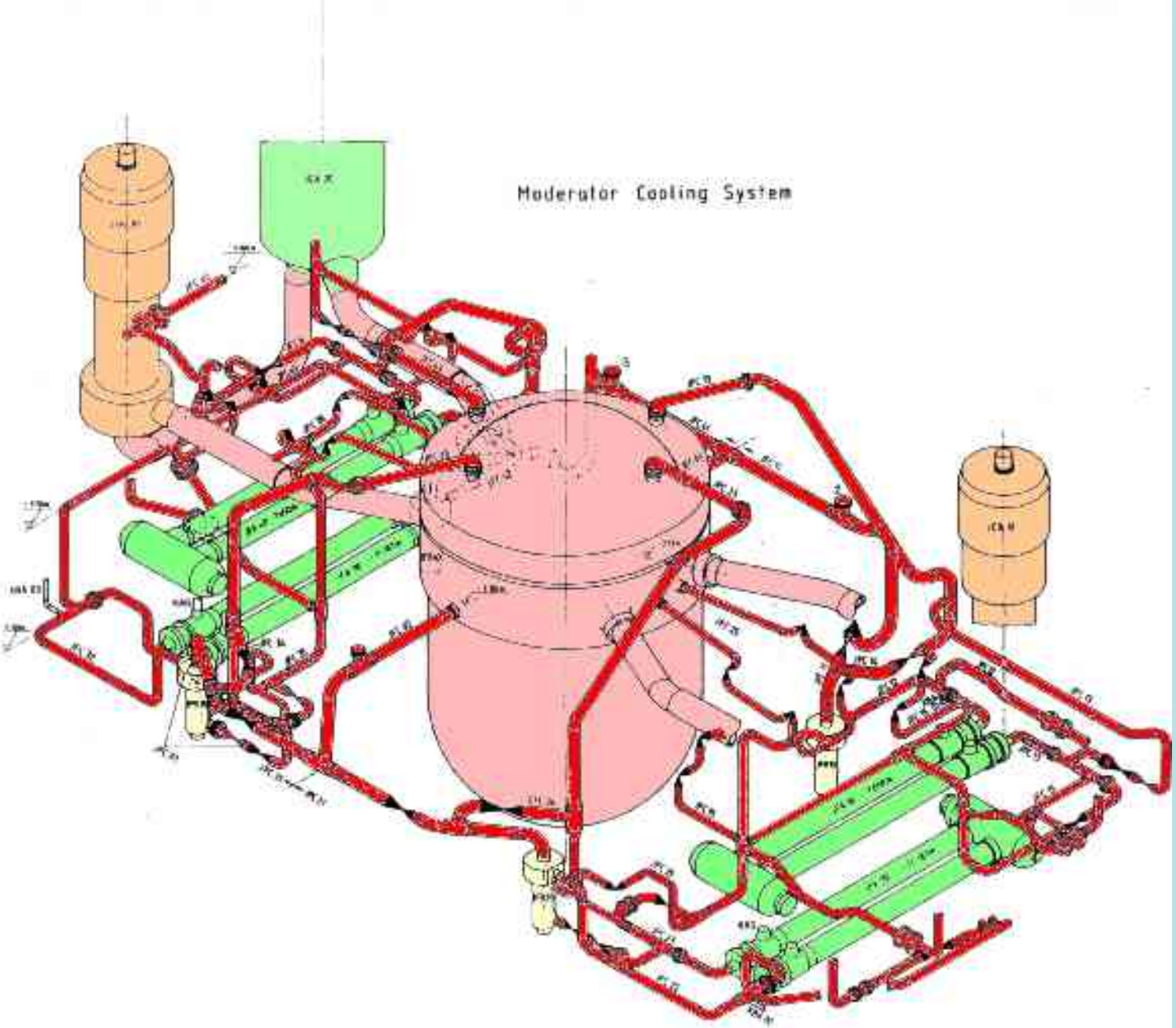
Type: Pressurized Heavy Water Reactor (PHWR)

Lifetime at full power:	**32 years**
Net Electric Power:	**692 MW**
Gross Electric Power:	**745 MW**
Coolant / Moderator Heavy Water (D2O):	**525 Ton**
Fuel Elements of Natural Uranium Dioxide:	**451**
Total Weight of each Fuel Element:	**254 Kg**
Total Natural Uranium Weight:	**85 Ton**
Coolant Pressure at Reactor output:	**115 bar**
Coolant Temperature at Reactor output:	**313,8 °C**

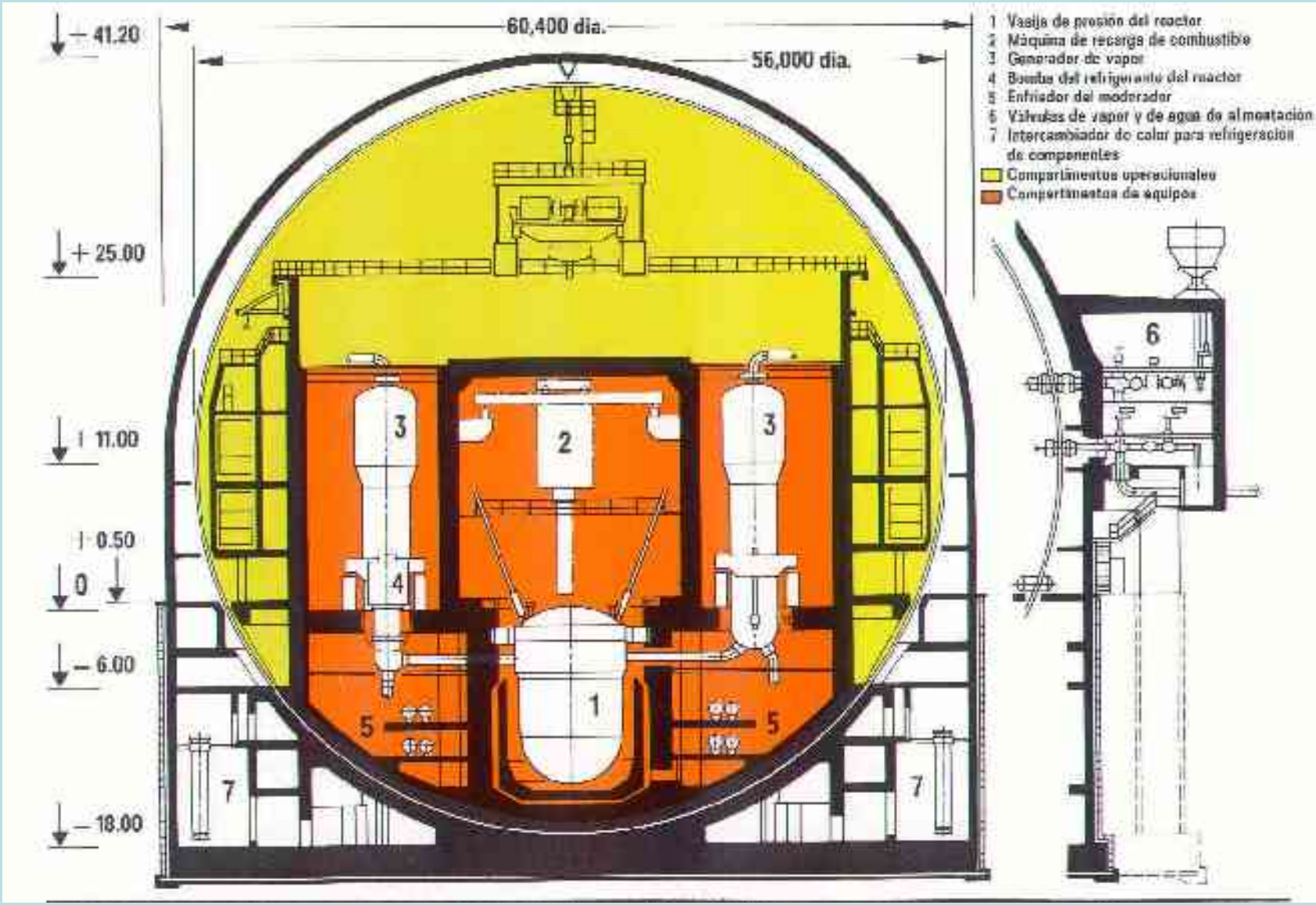
Simplified Flow Diagram



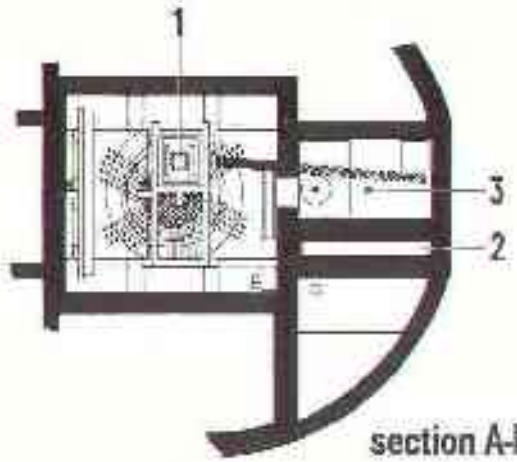

Reactor Coolant Piping
and
Pressurizing System
LOOP 2
LOOP 1

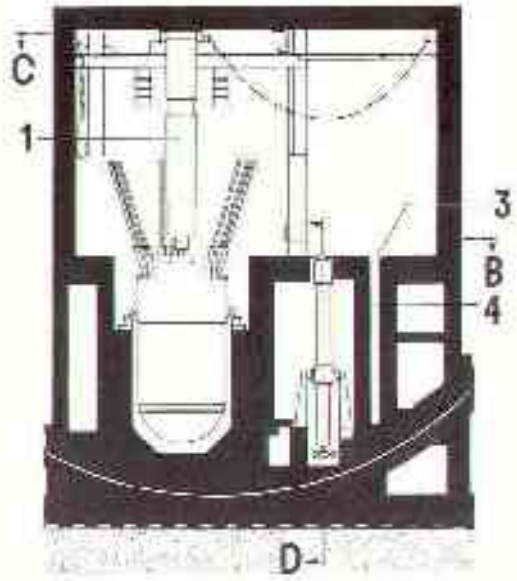

Moderator Cooling System

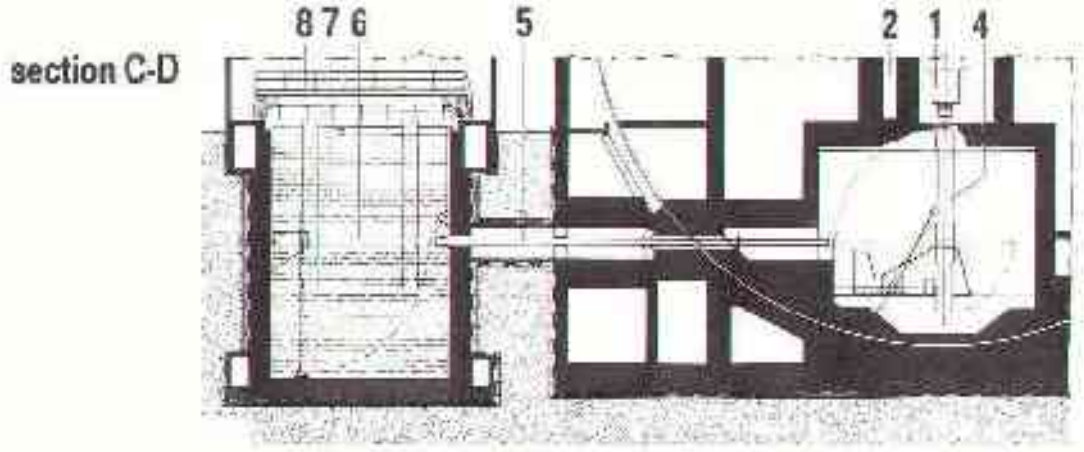
Reactor Building



Fuel Elements -Transport System

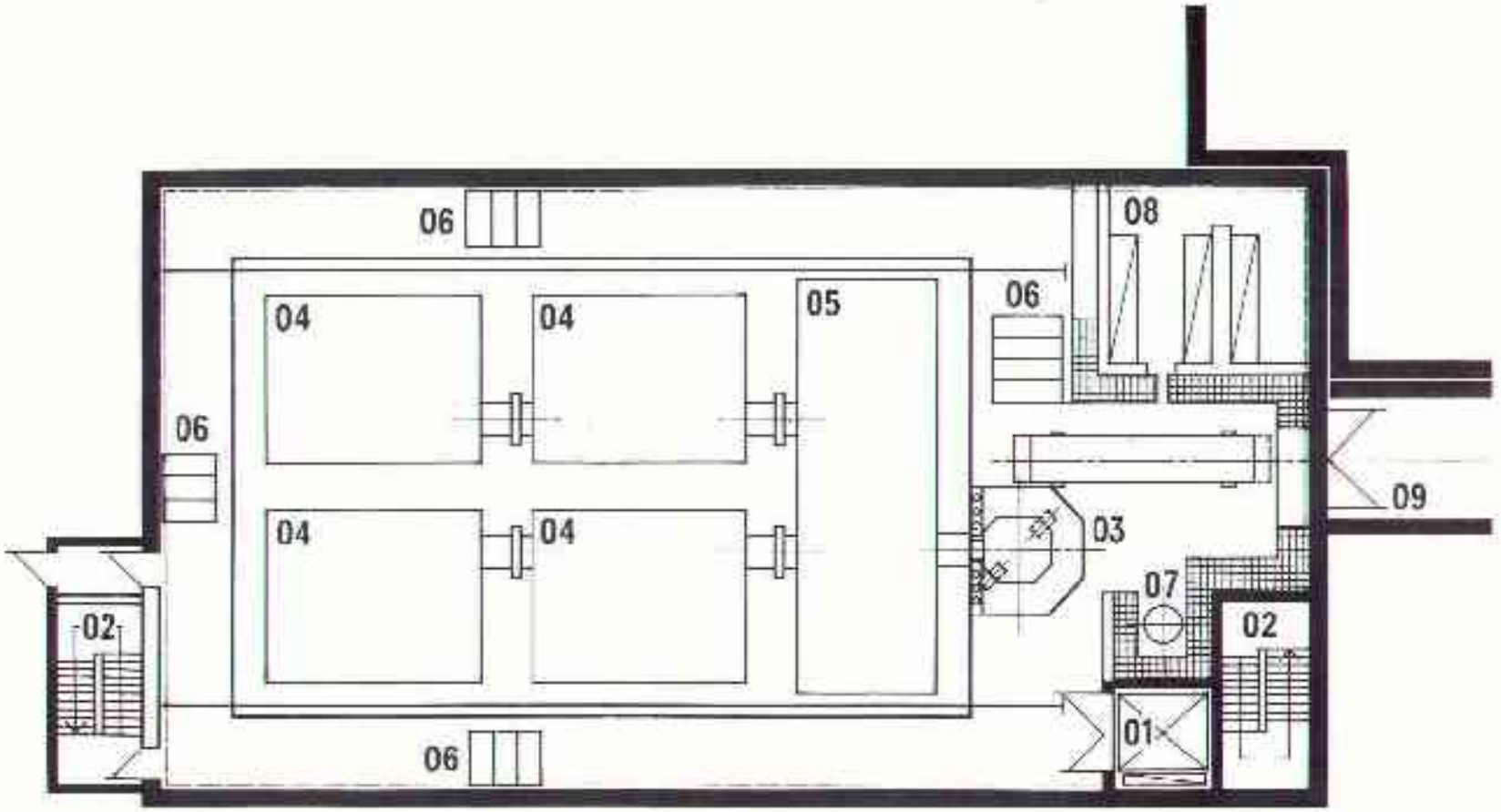






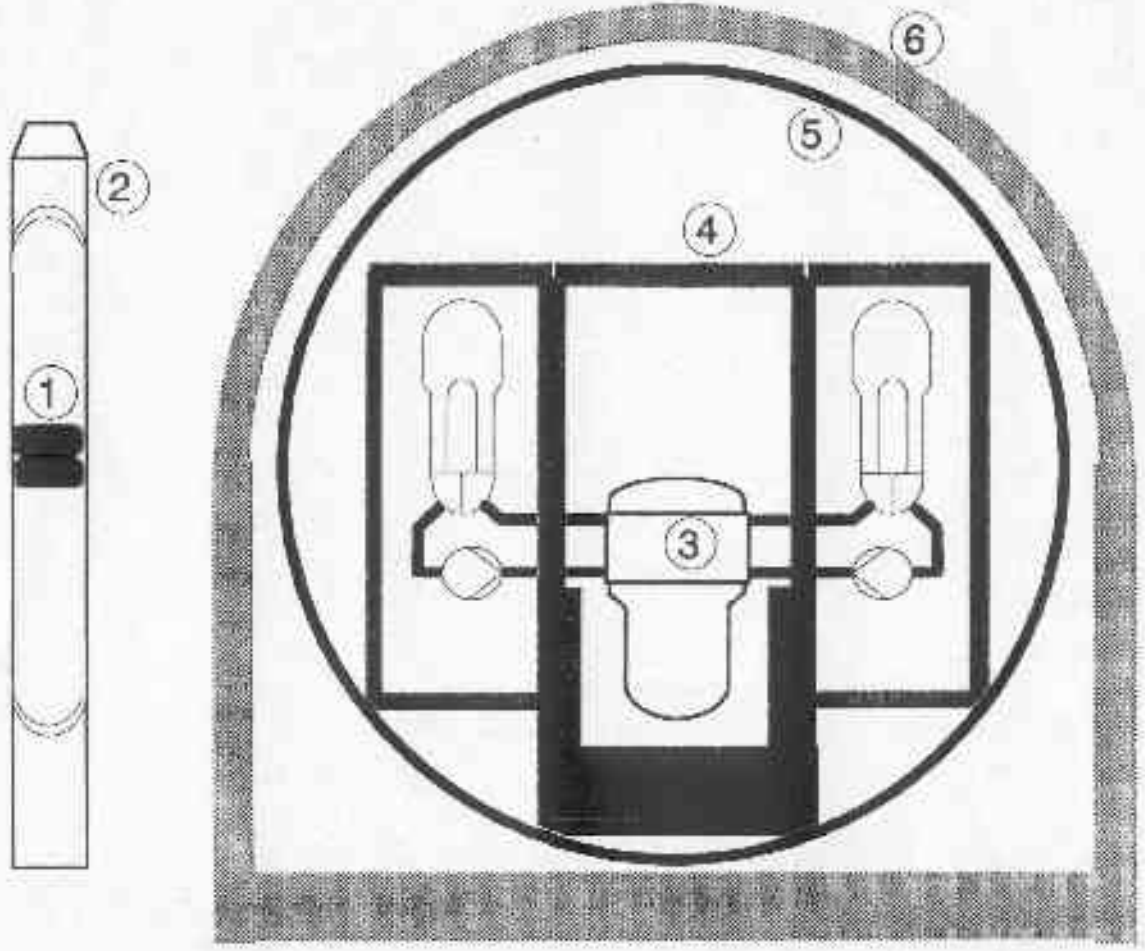
1 Refuelling machine
2 Shroud tube pit
3 Function testing position for refuelling machine
4 Tilting flask
5 Transfer tube
6 Tilting device
7 Spent fuel pool
8 Spent fuel pool bridge

Fuel Elements - Storage Building



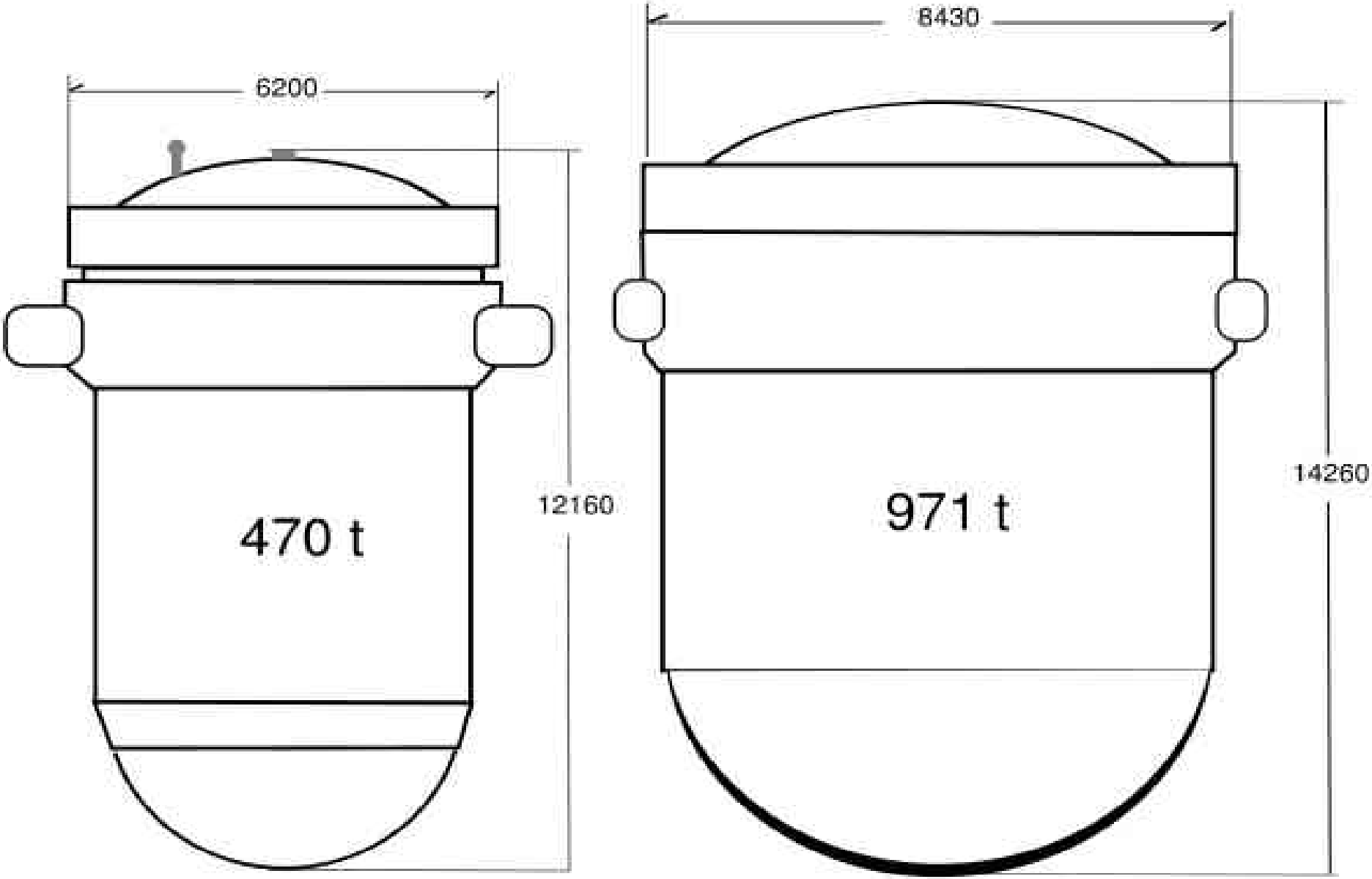
01 Montacargas
02 Caja de escalera
03 Piscina para recipientes de transporte
04 Piscina de almacenamiento de combustible agotado
05 Piscina de manipulación
06 Abertura de montaje
07 Recinto de descontaminación
08 Zona de almacenamiento de combustible nuevo
09 Esclusa

Safety Passive Barriers



1. Estructura cristalina del combustible
2. Vainas de los elementos combustibles
3. Recipiente de presión, Sistema de refrigeración y Sistema del moderador
4. Blindaje de hormigon
5. Recipiente de seguridad de acero
6. Cubierta exterior de hormigon

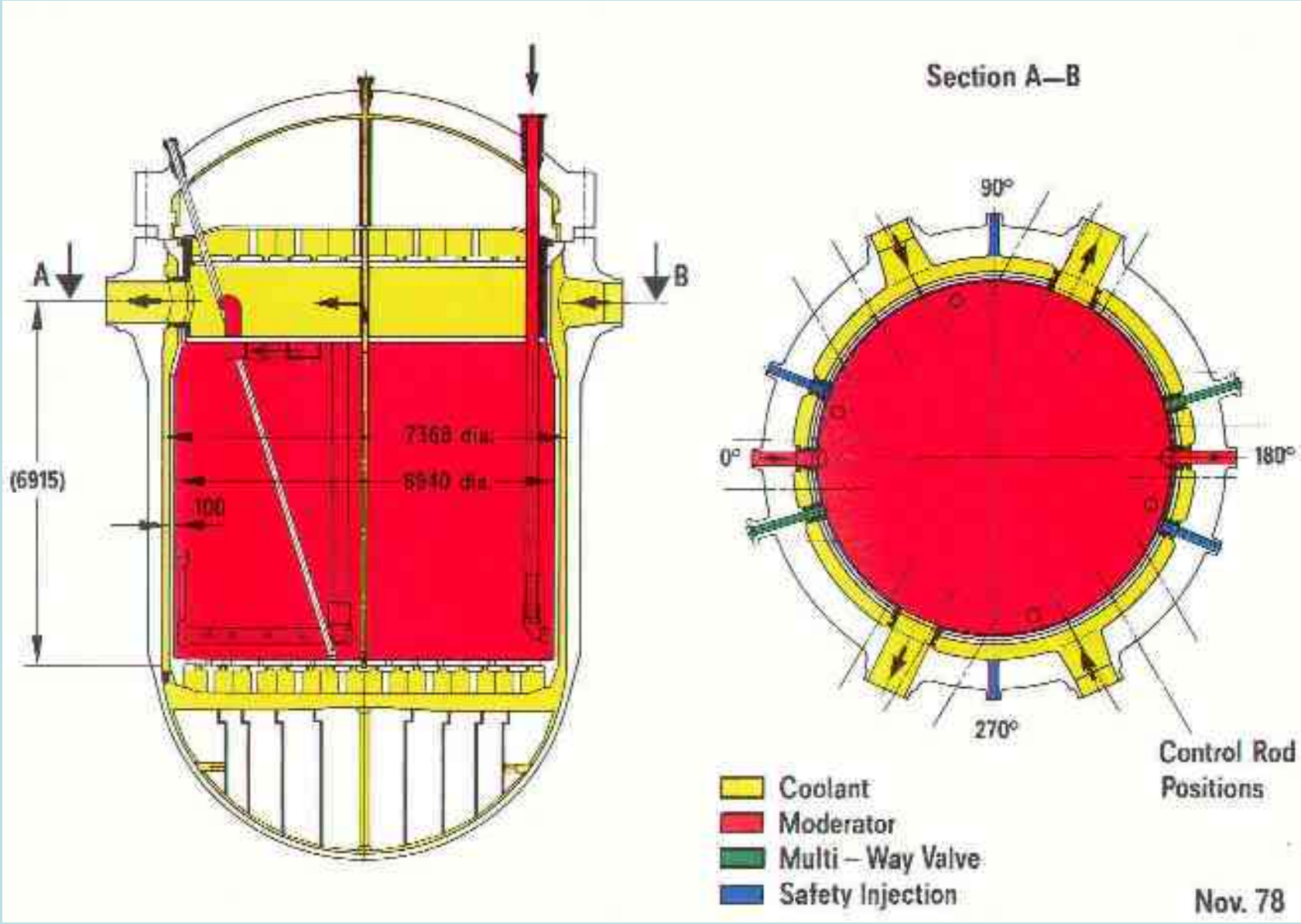
Barreras pasivas de seguridad



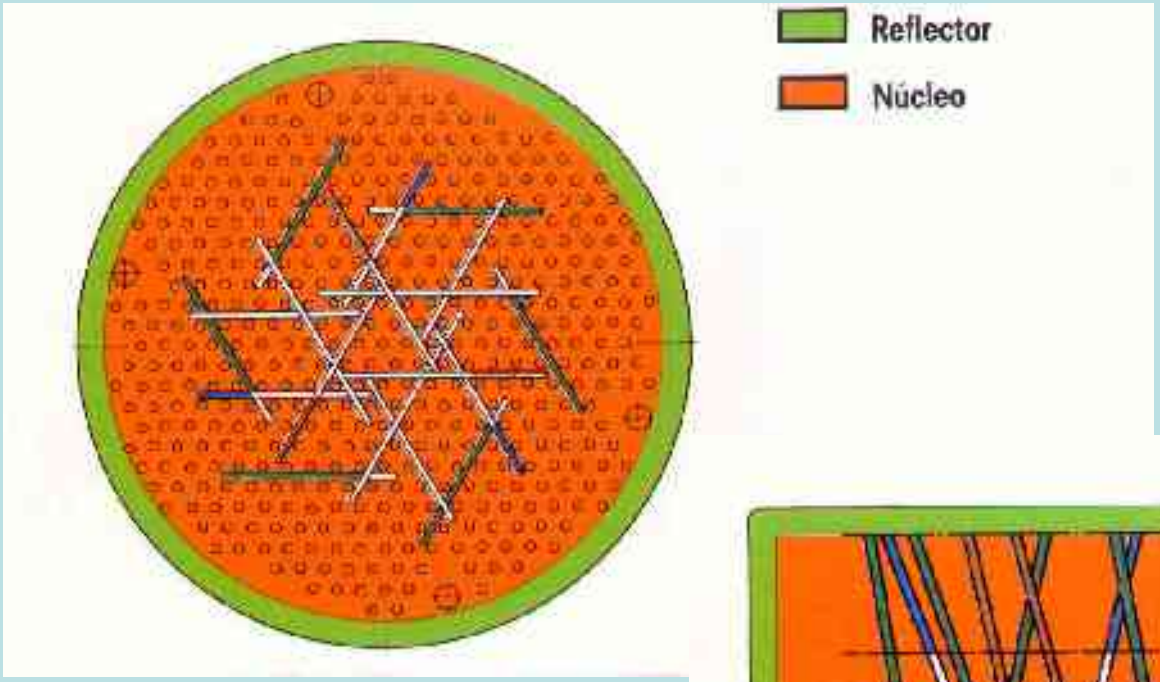
Atucha 1

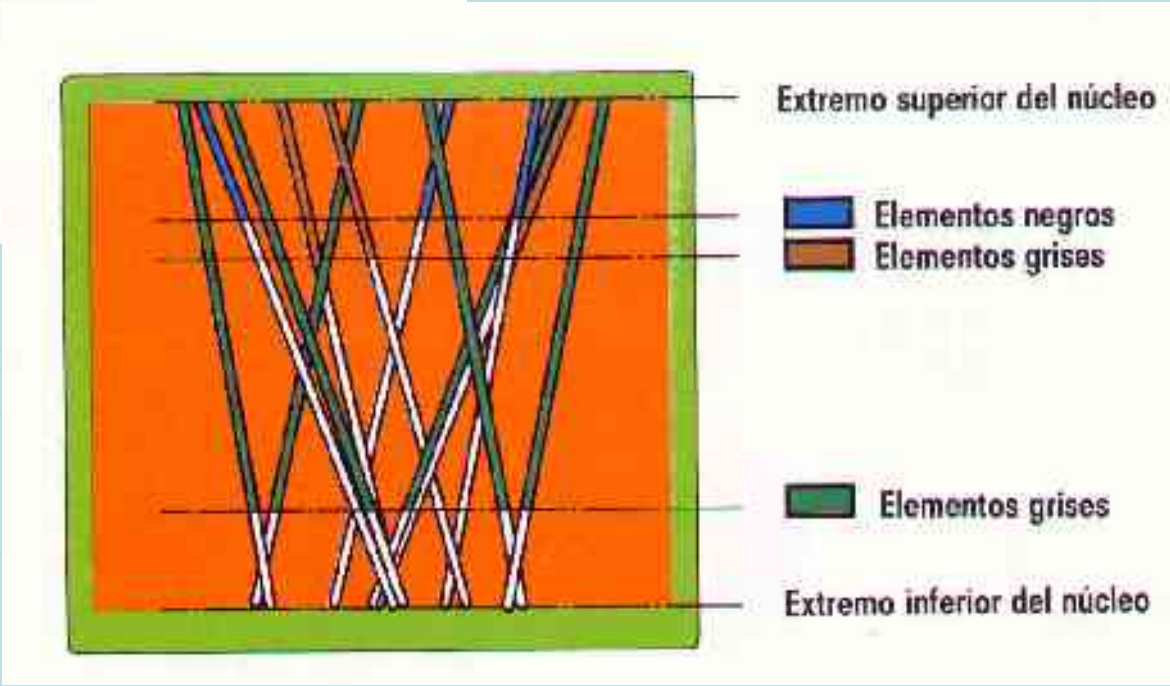
Atucha 2

Reactor Pressure Vessel

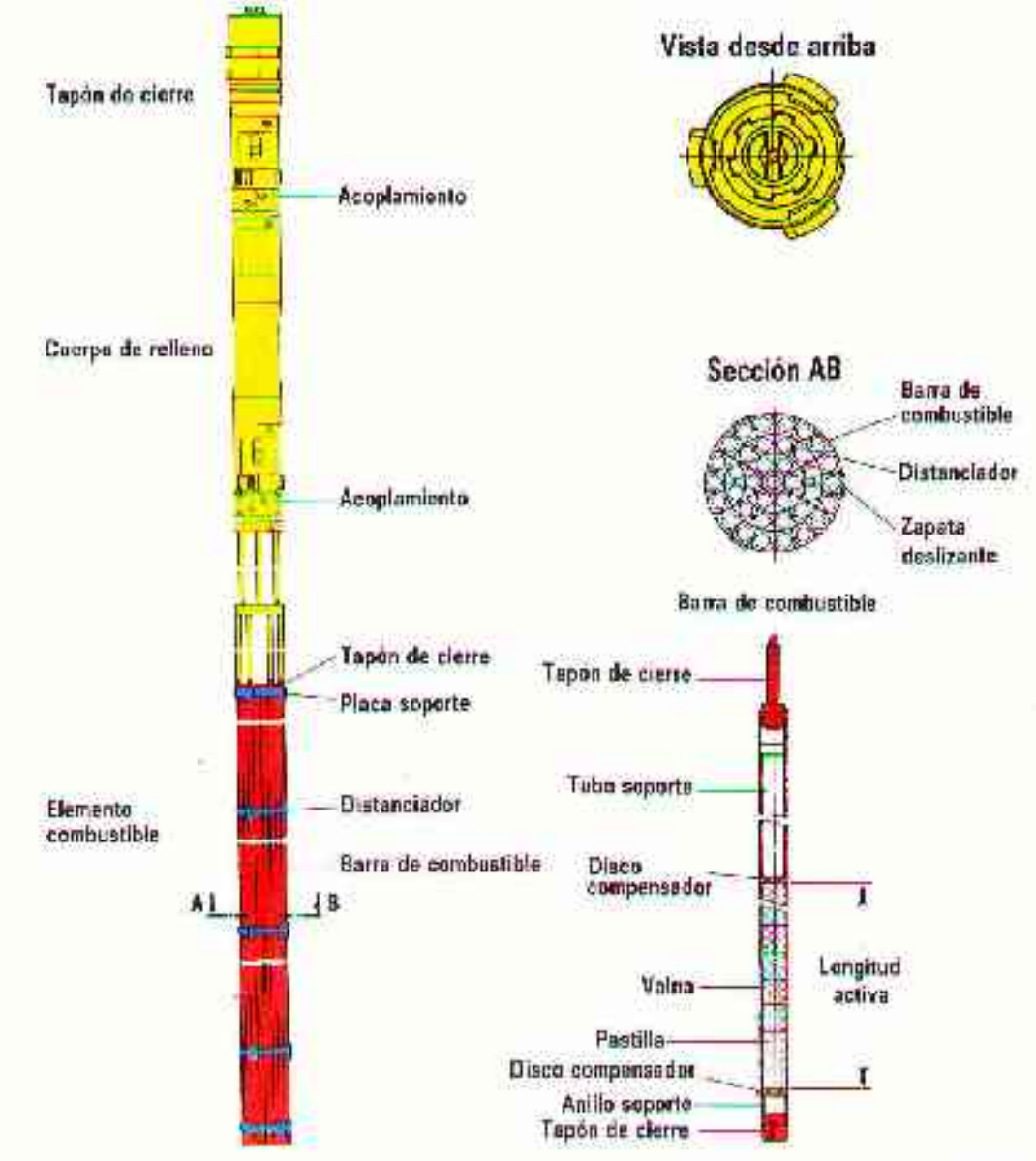


Control Rods Layout

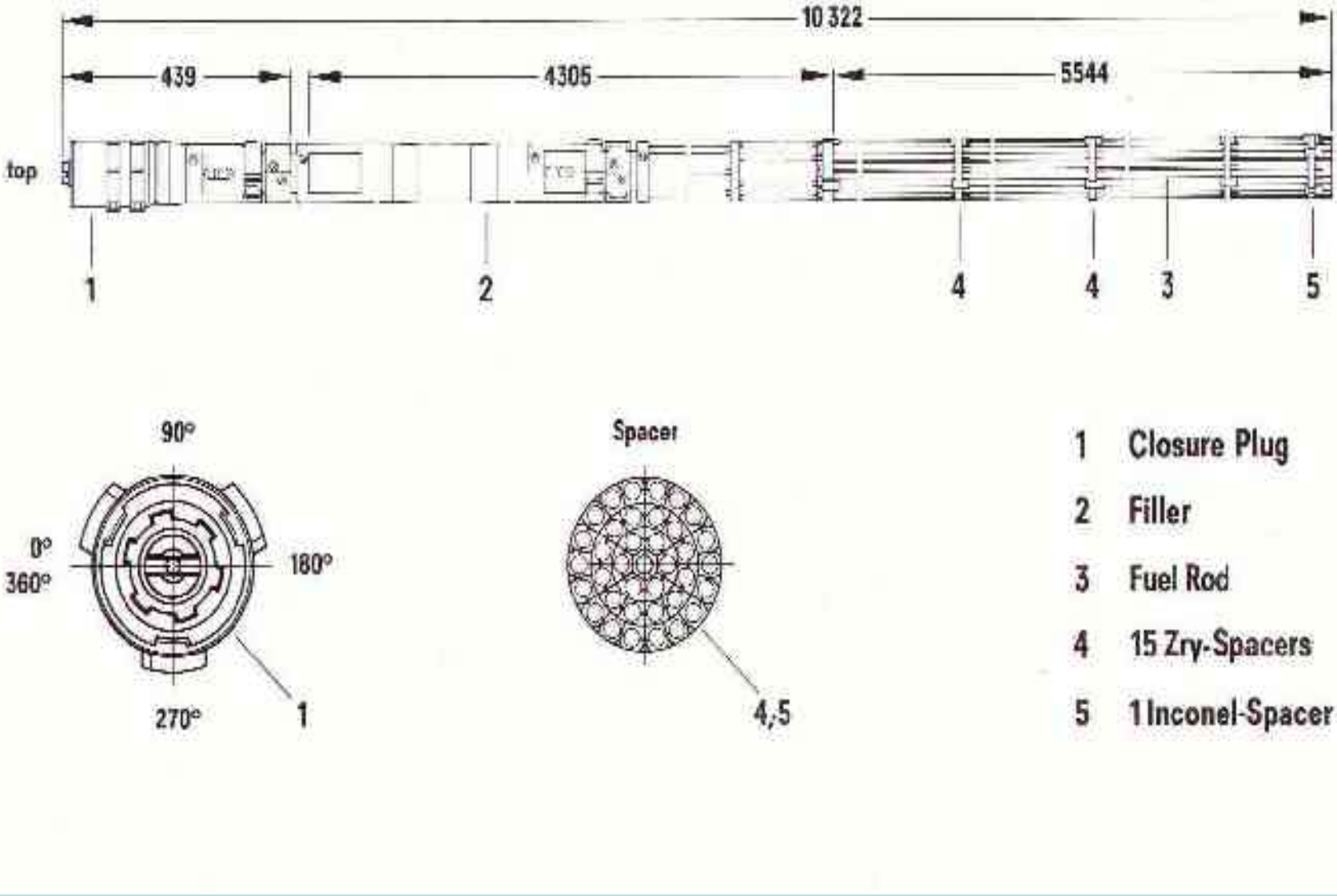




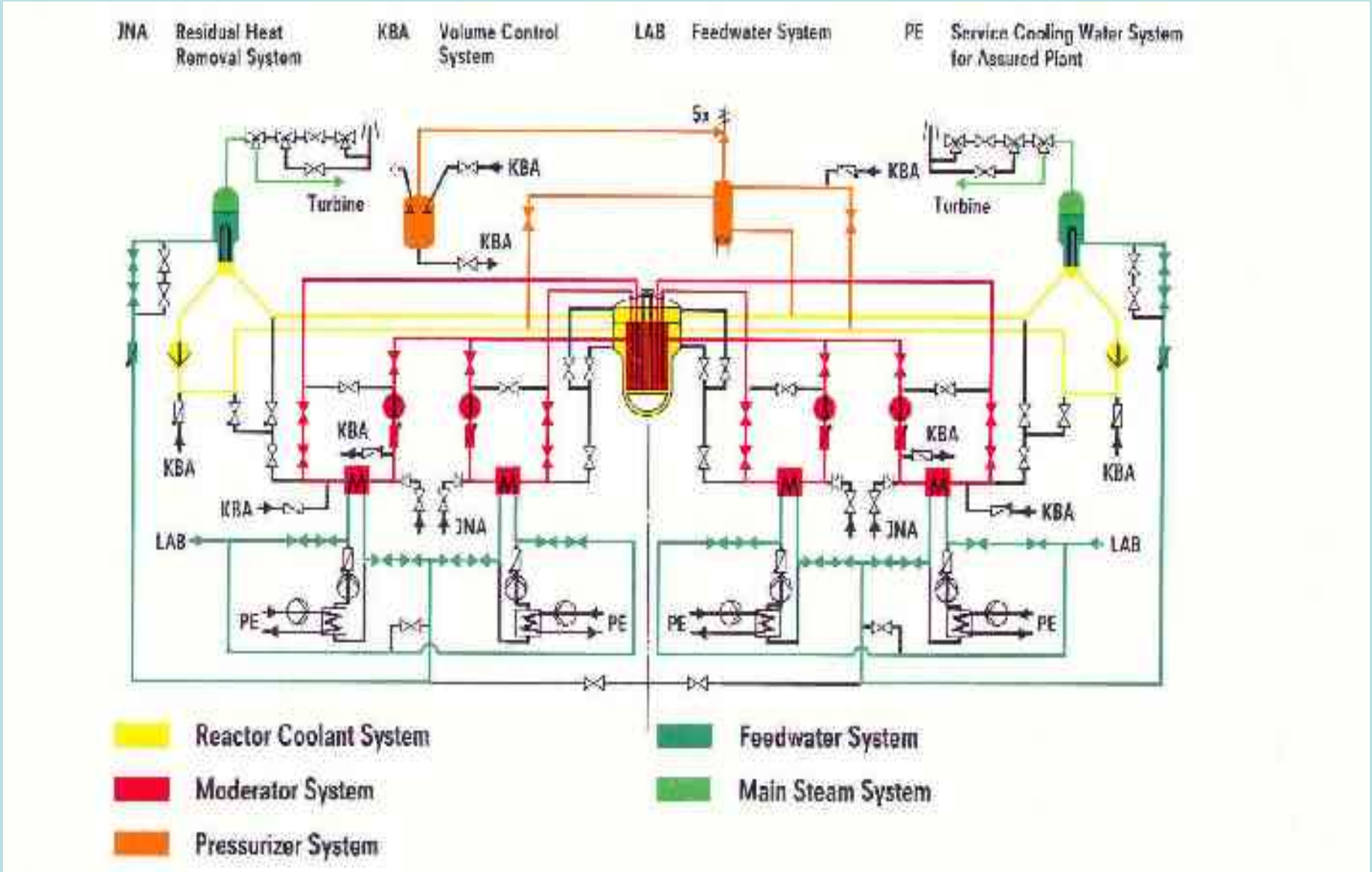
Fuel Element



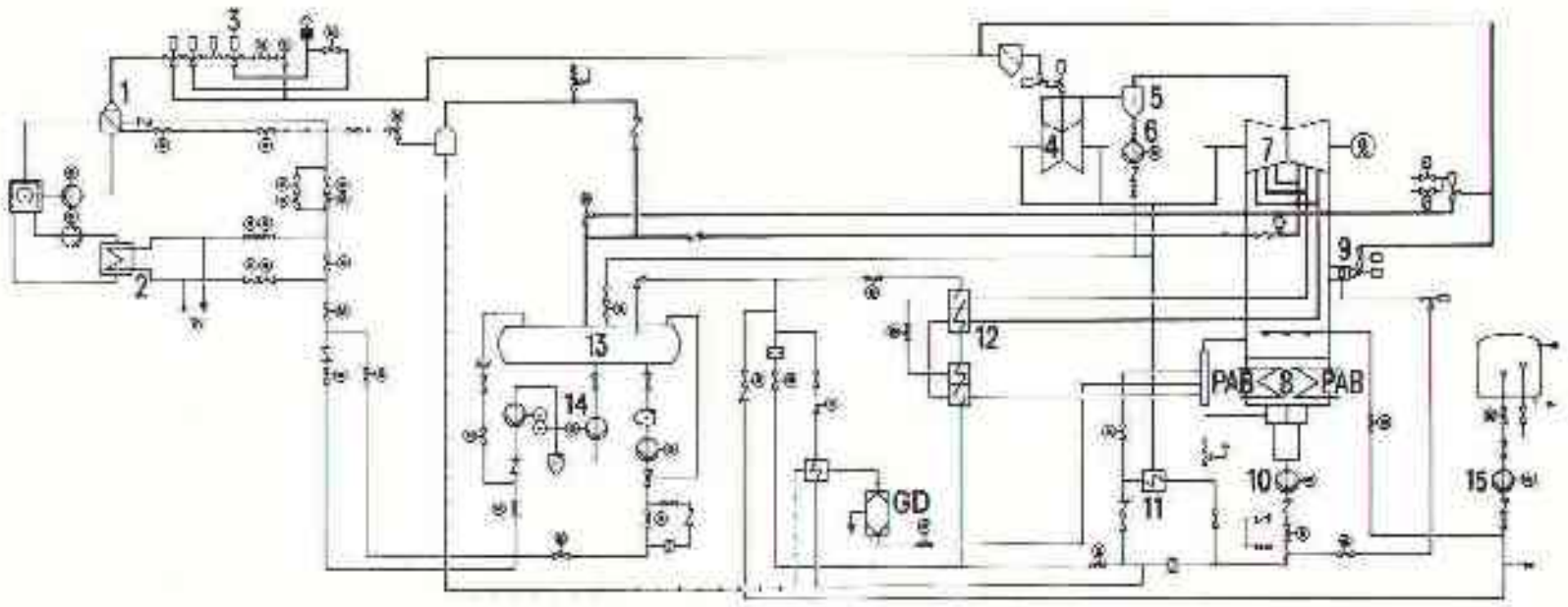
Fuel Element



Primary Systems - Normal Operation



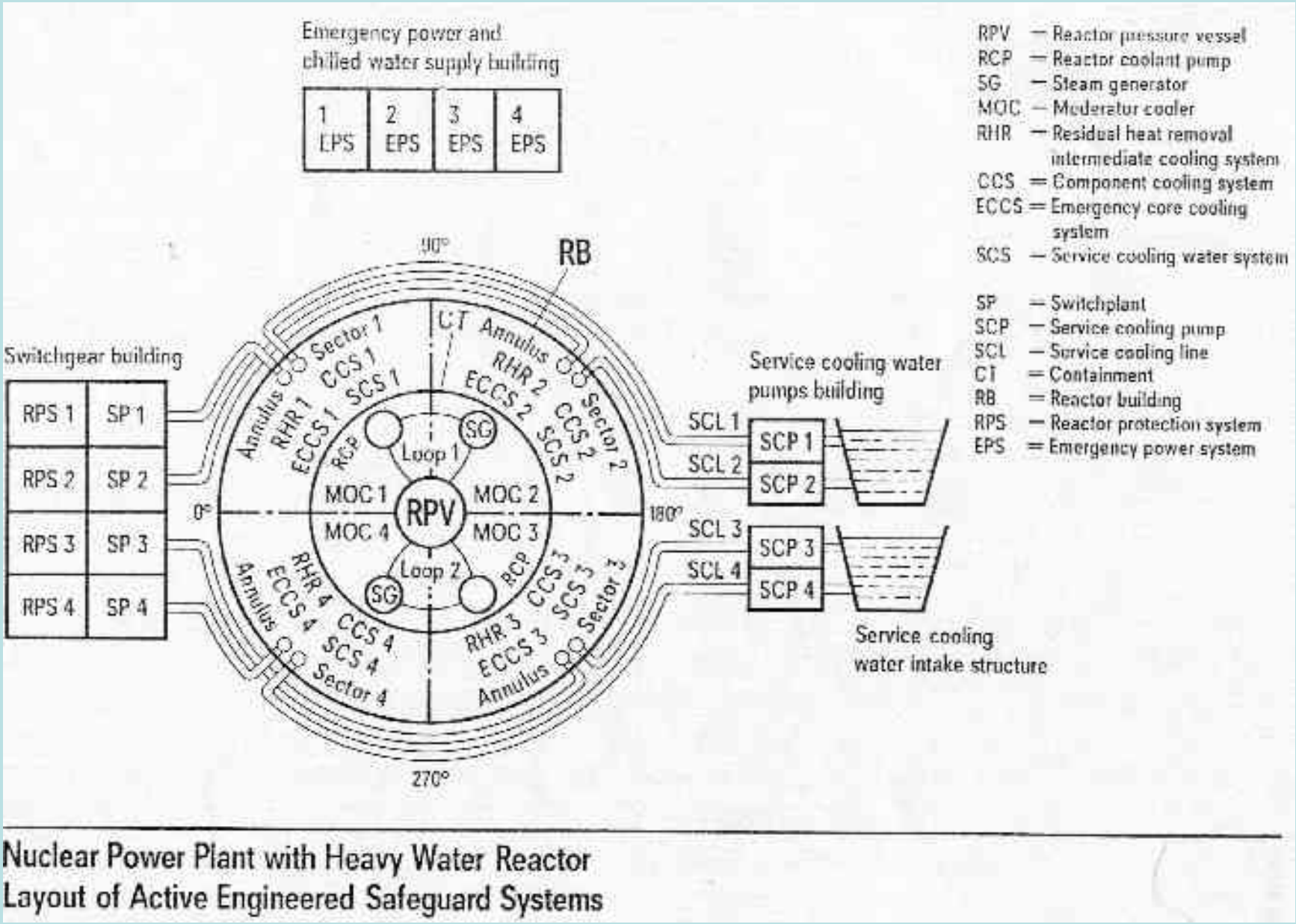
Steam Water Cycle



1 Steam generator JEA
2 Moderator cooler
3 Main-steam valve station LBA
4 H.P. Turbine MAA
5 Moisture separator
6 Separator drains pump LCT
7 L.P. Turbine MAC
8 Condenser MAG
9 Main-steam bypass system MAN
10 Main condensate pumps LCB
11 Gland steam condenser MAW
12 L.P. Feedwater heaters LCC
13 Feedwater tank LAA
14 Feedwater pumps LAC
15 Demineralized water pump GHC

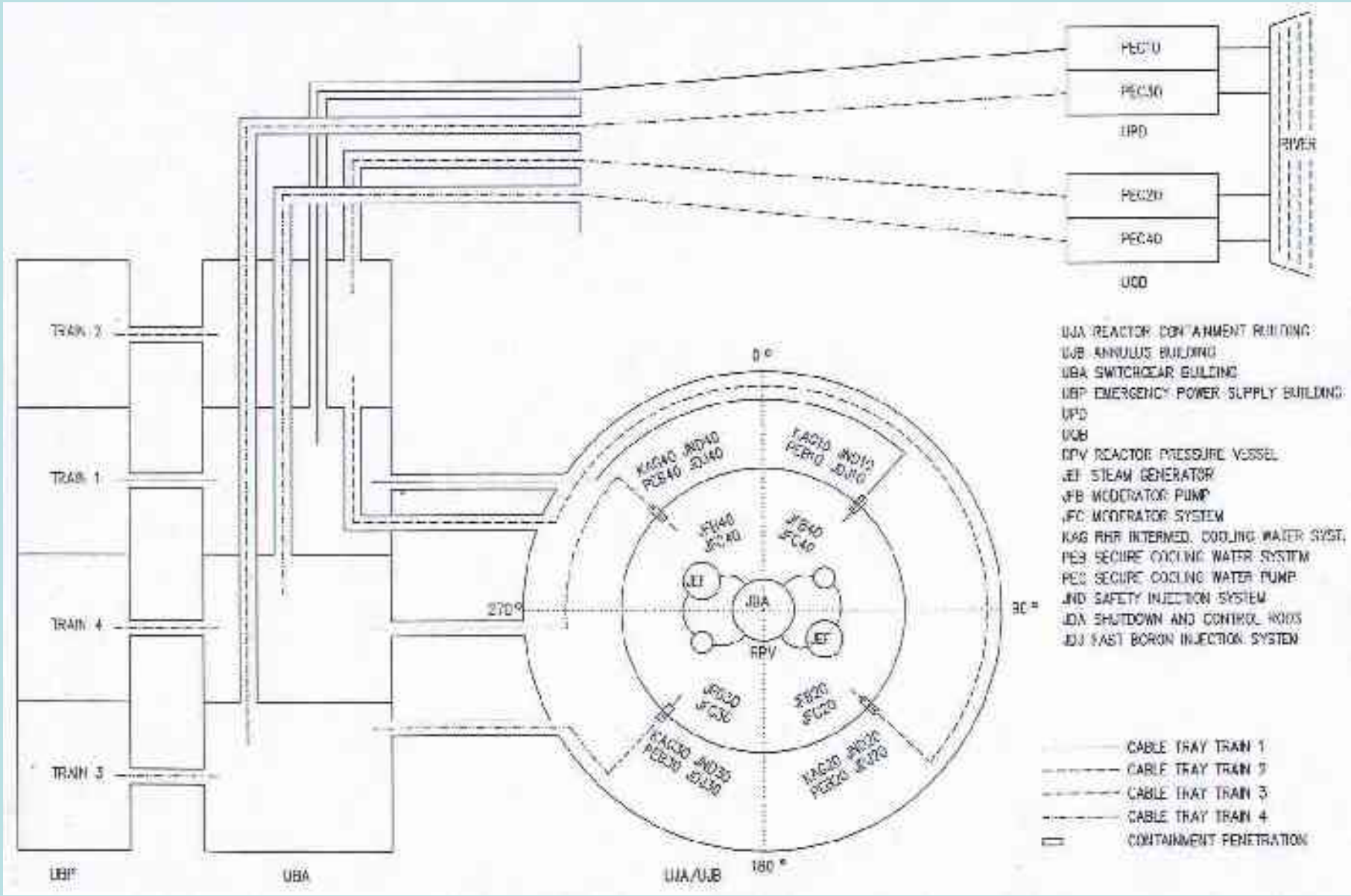
GD Blowdown demineralizing system
PAB Main cooling water system

Layout of Safety Active Systems

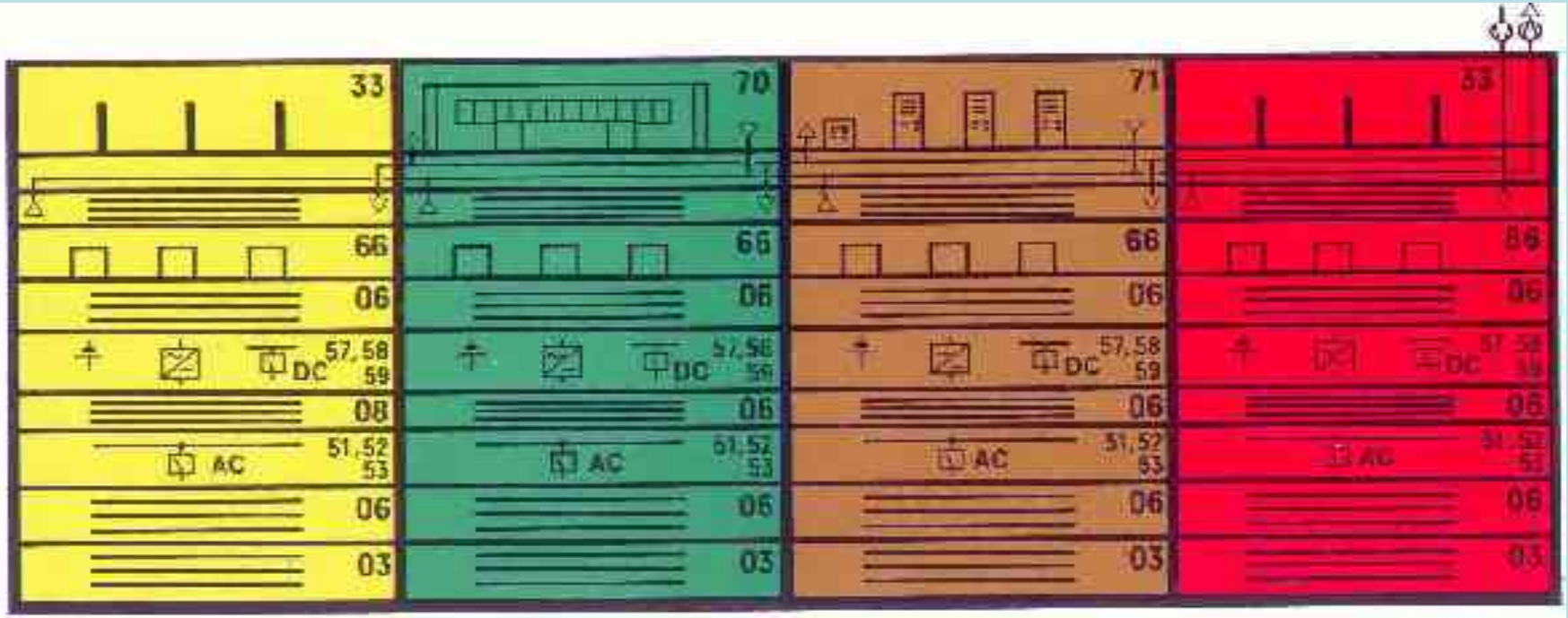


Nuclear Power Plant with Heavy Water Reactor
Layout of Active Engineered Safeguard Systems

Plant Trains Layout



Switchgear Building

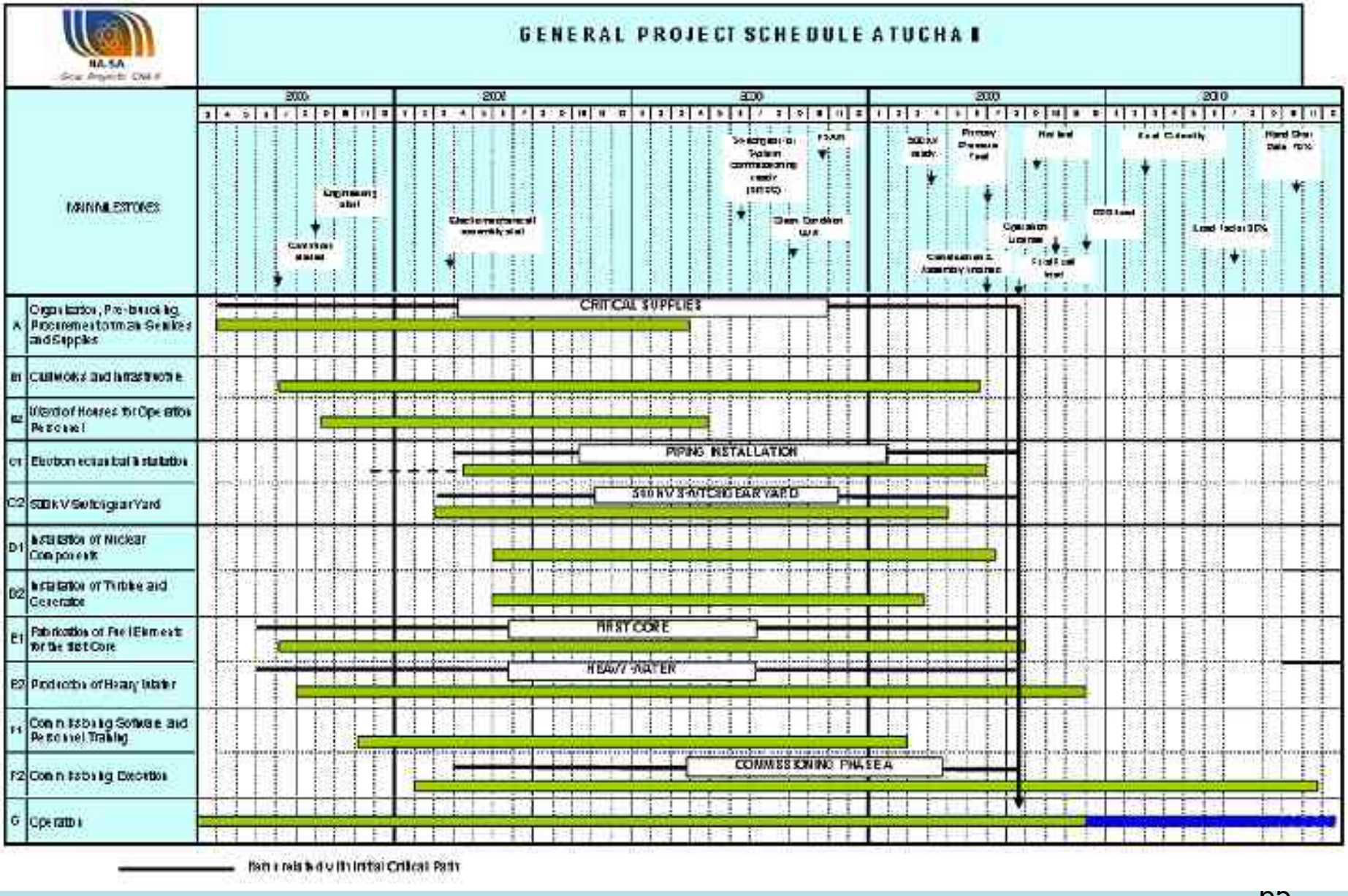


03	Cable duct to turbine building and cooling water Structures Redundancy groups 1—4
06	Cable basement, redundancy group 1—4
08	Junction passage to the shafts
33	Intake air system
51	10/0.66/0.38 kV — switchgear
52	10/0.66/0.38 kV — Emergency distribution
53	220 V d.c. distribution (valve actuators)
57	Batteries for 24 V d.c. distributions
58	Batteries for 220 V d.c. distributions (valve actuators)
59	Rectifiers and d.c. distributions
66	Cabinets for control and instrumentation, redundancy groups 1–4
70	Control room
71	Process computer room

Nov. 78

Nuclear Power Plant with Heavy Water Reactor (600 MW Class)
Switchgear Building

E 78 1215 Ce


NA-SA
GENERAL PROJECT SCHEDULE ATUCHA II
2009
2008
2010
2009
2010
MILESTONES
A Organization, Procurement and Supplies
B1 Civil Works and Infrastructure
B2 Erection of Houses for Operation Personnel
C1 Electromechanical Installation
C2 500kV Switchgear Yard
D1 Installation of Nuclear Components
D2 Installation of Turbine and Generator
E1 Fabrication of Fuel Elements for the first Core
E2 Production of Heavy Water
F1 Commissioning Software and Personnel Training
F2 Commissioning Operation
G Operation
CRITICAL SUPPLIES
PIPING INSTALLATION
500 kV SWITCHGEAR YARD
FIRST CORE
HEAVY WATER
COMMISSIONING PHASE A