

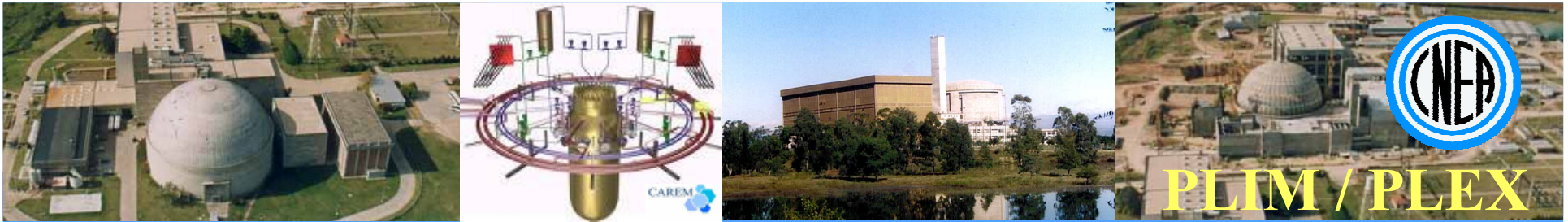
Integrated Plant Life Management for Long Term Operation of Argentinean NPPs

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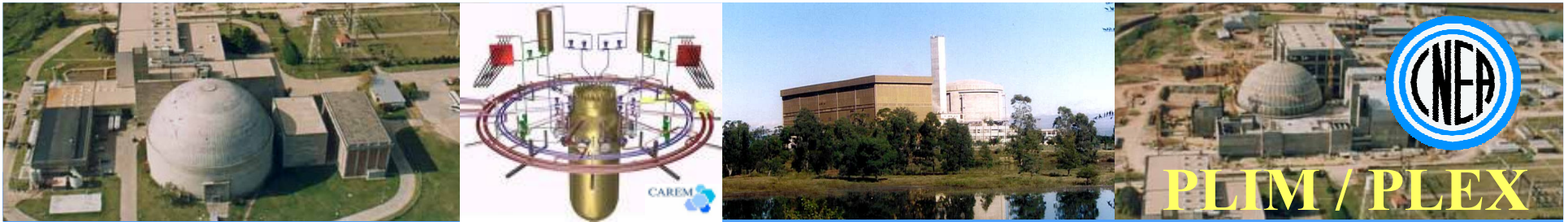


*COMISION NACIONAL
DE ENERGÍA ATÓMICA*

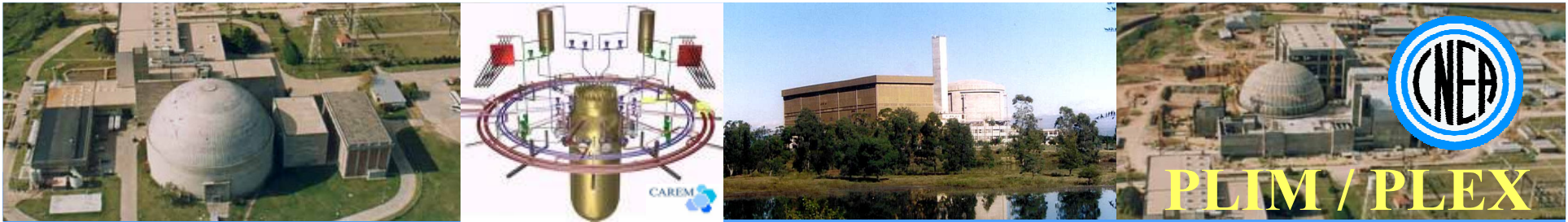


Outline

- Brief description of Argentinean nuclear situation
- Plant Life Management (PLIM) activities in the last four years
- Future Challenges



Brief Description of Argentinean Nuclear Situation

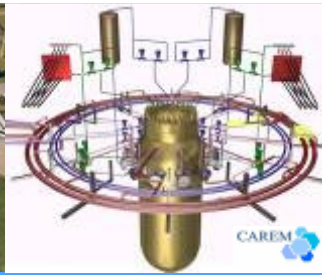


Argentinean Nuclear situation

Argentinean
NPPs

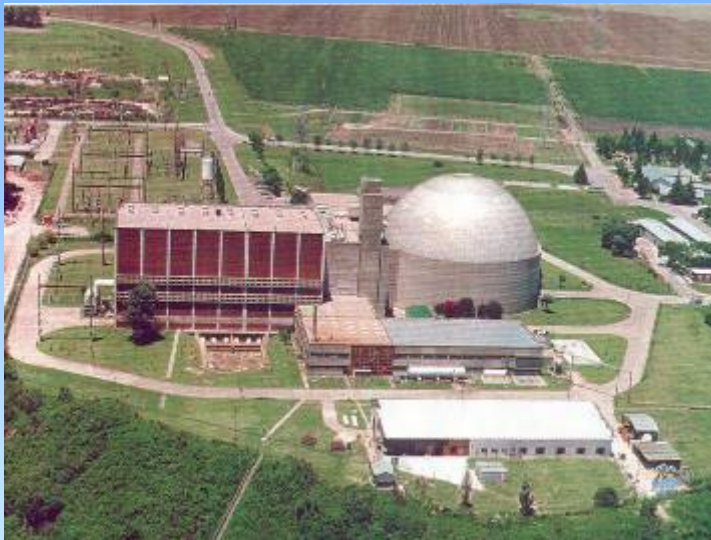
- Two operating NPPs (Atucha I, Embalse)
- One NPP under construction (Atucha II)
- One prototype NPP in design stage (CAREM)

“Different reactors within the country and within the region”
However, we still want to have an integrated view of PLIM for LTO



Argentinean Nuclear situation

Atucha I

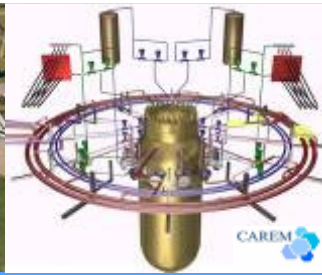


Pressure Vessel – PHWR Unique! (except for Atucha II)

252 vertical fuel channels

In service refuelling

357 Mwe Gross Power



Argentinean Nuclear situation



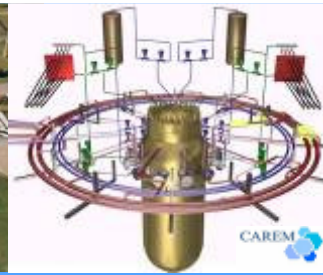
Embalse

PHWR CANDU - 6

380 horizontal Pressure Tubes

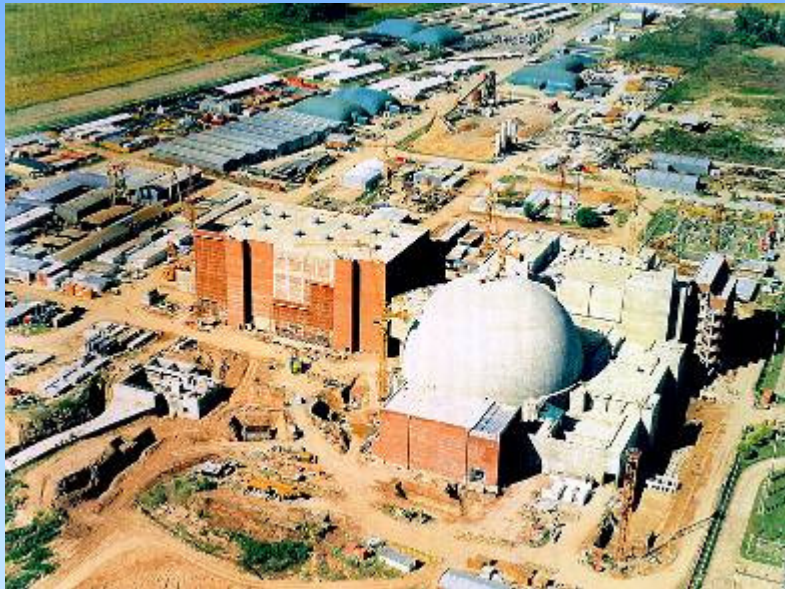
On line refuelling

648 Mwe Gross Power



Argentinean Nuclear situation

Atucha II

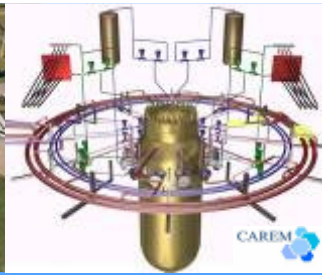


Pressure Vessel - PHWR

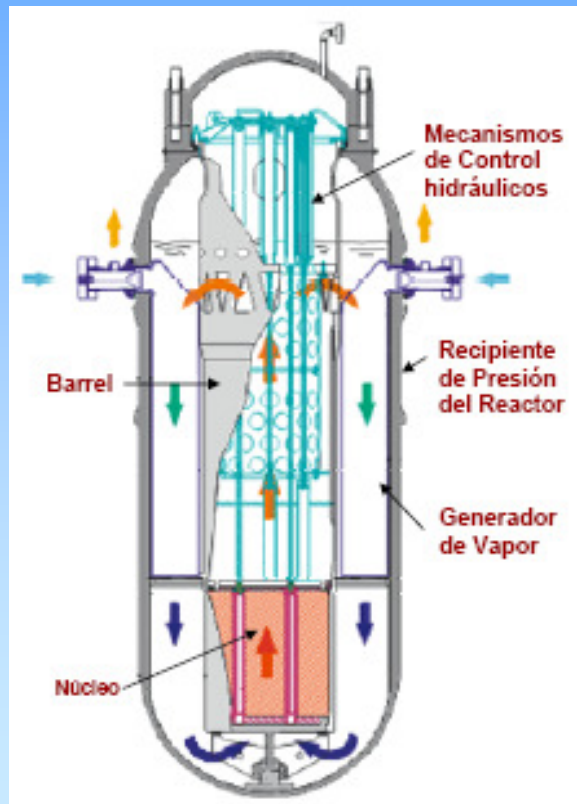
451 fuel channels – On line refuelling

740 Mwe Gross Power

Delayed Construction – Commissioning
expected for 2011



Argentinean Nuclear situation

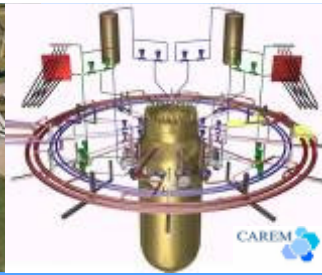


CAREM

Innovative Prototype Reactor - Natural Convection

Integrated Design with In-vessel Steam Generators

25 Mwe Nominal Power - Scalable



PLIM / PLEX

Argentinean Nuclear situation

Key Players



State Owned Utility

Responsible for the O&M of NPPs



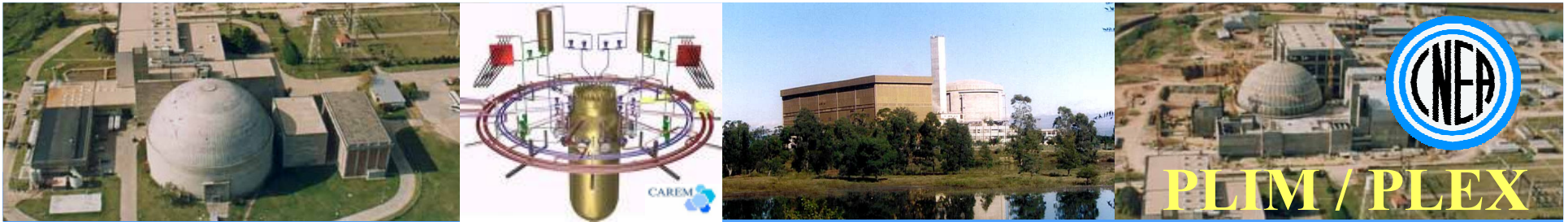
State Owned R&D Institution

Provides technological support to Na-Sa in many aspects



Regulatory Body

National authority for all nuclear facilities in the country



PLIM activities in the last four years (2005 – 2009)



PLIM Activities (2005 – 2009)

PLIM for LTO activities

Embalse Life Extension Project

Along with the Operator (Na-Sa) and the designer (AECL)

Links between NPPs and CNEA labs

Failure root cause and materials analysis

Cable degradation studies

In cooperation with polymers and materials groups, using CNEA irradiation facilities

Development of an integrated approach for Long Term Operation

Started for CAREM reactor. To be developed for Atucha II with the worthy collaboration of IAEA



PLIM Activities (2005 – 2009)

Embalse Life
Extension

Training Course on PLIM methodologies, focused on Plant Life Extension of Embalse NPP. AECL - Canada

Development of procedures and templates for Life Assessments (LAs) and Condition Assessments (CAs)

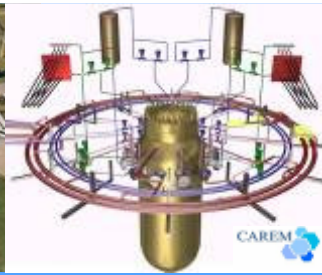
Assessment of SCCs to determine their current condition and to formulate an extended life prognosis

Links
between
NPPs and
CNEA Labs

Several failure analysis have been performed

Electronic components ageing analysis (Atucha II) and polymer fitness for service programs are under development

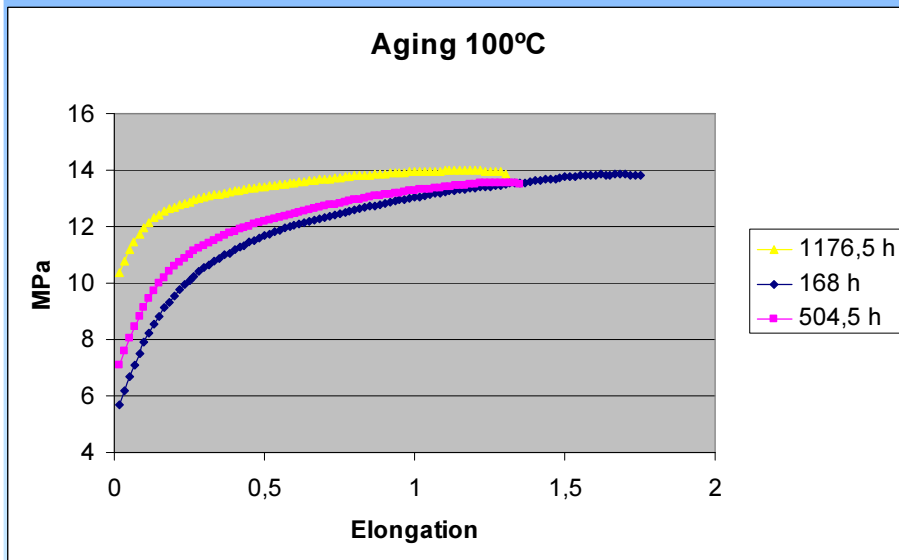
Activity to be promoted in the future, not only for failure analysis but also for materials and equipment reliability programs



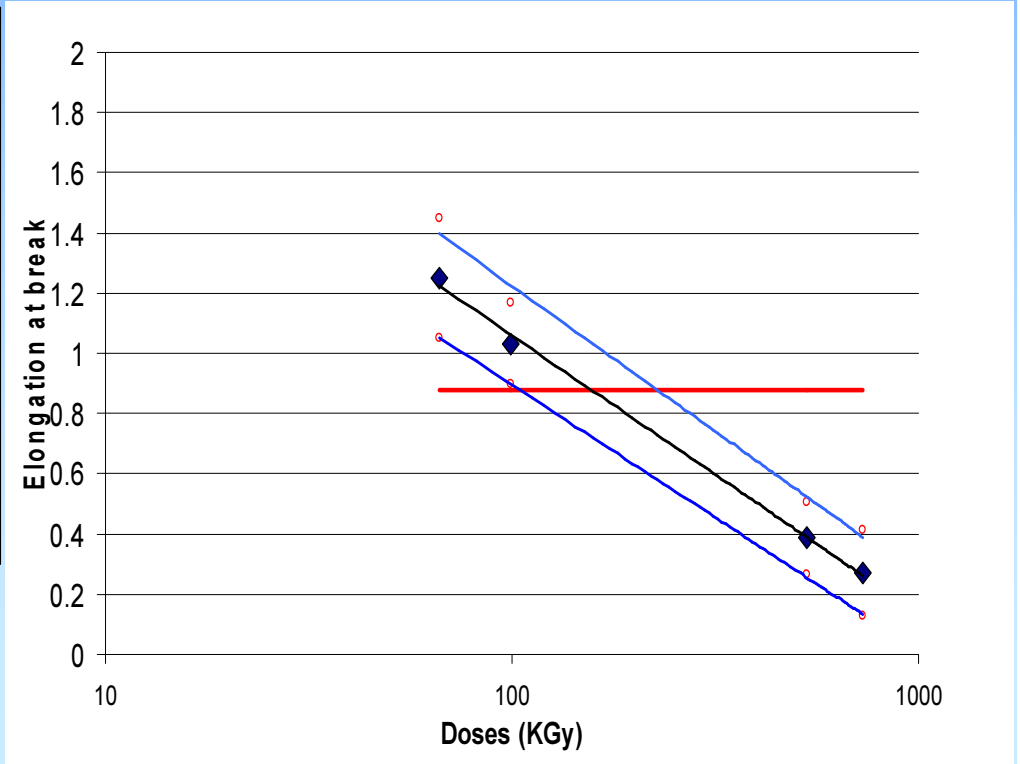
PLIM / PLEX

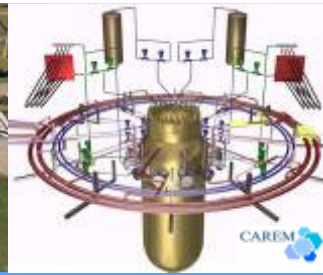
Cable Ageing Studies

Radiation Damage: “Equal dose – equal damage” (IEEE 775)



Thermal Damage: *Arrhenius Law*
(IEEE 98)





Cable Ageing Studies

Our Activities

Material characterization of stored and in-service cables

Thermal endurance properties of stored cables

- Activation energy
- Plastizer lost
- Elongation at break

Radiation damage studies for fuelling machine cables

Cable Aging Management Program including disposition of samples on site for future testing

Participation on SCAP Project as observers and, hopefully, as full members



PLIM Activities (2005 – 2009)

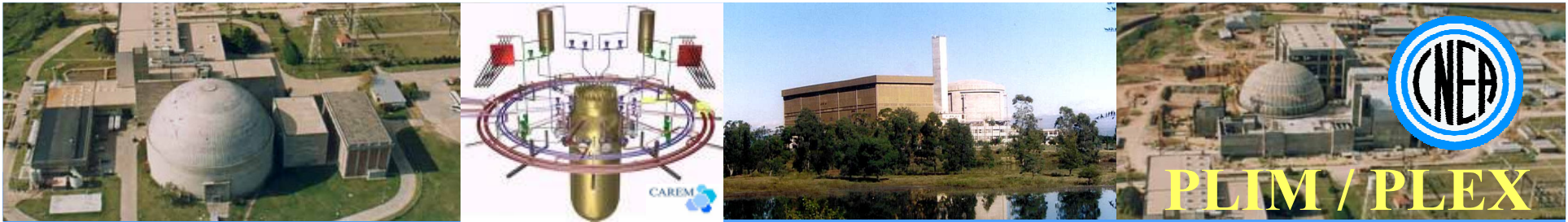
Development
of an
integrated
approach for
Long Term
Operation

Already started for CAREM reactor and conversations are being held with Atucha I, who is enfacing the build-up of their own PLIM department

To be completed for Atucha II with IAEA collaboration through Technical Cooperation Program ARG/4/093

A single approach will be very beneficial, but should take into account the stage in which the plant is; among other plant-specific needs

Objective: To have in place a program that allows us to operate our plants for the longest possible time in a safe and reliable way



Integrated Approach for LTO

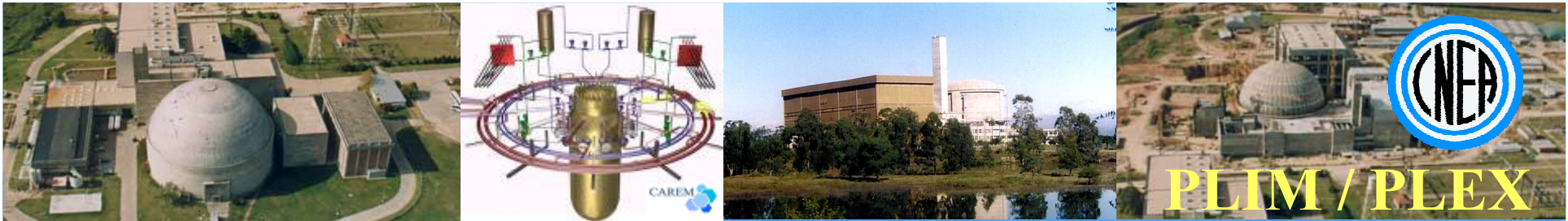
Current Status

The project is under development

Argentinean NPPs are to integrate all Maintenance, Surveillance and Inspection (MSI) activities into AMPs

Once finished, it will be applicable to all NPPs including Embalse second operational cycle.

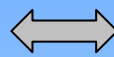
Powerful tool in case of switching from time limited license to Periodic Safety Review (PSR) regulatory approach



Plant Life Management for Long Term Operation

System Engineering

Functions and operational conditions. SSCs Screening



Component Engineering

Technological aspects of prioritized SCCs



ARDM-NDT Management
Materials degradation, Fracture Mechanics-Fatigue, NDT techniques

ARDM management programs

SSC: Systems, Structures and Components
ARDM: Ageing Related Degradation Mechanism

Ageing Management Programs (AMPs) of prioritized SSCs

- Pressure Vessel and Internals
- Reactor building concrete structures
- Steam Generators
- Pumps and Heat Exchangers
- Pipelines and Supports
- Cables -
- Etc.

Design codes and regulatory aspects

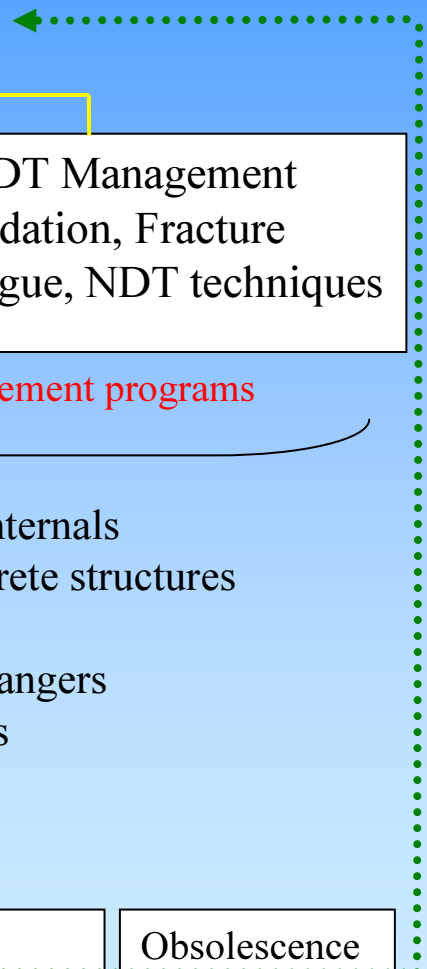
Maintenance Surveillance and Inspections

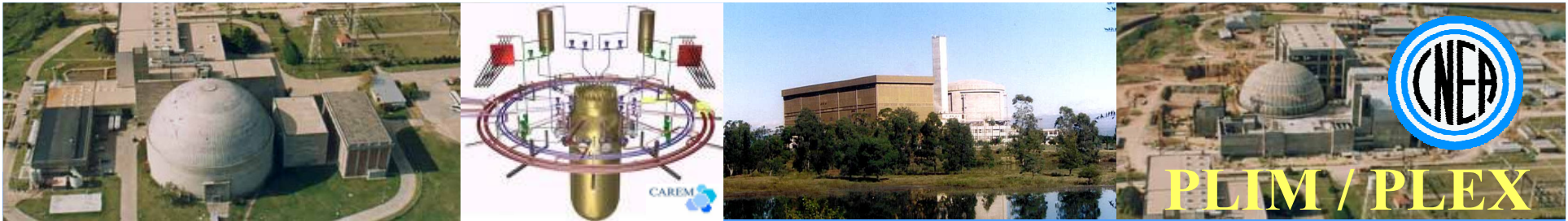
Environmental Qualification (EQ)

Quality Assurance

R&D and Operational Experience

Obsolescence Technological Update

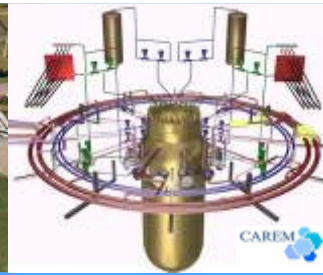




Integrated Approach for LTO

Program Stages

1. Design Review and Screening of major System, Structures and Components (SSCs)
2. Development of a Generic Ageing Knowledge-base and related reference material
3. Analysis and /or design of specific Ageing Management Programs (AMPs)
4. Determination of measurable Program Performance Indicators. AMP evaluation and feedback



Integrated Approach for LTO

Stage 1

Design
Review and
Screening of
SCCs

Design review focused on Long Term Operation very valuable for CAREM reactor, which is in design stage

Originally thought as an Experience-based Screening. Studies started to include PSA results for Atucha II

The output of the screening process are the SCCs that will be included within the AMPs

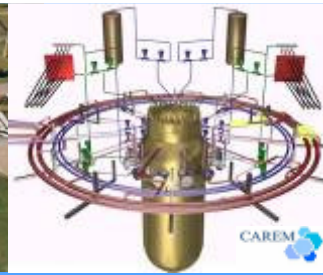
Stage 2

Reference
Material and
Generic
Ageing
Knowledge-
base

Generic and Training Material:

- Materials & Degradation Mechanisms in NPPs
- Training course for NPP personnel

Operational Experience: Home experience and AMPs used around the world



Integrated Approach for LTO

Stage 3

Design and
implementation
of specific
AMPs

More than 20 years of O&M experience

Preventive, Predictive, Corrective Maintenance and In-service inspections have been managed without an integrated view

Plenty of results to be integrated from a Long Term Operation stand point

Stage 4

Program
Performance
Indicators,
Evaluation and
Feedback

Each AMP has its own parameters

To include currently analyzed parameters, such as vibrations, heat exchanger tube plugging rate, temperature trends, etc.

External experience to be used as a reference and for comparison proposes

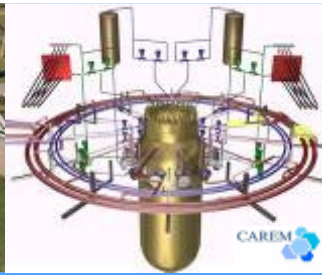


PLIM / PLEX

Information processing for a given SSC

- Study of Materials and Environment

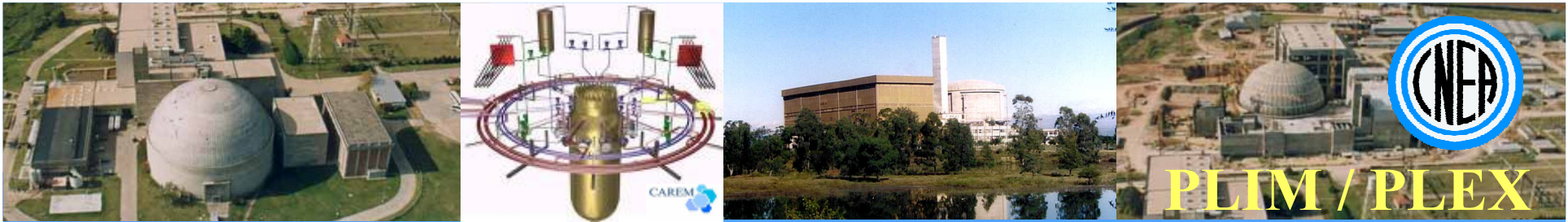
Group Name	Subcomponents	Material	Environment
Tubes	Tubes	Alloy 800	Heavy water (inner) / High pressure service water (outer)
Shell & shell side nozzles	Shell	Carbon steel SA-516 Gr 70	High pressure service water
	Shell inlet & outlet nozzles	Body: Low alloy (Cr, Ni, Mo, V) steel SA-106-B. Flanges: Carbon steel SA-105.	
	Shell vent & drain nozzles	Low alloy (Cr, Ni, Mo, V) steel SA-106-B	
	Shell end flange	Inconel overlaid carbon steel SA-105	
Etc.			



PLIM / PLEX

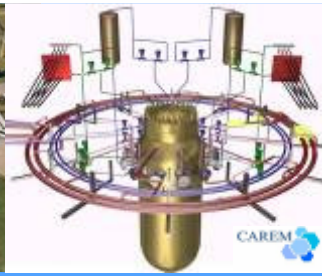
- Comparison of MSI practices

		Subcomponents						
Recommended MSI practices		Tubes	Tubesheet	Shell and shell side nozzles	Shell side internals	Channel cover assy.	Important bolts and nuts	External supports
	Leak detection	X	X			X		
		Yes	Yes			Yes		
	Visual inspections		X	X	X	X	X	X
			Yes	Yes	Partially	Yes	Yes	Partially
	Pressure test			X		X		
			NO		NO			
Etc.								



Future Challenges

- To define the scope of aging related parameters for the baseline inspection of Atucha II
- To systematize the collection and analysis of aging relevant information
- To customize experimental facilities to perform cable tests under LOCA conditions (some valves have already been tested)



**Many Thanks for your
Attention!!**