



JOSÉ CABRERA NPP

DISMANTLING & DECOMMISSIONING PROJECT

WORKING GROUP ON RADIOLOGICAL PROTECTION ASPECTS
OF DECOMMISSIONING ACTIVITIES AT NPPS
(WGDECOM)

2017, April 27th

Manuel Ondaro (Site Director)

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3.- Characteristics

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1.- Background

General Information - Enresa

State OWNED Company - RD 1984

Duties:

- **The management of all RadW - SPAIN**
- **The DECOMM of Nuclear Installations**

Framework:

Responsible for managing funds and liabilities, in accordance with a periodical modification of the ‘General RadW Plan**’ approved by the Government (Ministry of Energy).**



General Information - Enresa



High Level Waste (HLW)



Dismantling of Nuclear Installations



Very Low Level Wastes (VLLW) and Low and Intermediate Level Wastes (LILW)

General Information - Enresa

EI CABRIL

It's the disposal center for radioactive wastes:

- VLLW – I&LLW
- Located in Cordoba province

In this facility are disposed all the RadW arising from hospitals, research centers and nuclear facilities.



University Research Reactor - Dismantling



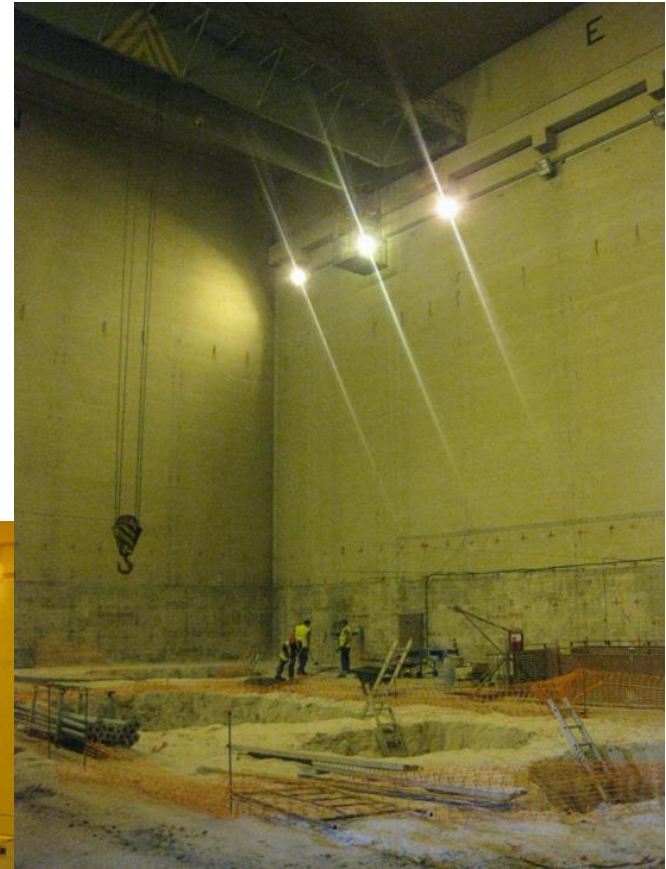
ARBI

ARGOS



PIMIC Project

REACTOR BUILDING



Vandellós-1 NPP Decomm Status





2.- International Approach

Spanish Framework – International Context

You NEED...

Spain

International Context

- **Competent Company for managing & Supervising D&D Projects**

Enresa's duties:

- RAD Management
- D&D Activities

As general rule... Each company carry out by itself the D&D activities

- **Financial Aspects**

- Enresa's Fund
- Collect in advance during Operation

Many countries... Each owner collect in advance the fundings. Not always this aspect is guaranted

- **Management & Store of RadW**

- El Cabril (RBMA-RBBA)
- ATI – ATC (VLLW-ILLW)

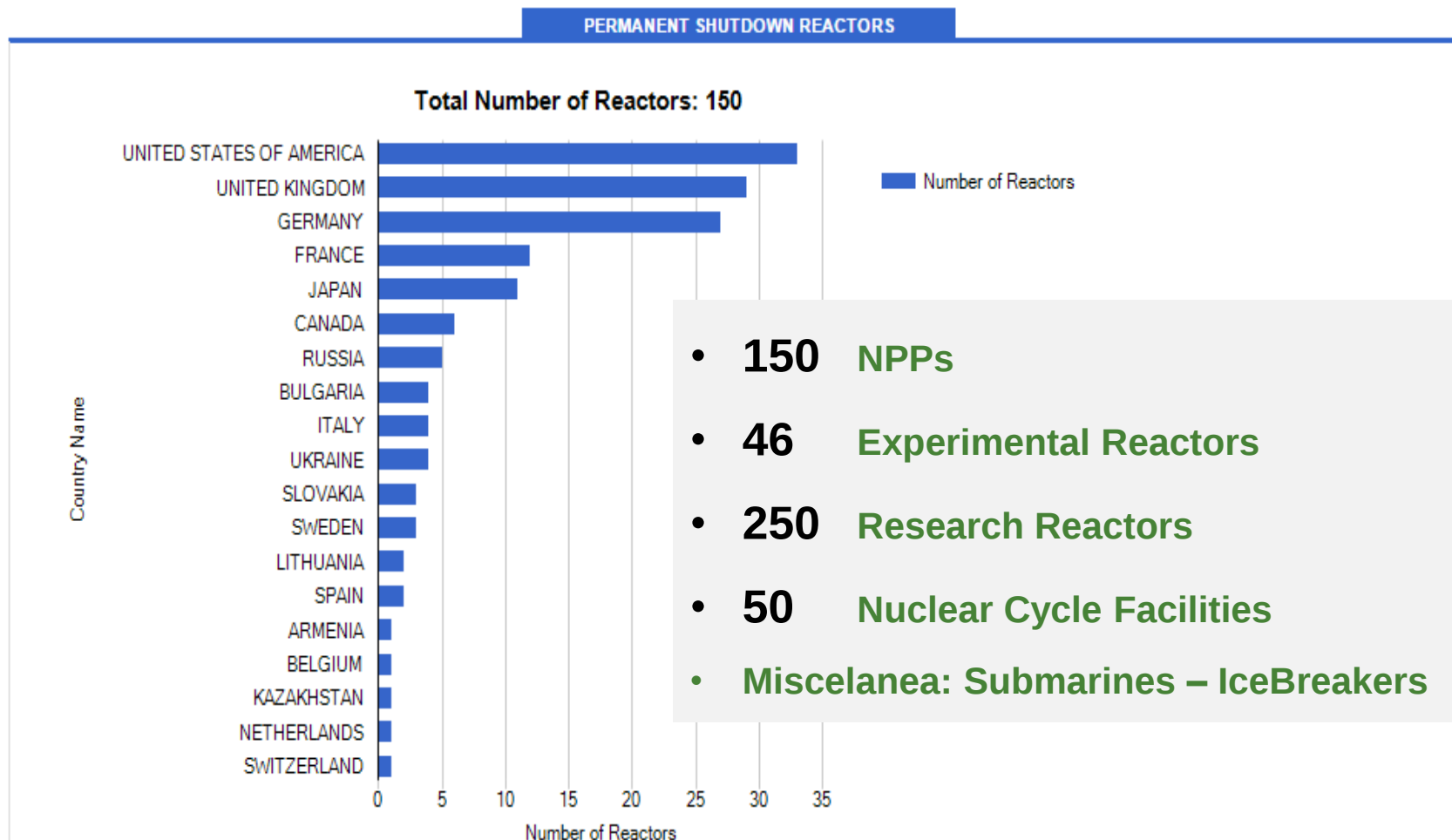
Many countries have not Final RadW Disposal facilities. Some of them have permit to manage Major components without Segmentation. Unique piece.

- **Regulatory Aspects**

- NIRD – GRadWP Authorization
- Transfer + Clousure

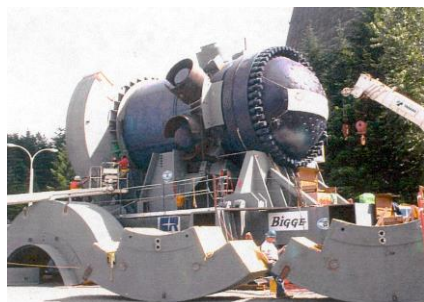
Many contries have not an appropriate Regulatory FrameWork.

PERMANENT SHUTDOWN REACTORS

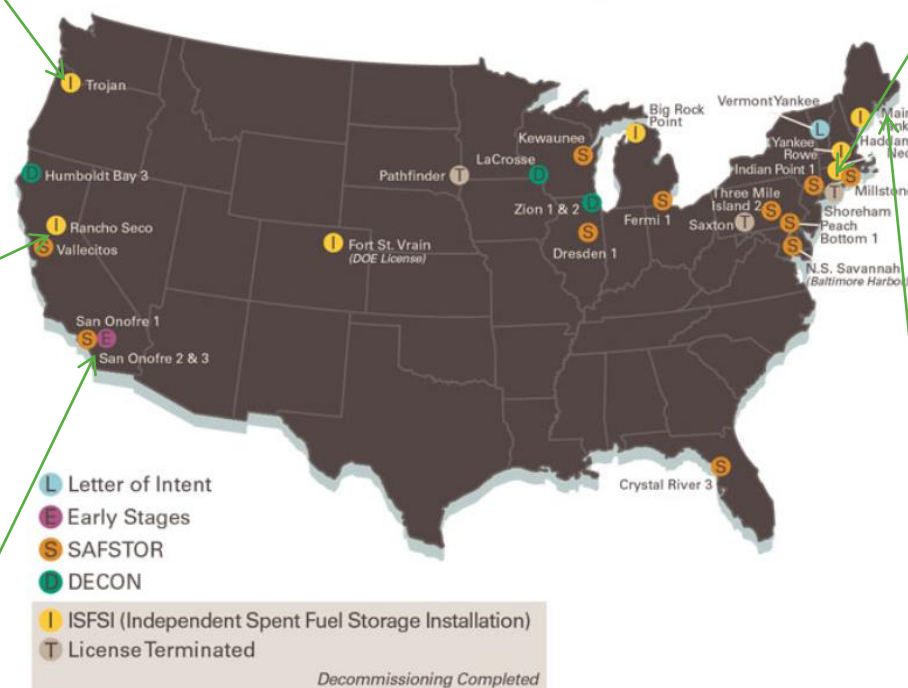


Among 10-20 NPPs have been totally dismantled – Most of them in USA

Finished Projects - USA



Power Reactors Decommissioning Status



Notes: GE Bonus, CVTR, Elk River, Hallam, Piqua, and Shippingport are part of the DOE legacy reactors. For more information contact DOE/NNSA at www.doe.nnsa.gov.



3.- Characteristics

Project Objectives

- 1 The Complete dismantling of the nuclear site (first time in Spain)
- 2 To manage properly the resulting materials

Dismantling is the best way for controlling the risk at any NPP after operation period



1

2



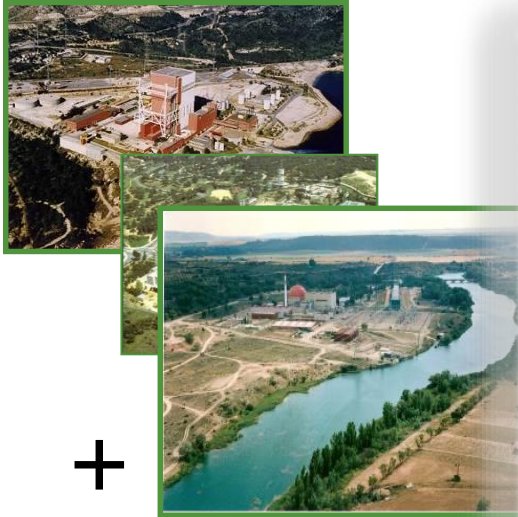
ALTERNATIVE

Immediate **TOTAL** DISMANTLING

Materials Management Philosophy

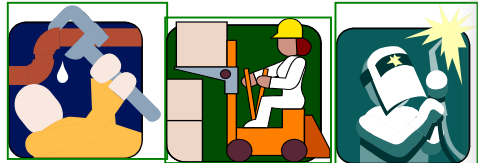
Inputs

RAW MATERIAL



+

PRODUCTION RESOURCES



Implementation

PROCESS

- 1.- Tech. Specifications
- 2.- Contractors
- 3.- Cutting - Segmentation
- 4.- Procedures
- 5.- Organization
- 6.- Responsibilities
- 7.- Characterization
- 8.- Logistics + Expeditions
- 9.- Conditioning
- 10.- Restoration

Outputs



+

MATERIALS



Dismantling IS NOT A DEMOLITION
INDUSTRIAL PROCESS

Decommissioning – Key Pillars - Viability

Phases & Progress



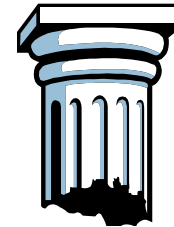
Technical Project

- Tech. Specs.
- Requeriments
- Methods
- Analysis
- Selection
- Conclusion
- Award



Organization On Site

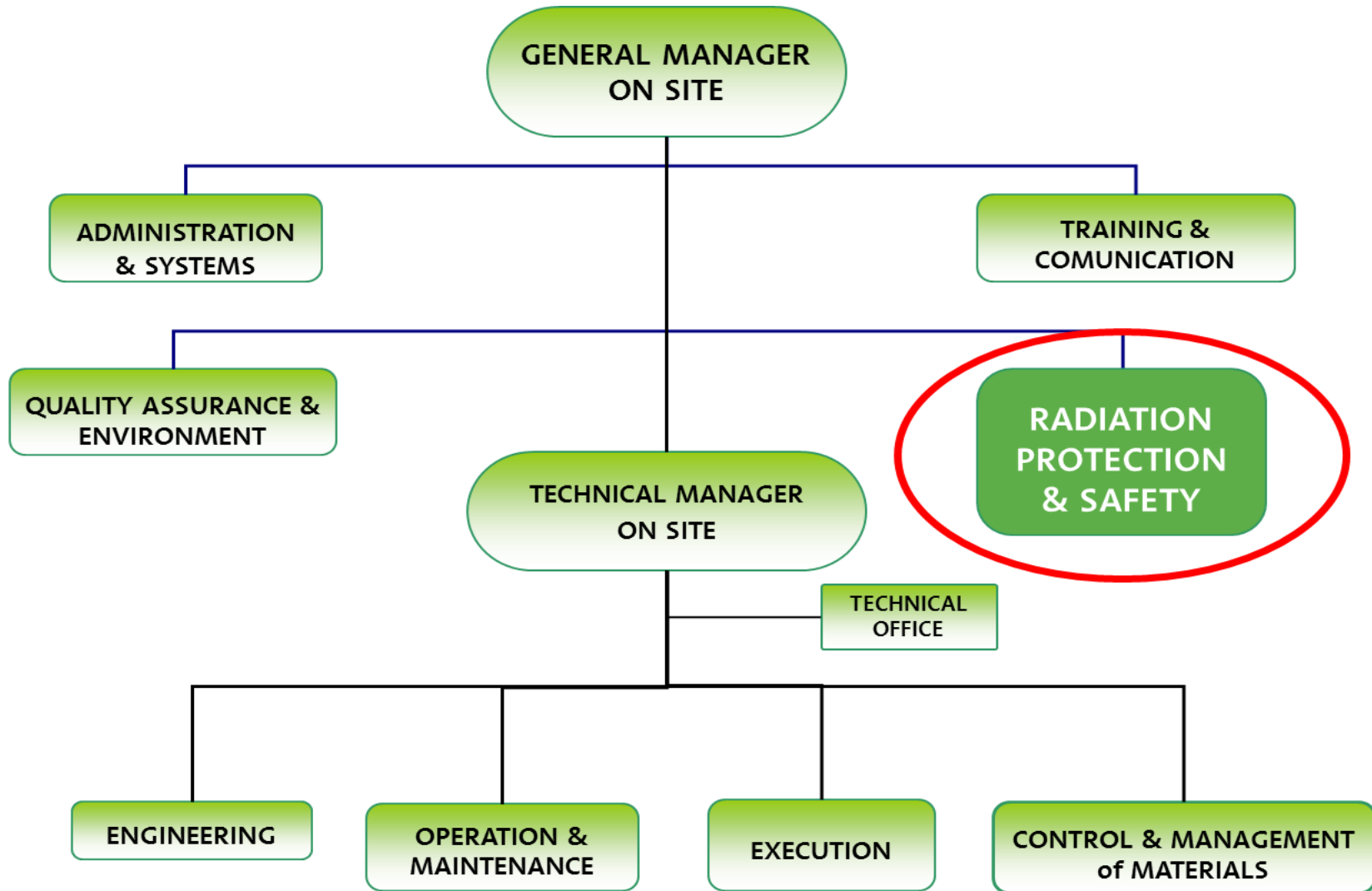
- Contract
- Planning
- Requeriments
- Responsibilities
- Execution
- Documentation



Results

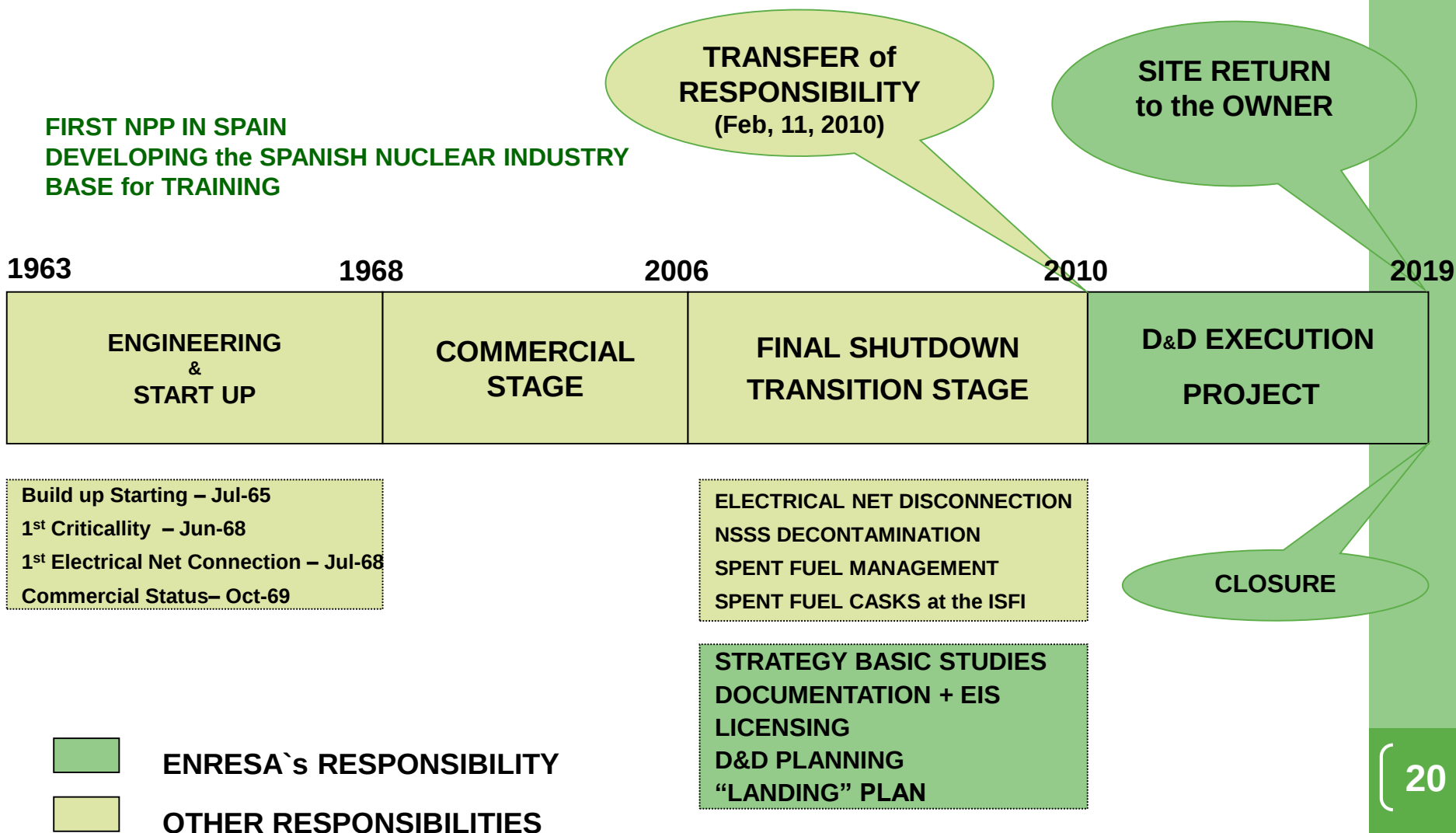
- Conclusions
- Key Points
- Lessons
- Aid New Works

Organization & Management



HISTORY – LIFE CYCLE

**FIRST NPP IN SPAIN
DEVELOPING the SPANISH NUCLEAR INDUSTRY
BASE for TRAINING**



INSTALLATION MAIN DATA

Type: Westinghouse - 1-Loop PWR

Net Electrical Power: 160 MWe

Net Thermal Power: 510 MW_{th}

Fuel Elements: 69 – 14x14

Fuel Type: UO₂ – enrichment 3,6% (U-235)

Mass UO₂ (core) 20,76 t

Control Rod (Banks): 17

Reactor Vessel (Diameter): 2,82 m

Reactor Vessel (Height without Head): 5,87 m

NSSS (Diameter): 70 cm

Containment:

Reinforced concrete

Stainless Steel Head

Spent Fuel Pool:

In Containment

Final cooling:

Tajo River



PHASE 0 – REMOVAL of FUEL & PRELIMINARY WORKS – 100%

PHASE 1 – PREPARATORY ACTIVITIES – 100%

PHASE 2 – DISMANTLING of MAJOR RAD COMPONENTS – 100%

PHASE 3 – DECONTAMINATION – RELEASE & DEMOLITIONS – 20%

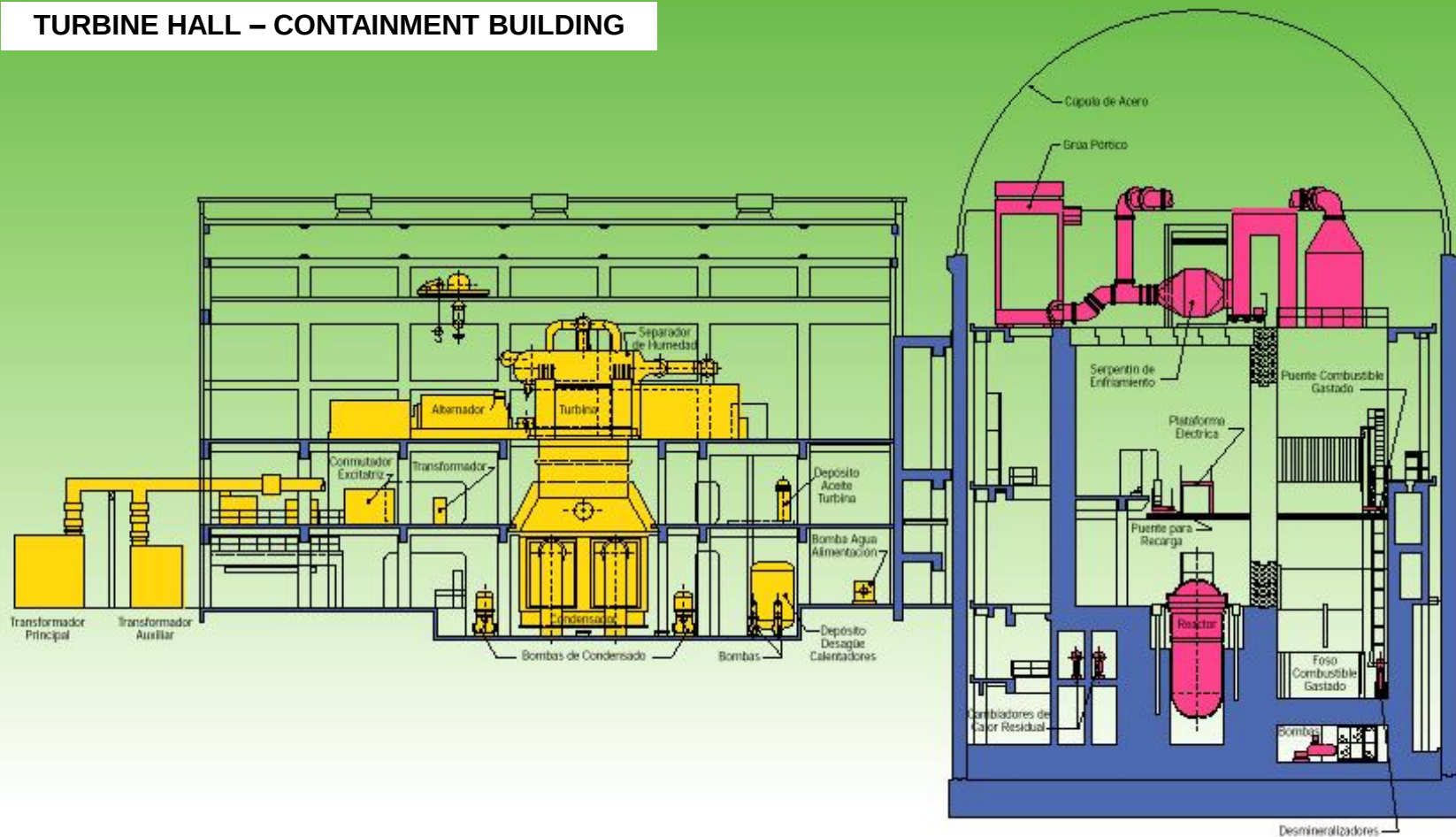
PHASE 4 – ENVIRONMENTAL RESTORATION – 5%

CONSTRUCTION WORKS



INSTALLATION MAIN CROSS SECTION

TURBINE HALL – CONTAINMENT BUILDING



4.- Works

**Transfer
Authorization**

Characterization

Adaptations

Dismantling

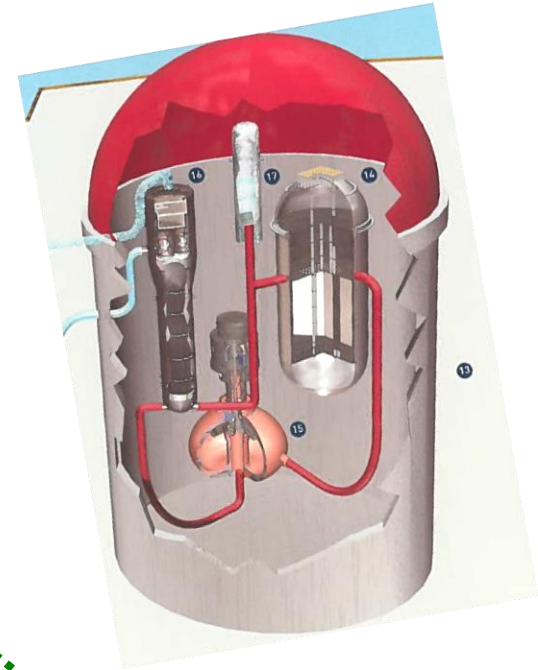
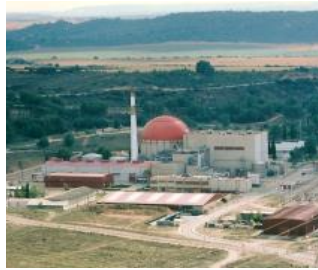
Decontamination

Release Process

Demolitions

Restoration

Materials Management



Closure

THE PROJECT – Video (1/5)



DISMANTLING OF THE JOSÉ CABRERA NUCLEAR POWER PLANT

Video 1

(26)

Works 2016 – Video (2/5)



Video 2

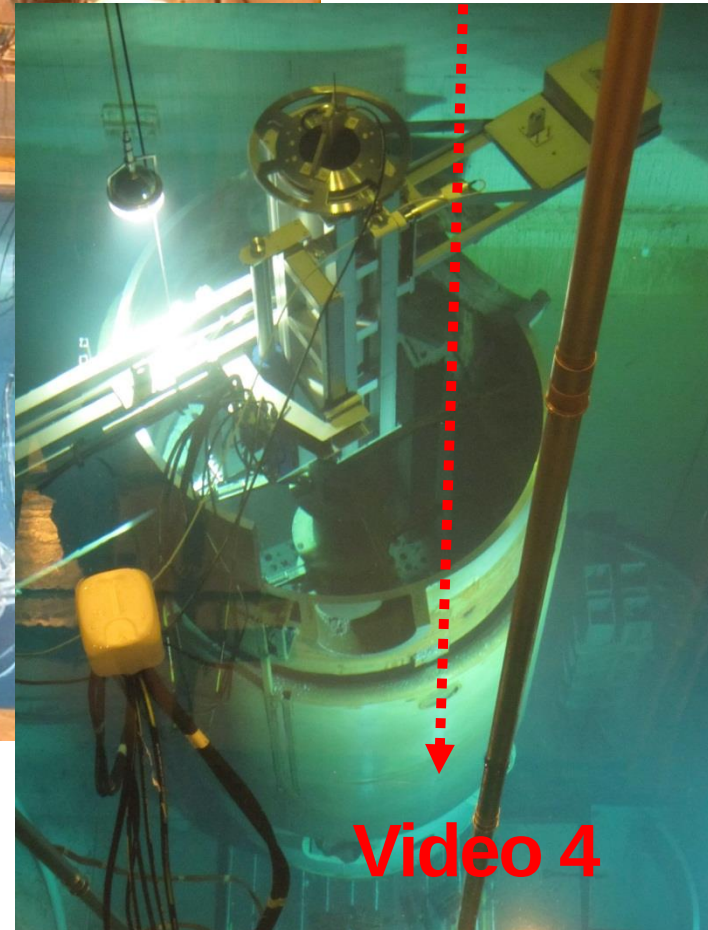
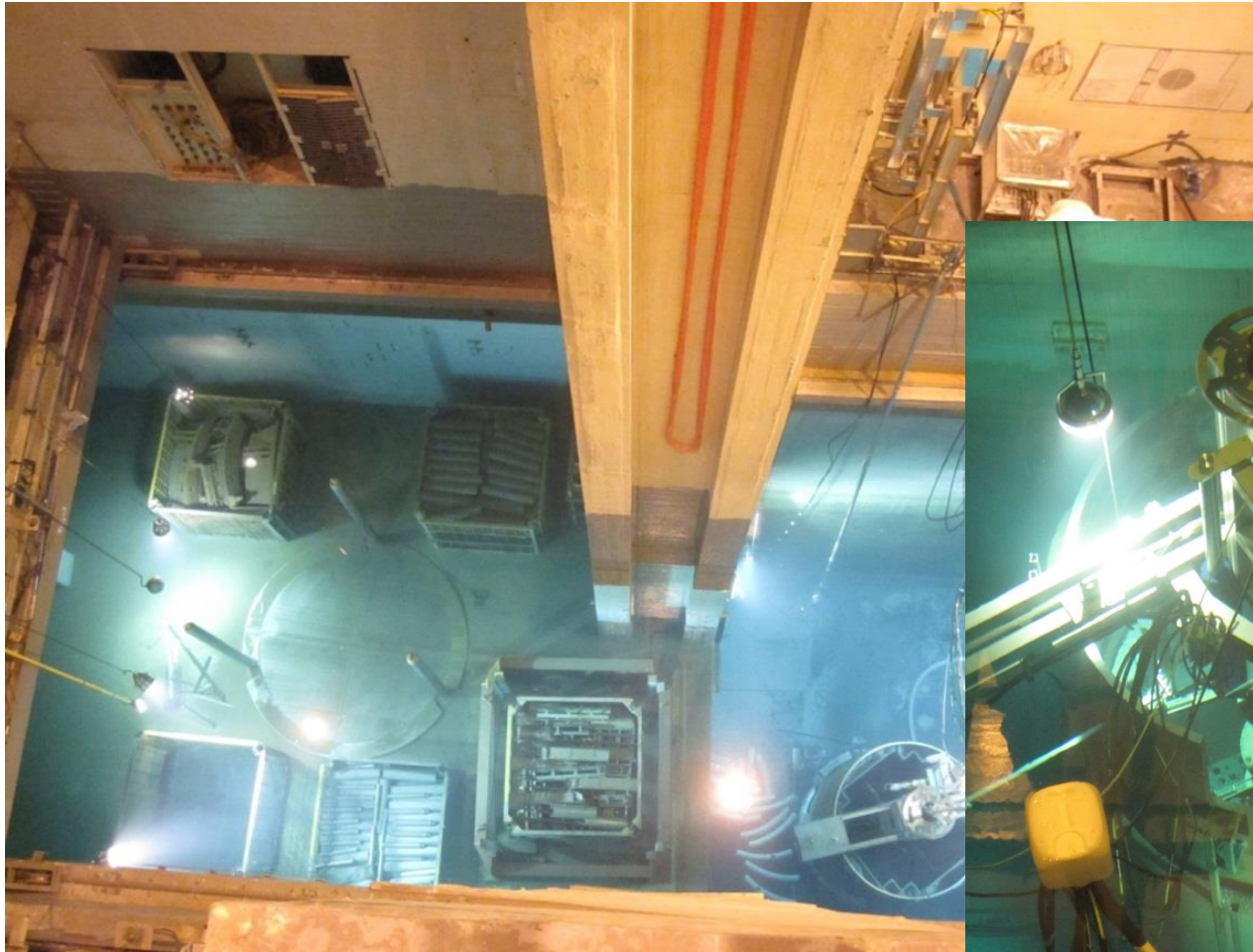
Works 2016 – Video (3/5)



Video 3

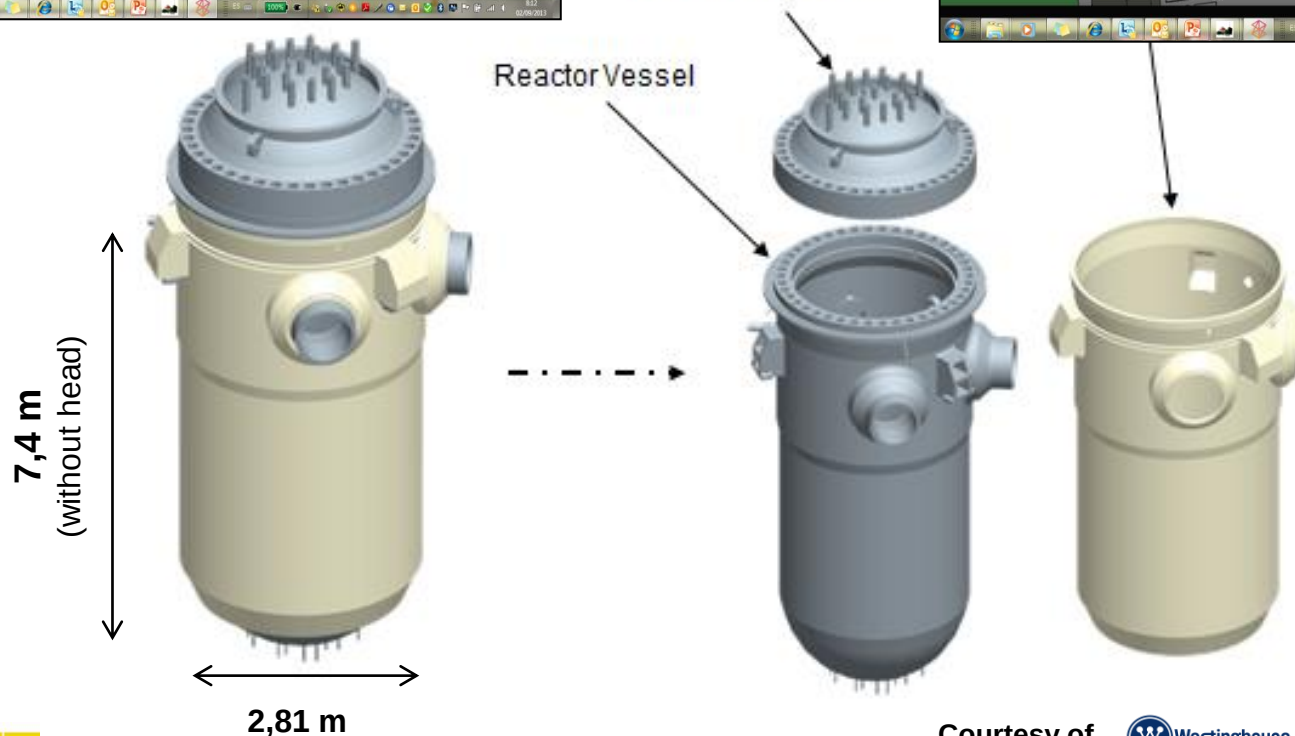
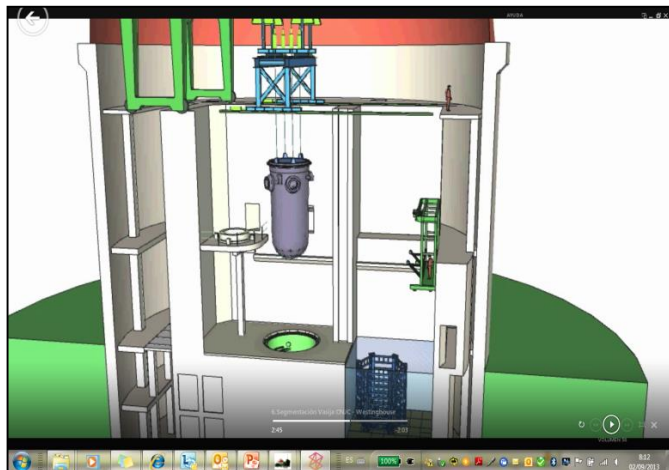


Reactor Internals Segmentation – Works – Video (4/5)



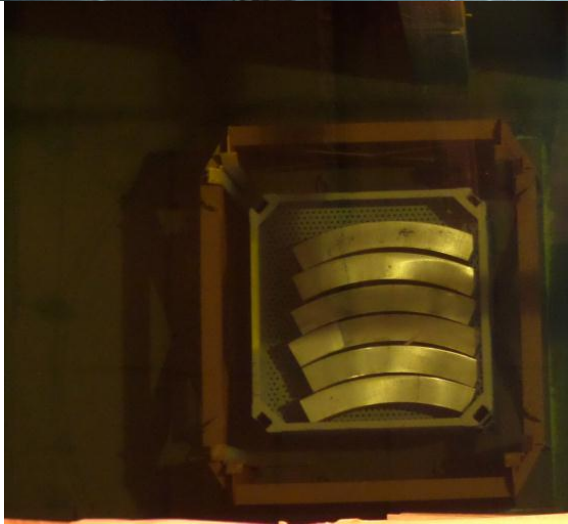
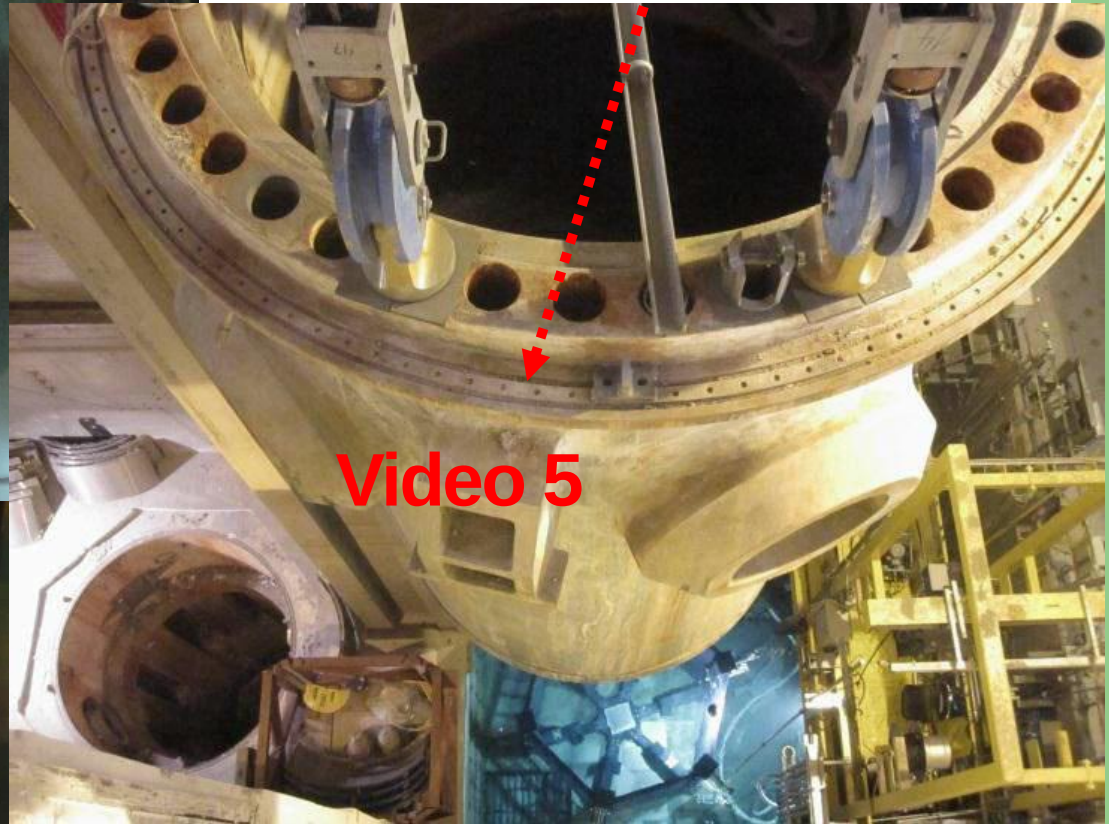
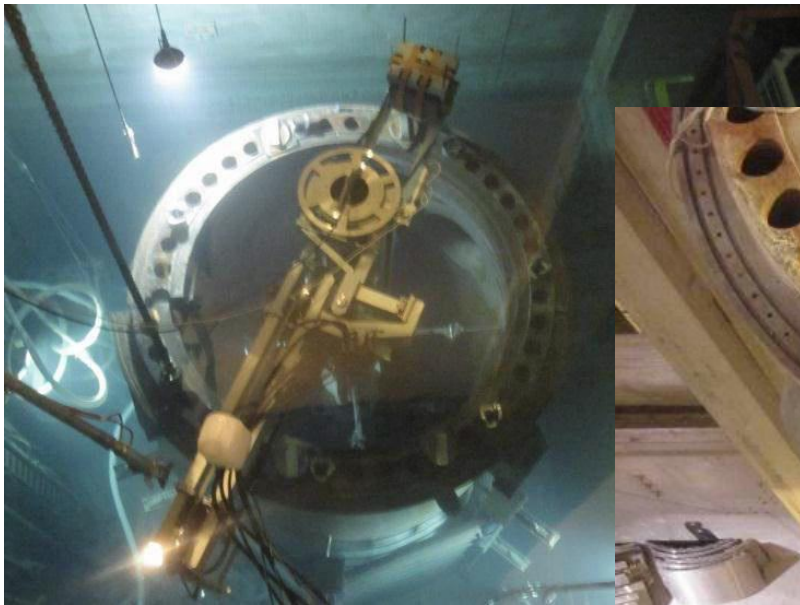
Video 4

RPV Segmentation Scope – Major Components



Courtesy of  Westinghouse

Pressure Vessel Segmentation – Works - Video (5/5)



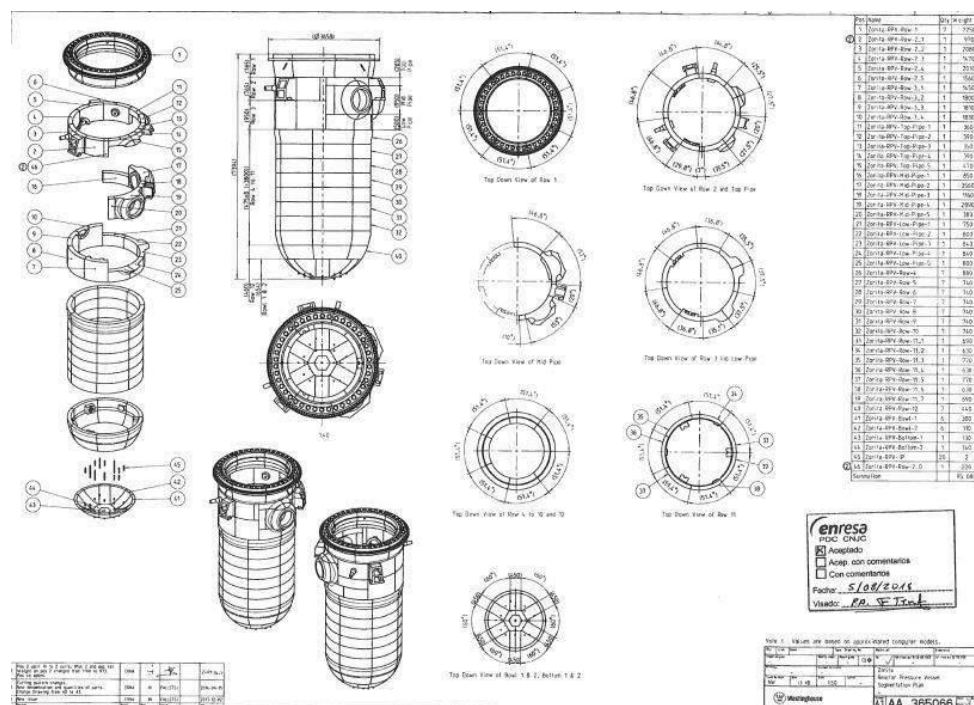
Pressure Vessel Segmentation – Results (1/2)



Materials Generation

Main Data

- 172 m of CUTTINGS
- 95 tons
- 120 pieces
- 7 CE-2a
- 8 CE-2b



Pressure Vessel Segmentation – Results (2/2)

ACTIVITIES	2013				2014				2015			
	1 ^{er} T	2 ^o T	3 ^{er} T	4 ^o T	1 ^{er} T	2 ^o T	3 ^{er} T	4 ^o T	1 ^{er} T	2 ^o T	3 ^{er} T	4 ^o T
ENGINEERING - TESTS & PREPARATORY ACTIVITIES												
Scheduled												
Real												
VESSEL SEGMENTATION												
Scheduled												
Real												

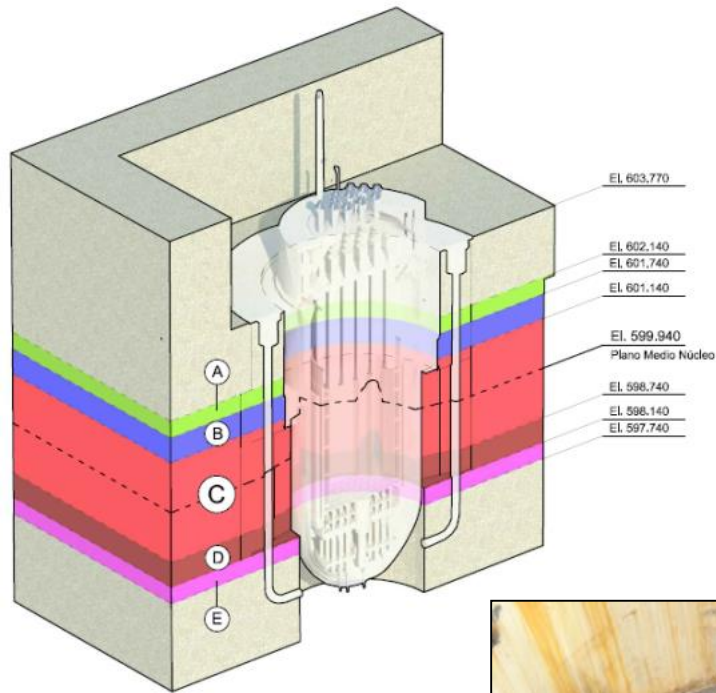
INITIAL vs FINAL - COLLECTIVE DOSE

Preparatory Activities	660 vs 199,1 mSv.p
Segmentation	392 vs 27,8 mSv.p
TOTAL	10,5E2 vs 2,27 E2 mSv.p

≈ - 80 %

(33)

REMOVAL OF ACTIVATED CONCRETE DECONTAMINATION OF CAVITIES (2015-2016)



1.- Segmentation of contaminated walls from:

1. Reactor Area
2. Spent Fuel Zone

- 2.- Activated Biological Shield removal
- 3.- Soil scarification

FASE 1 – ACTUACIONES

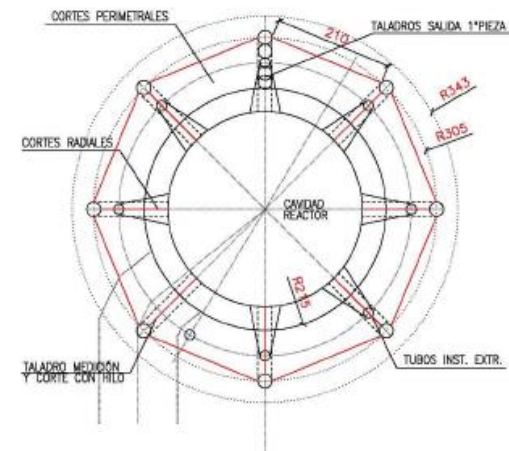


Diagram illustrating the assembly of a 3D structure, showing various components and their labels:

- 8 PIEZAS PARED S SUP (PISC)
- 8 PIEZAS PARED S INF (PISC)
- 8 PIEZAS PARED N (PISC)
- 8 PIEZAS PARED E SUP (PISC)
- 8 PIEZAS PARED E INF (PISC)
- 8 PIEZAS PARED S1 (PISC)
- 8 PIEZAS PARED E1 (PISC)
- 8 PIEZAS PARED O SUP (ICR)
- 8 PIEZAS PARED O (ICR)
- 8 PIEZAS PARED O1 (ICR)
- 8 PIEZAS PARED N1 (ICR)
- 8 PIEZAS PARED E1 (ICR)



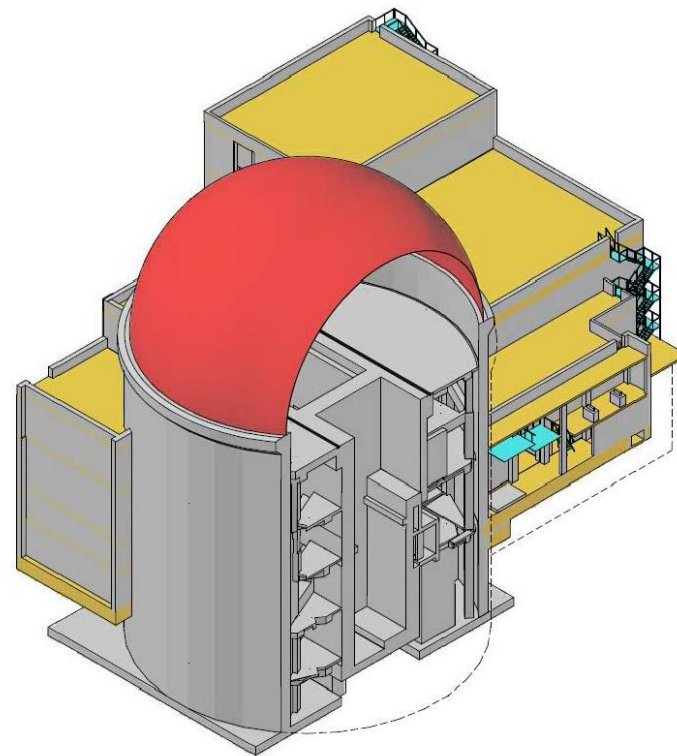
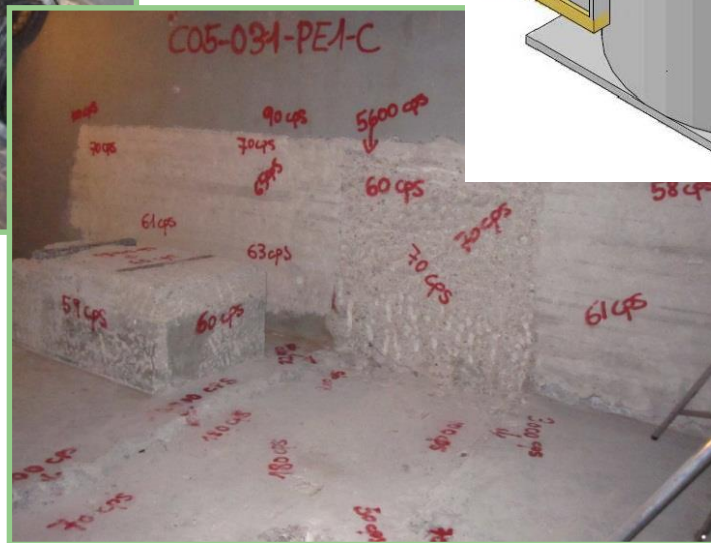
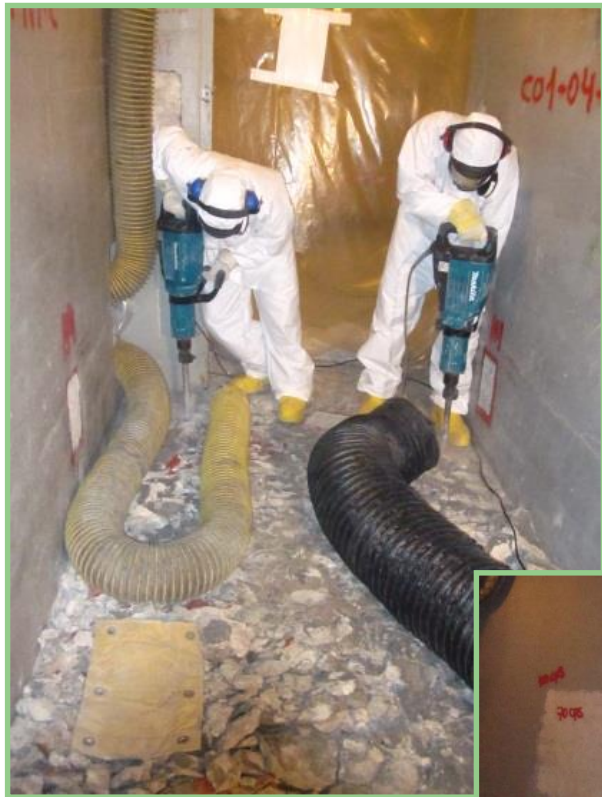
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REACTOR CAVITY + SPENT FUEL POOL

DECON WORKSHOP – LESSONS LEARNED



SURFACES & STRUCTURES DECONTAMINATION



Soils Decontamination & Clean Up Facility



Soils Decontamination Clean Up Facility



Soils Decontamination Clean Up Facility



5.- Data & Conclusions

MATERIALS MANAGEMENT

≈ 104.000 tons

Initial Situation



95.300 t

Concrete & Demolitions



Spent Fuel



175 t

Conventional Scraps



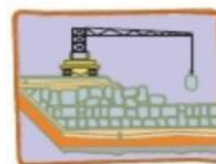
4.700 t

Recycling



Small Quantities

Toxic & Hazardous



Controlled LandFill

RadW



4.000 t

4% - Radioactive Waste Management

12 HI-STORM

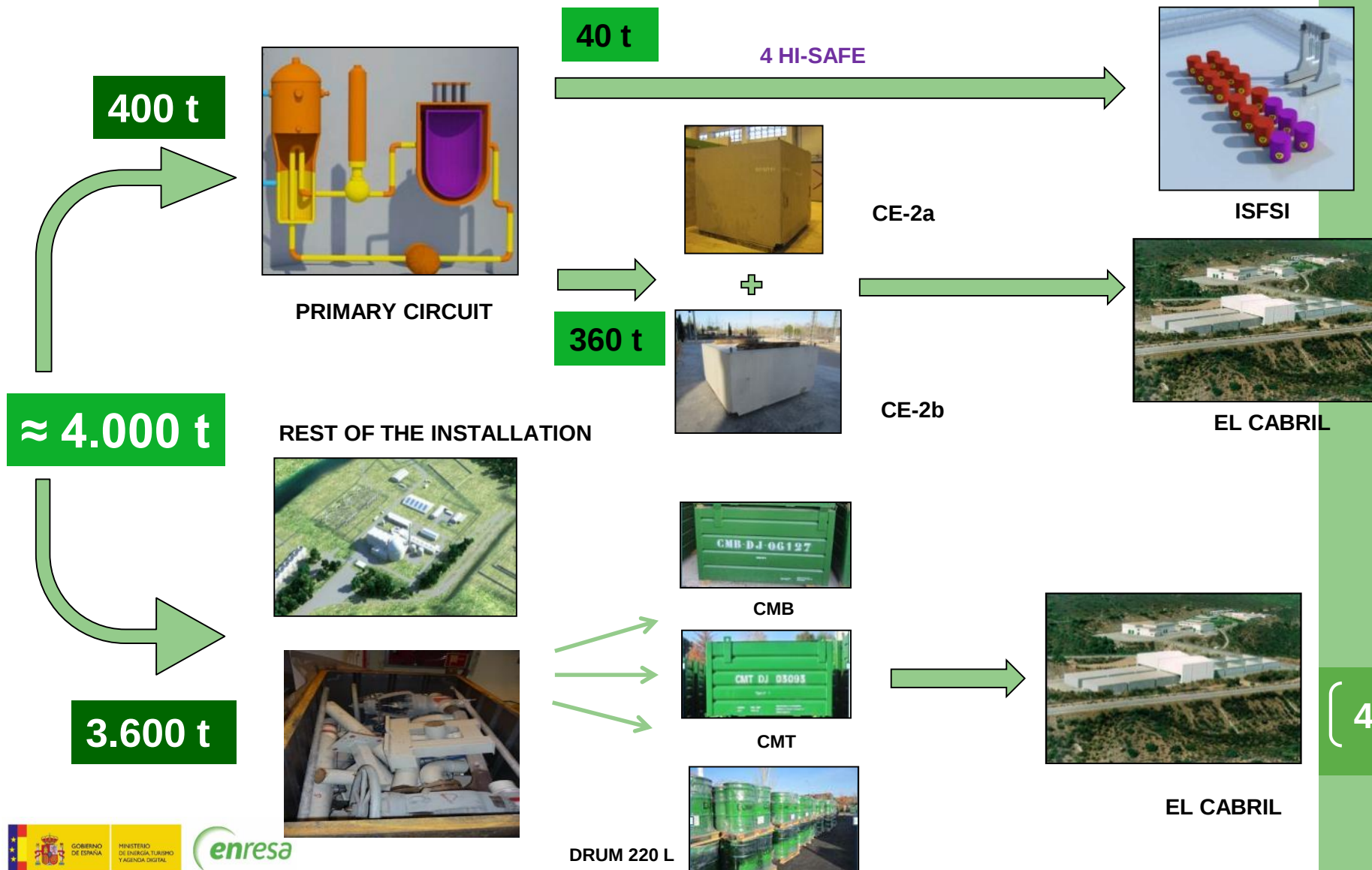


All the materials have a final destination



Final Status

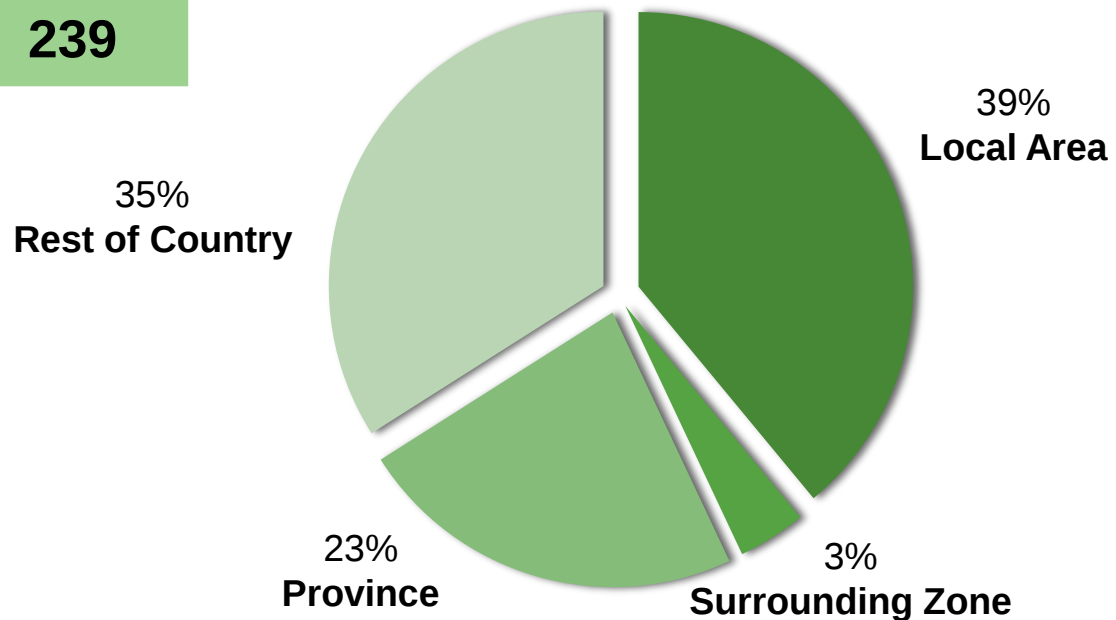
RADIOACTIVE MATERIALS MANAGEMENT



Human Resources

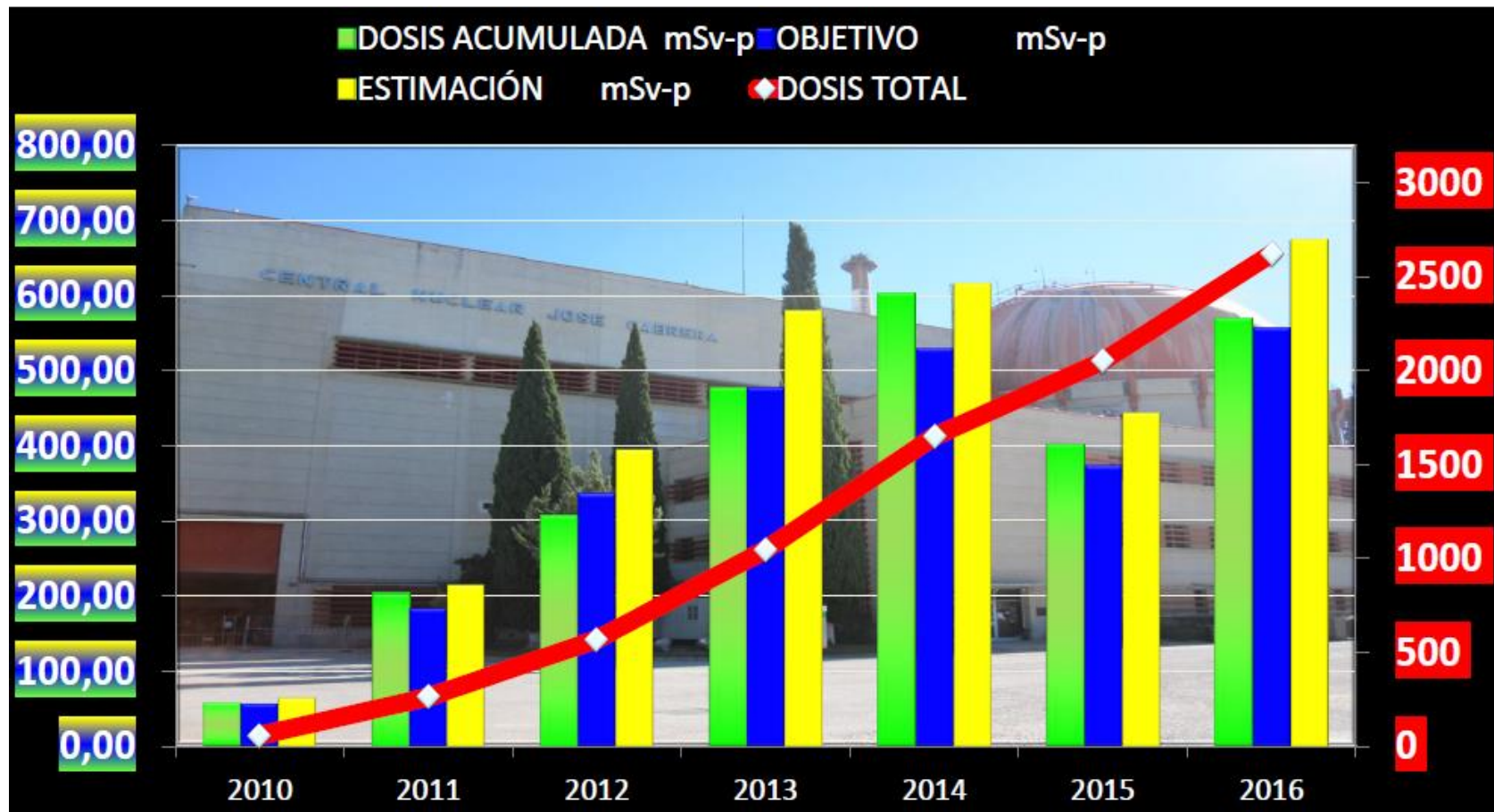
Local Area	94
Surrounding Zone	8
Province	54
Rest of Country	83
Total workers	239

Workers are coming FROM...



65% of workers are coming FROM Guadalajara Province

Total Collective Dose

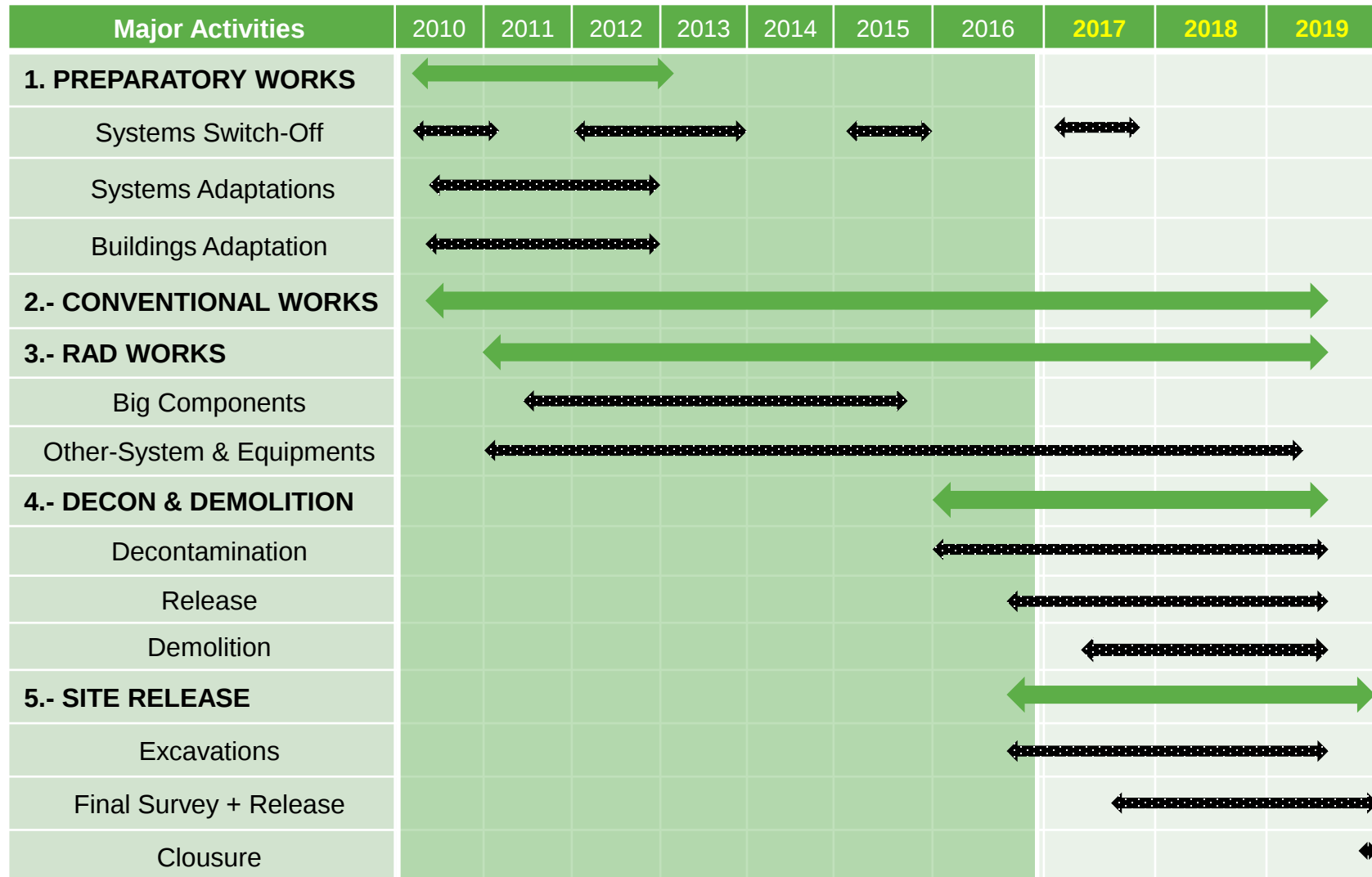


Project Collective Dose

- **TOTAL = 6,41 Sv-p (100%)**
- **Cummulated (2010-2016) = 2,62 Sv-p (- 60%)**

Time Schedule

80% IN GLOBAL



COMMUNICATION AS A KEY FACTOR

Over 4.200 people have visited the Installation & the Information Centre (Enresa Space)



- ✓ to inform
- ✓ to neutralize negative:
 - ✓ opinions & attitudes
- ✓ to remove false expectations
- ✓ for training

Companies – International Organizations - Media



International Visitors - Countries



Conclusions...

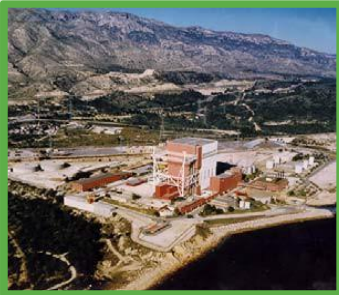
- ✓ NO BIG COMPONENTS
- ✓ CUTTINGS of CONCRETE BLOCKS
- ✓ NO WATER INSIDE BUILDINGS
- ✓ NON RELEVANT INCIDENTS
- ✓ NO BUDGET DEVIATIONS
- ✓ COLLECTIVE DOSE – 50%
- ✓ AUTHORITIES CONTROL - GOOD
- ✓ INTERNATIONAL INTEREST



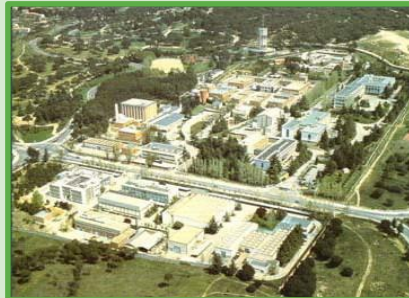
Know How – Experience's Chain...

The DECOMM WORK in Spain is an **INDUSTRIAL CONSOLIDATED ACTIVITY**. The Main Objectives are Environmental & Radiation Protection to the Public. The Methods & Organization aspects constitute an **INTERNATIONAL REFERENCE**, **THEREFORE**, we have the capability to perform with solvency the **FUTURE DECOMM PROJECTS** in SPAIN

Vandellós I
1998/2003



PIMIC
2006/2015



Zorita
2010/2018



Lessons Learned

We are READY

Greetings from CNJC people



¡ Thank you for listening !