



THE DECOMMISSIONING OF RESEARCH INSTALLATIONS AT CIEMAT IN MADRID



GOBIERNO
DE ESPAÑA

MINISTERIO
DE CIENCIA, INNOVACIÓN
Y UNIVERSIDADES

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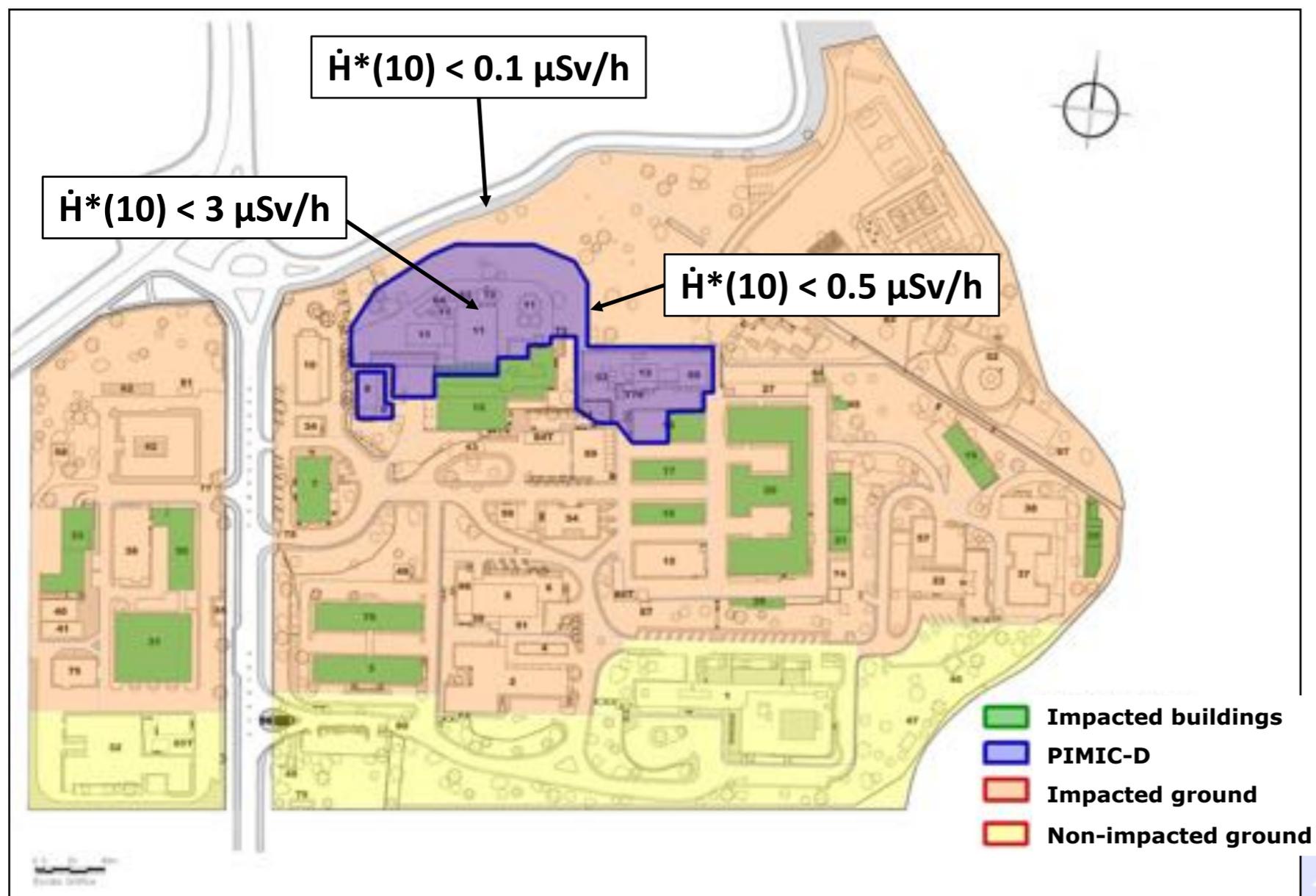
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Ciemat

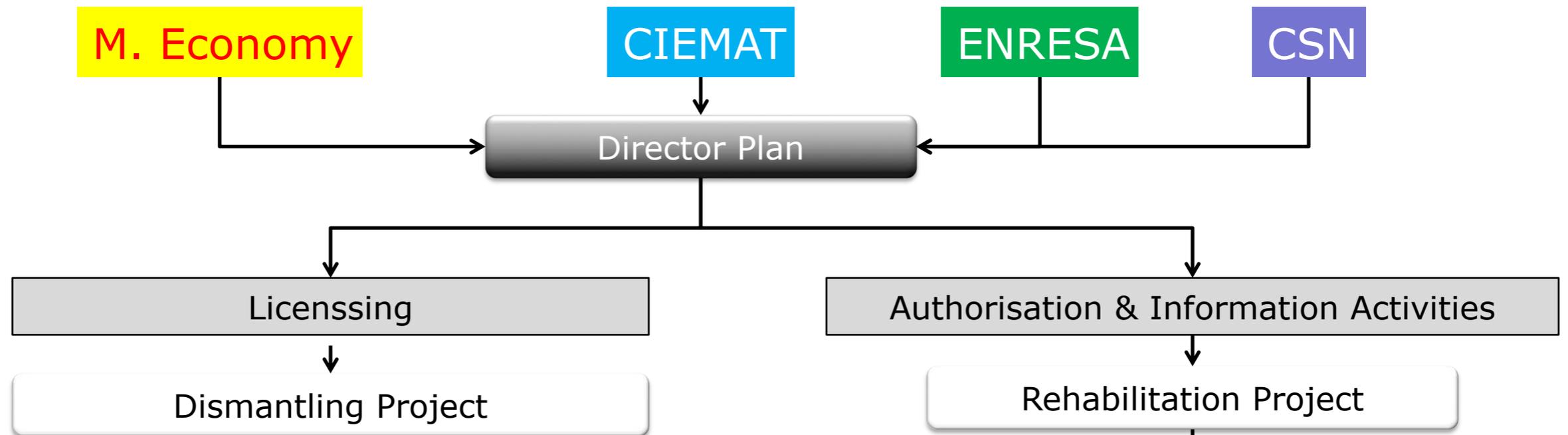
INTRODUCTION

In 1986 CIEMAT took over from the Junta de Energía Nuclear (JEN), which since 1951 had led research in nuclear fission energy production and control in Spain. At present, the main lines of action are the study, development, promotion and optimisation of various sources as: renewable energies, nuclear fusion, nuclear fission and fossil fuels.



- Legally stated as a Nuclear facility due to past activities, including fuel cycle an experimental nuclear reactor.
- 21 radioactive facilities at operation.
- PIMIC Dismantling and Rehabilitation Projects.

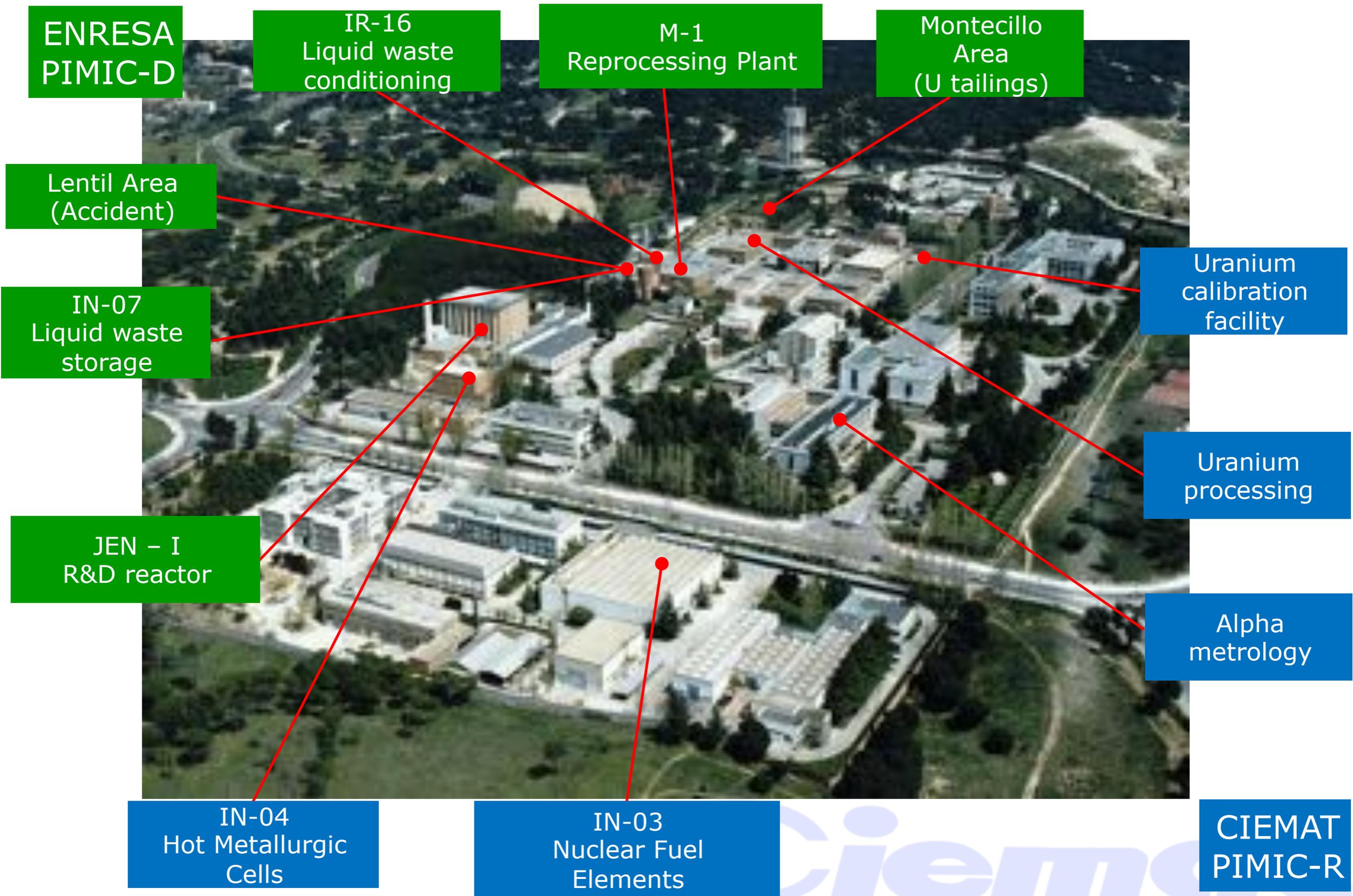
PIMIC: Integral Plan for CIEMAT Facilities Refurbishment



- Project Leader → CIEMAT
- Performed by ENRESA (2000-2018)
 - Specific Radiation Protection Service
 - Facilities
 - JEN-1 (IN-01)
 - Reprocessing Pilot Plant (IR-18)
 - Liquid Radioactive Waste Treatment (IR-16)
 - Liquid Radioactive Waste Facility (IN-07)
 - Contaminated Soils
 - “Lentil” & “Montecillo” Zones

- Project Leader → CIEMAT
- Performed by CIEMAT (2000 - ...)
- Radiation Protection Service → CIEMAT
- Site Radiological Characterisation
 - Hydro - Geochemical studies
 - Facilities & Buildings
 - Radionuclide Metrologic Lab. (IR-13A)
 - Nuclear Fuel Element (IN-03)
 - Hot Cell (IN-04)
 - Underground Tank
 - Buildings 20, 21, 25, Minerals

OBSOLETE FUEL CYCLE FACILITIES AT CIEMAT



DECOMMISSIONING OF IN-01 Research Nuclear Reactor

Reactor building (32x23x20 m), Pool platform (4 m wide, 10 m height), Auxiliary systems including cooling, ventilation, purification, and effluents treatment and underground drainage tanks.



1980: Final shut down



2006: Initial dismantling



Demolition



Refurbishment



Filling cavities



2015: Temporary VLLW repository

DECOMMISSIONING OF IR-18 Pilot Reprocessing Plant



Main dismantled components were:

- A shielded cell for the fuel purification cycle
 - A suite of glove boxes
- Two shielded underground tanks for the storage of effluents (F1 cell)
 - Ventilation and auxiliary systems
 - Final Radiological characterization
 - No radiation risk in the building



Example of respiratory protection

DECOMMISSIONING OF IR-16: Liquid Conditioning Plant



- Conventional zones
 - Ventilation room
 - Operation area
- Evaporation and Chemical treatment cells
 - Cells F2 and F3
 - Corridors
- Final Radiological characterization
- Re-use as conventional building

Orion

DECOMMISSIONING OF IN-07 Liquid Storage facility



- Control room.
- Ventilation room.
- Underground cells F4 and F5.
- Removal of embedded elements, marking of surfaces, clean up,
- Final Radiological characterization
- Building demolished (Lentil area) and cavity filled used as a temporary VLLW repository

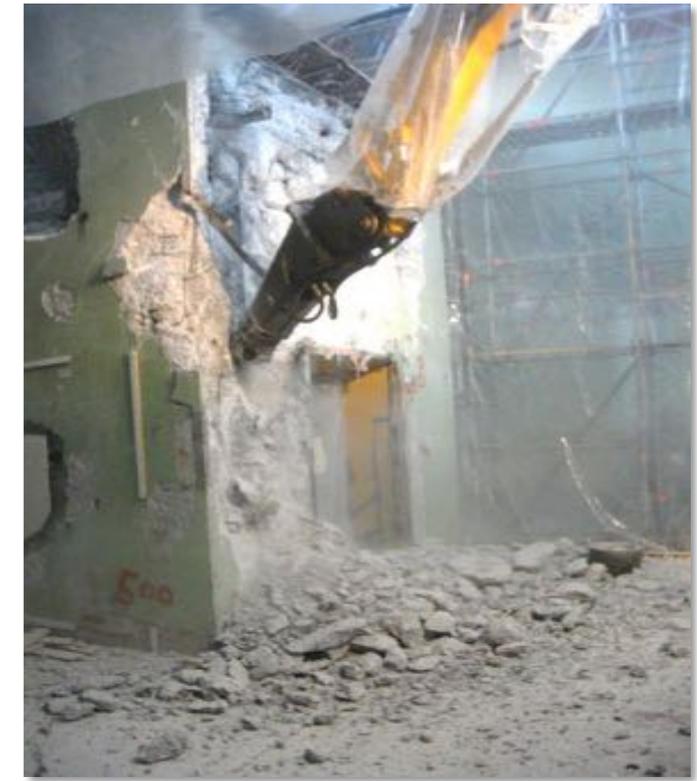
DECOMMISSIONING OF IN-04 Hot metallurgical cells



1995: Final shut down



Dismantling



Demolition



Underground pits for fuel samples



Crane dismantling



Waste segregation and storage

DECOMMISSIONING OF IN-03 Research reactor fuel element plant



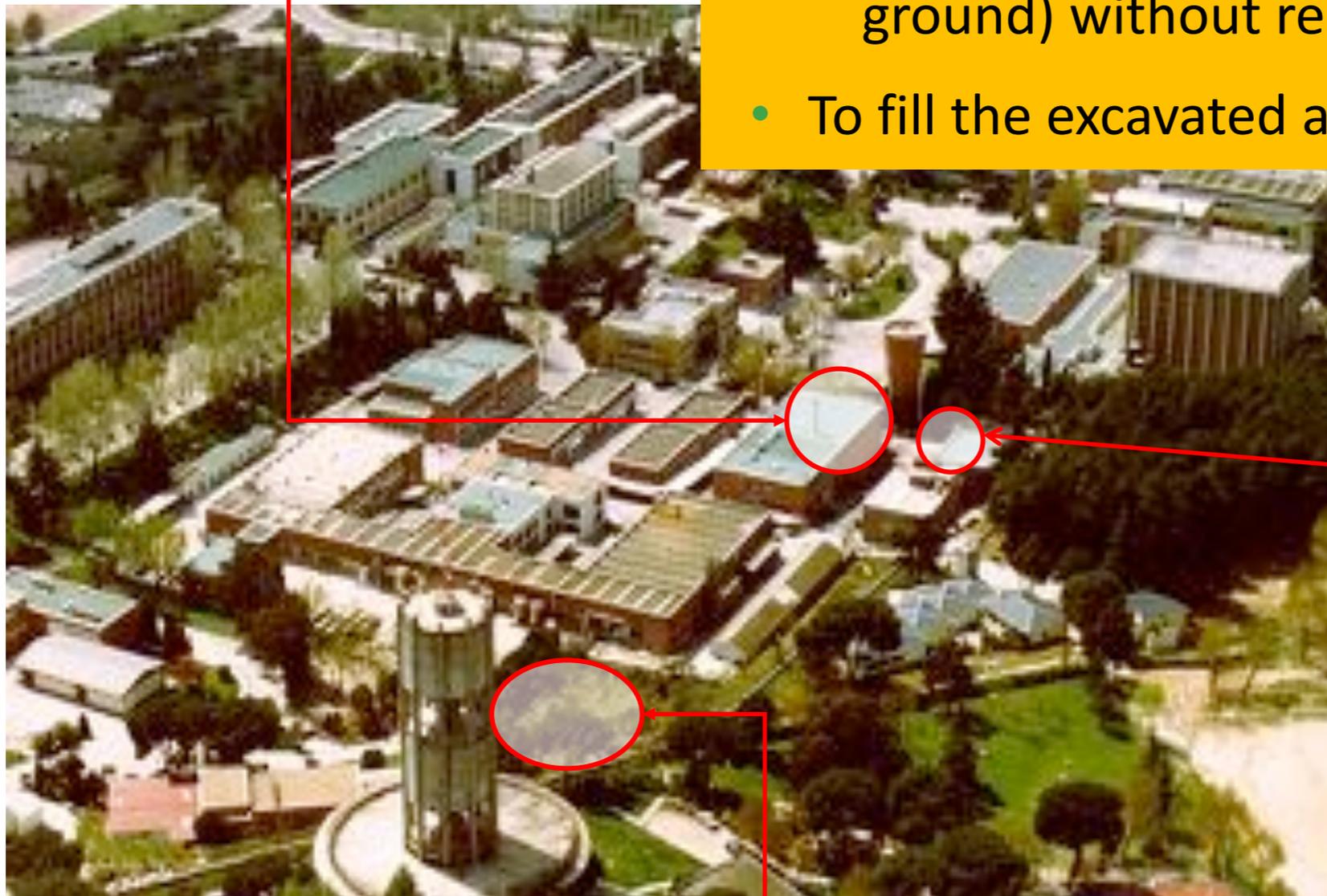
- Old Glove Boxes
- Ventilation System
- Decontamination



2011: CIEMAT Neutron Standards Laboratory

REMEDIATION PROJECTS (2010-2018)

**BUILDING 18
PILOT REPROCESSING PLANT**



OBJECTIVES

- To segregate contaminated soil and no contaminated soil.
- To leave the cavity (walls, soil and underlying ground) without residual contamination.
- To fill the excavated area with clean material.

**LENTIL ZONE:
Accidental
contamination**

**MONTECILLO:
Uranium tailings**

REMEDIATION WORKS AT THE LENTIL ACCIDENTAL CONTAMINATED AREA (^{137}Cs & ^{90}Sr)



Building demolition



Pile foundation for safe excavation



Protective clothing and air monitoring



Excavation reached 10 m deep



Filling cavities



2012: Temporary VLLW repository

REMEDIATION WORKS AT MONTECILLO CONTAMINATED AREA (URANIUM TAILINGS)



Montecillo, 2011



Vegetation and trees removal



Soil excavation



Protected conveyor for waste



Soil conditioning



End of excavation, 2014

RADIOLOGICAL PROTECTION AND SURVEYS AT DIFFERENT STAGES



Ceiling survey



Wall survey



Ground survey



Ge survey



In situ material segregation



Working area isolation and Air monitoring



Clothing and Respiratory Protection

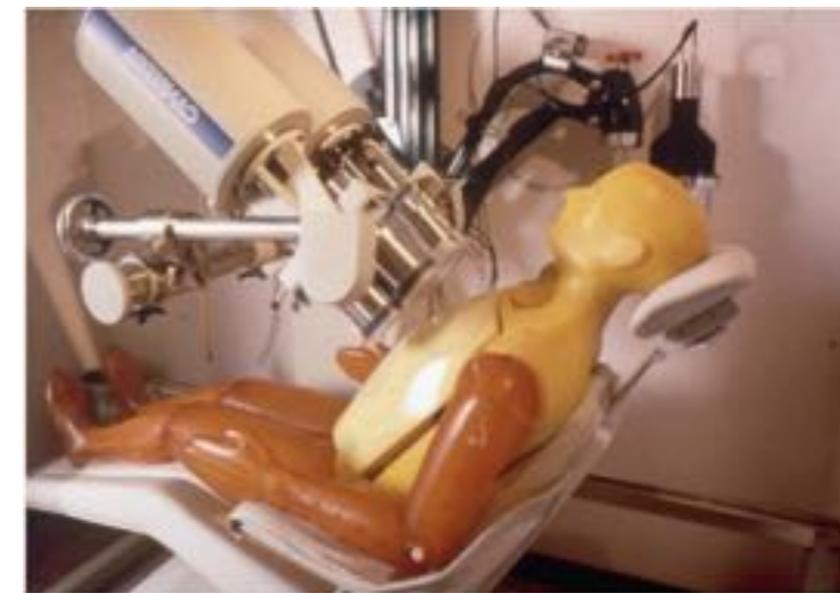
INDIVIDUAL RADIATION MONITORING



**Operational Dosimetry
(EPD)**



**Official External Dosimetry
(TLD)**

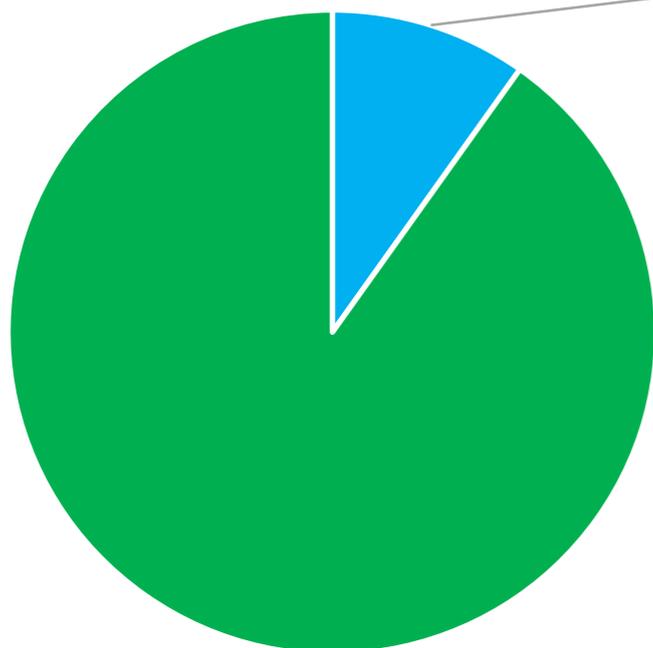


**Internal Dosimetry
(WBC & Bioassay)**

Year	External Dosimetry				Internal Dosimetry		
	Exposed people	Collective Dose mSv p	Mean Individual Dose mSv	Maximum Individual Dose mSv	WBC Controlled people	Bioassay Controlled people	Collective Dose mSv p
2006	56	1.22	0.20	< 1	56	27	0.0
2007	83	27.32	0.62	3.49	84	41	1.7 (1 person)
2008	93	38.10	1.36	4.62	92	33	0.0
2009	86	5.80	0.73	2.95	85	6	0.0
2010	72	0.24	0.24	0.24	71	0	0.0
2011	48	6.85	0.62	1.65	54	14	0.0
2012	74	1.23	0.10	1.23	74	112	0.0
2013	26	0.31	0.16	0.15	30	6	0.0
2014	62	1.26	0.02	< 1	n/d	n/d	0.0
2015	51	3.23	0.06	< 1	n/d	n/d	0.0
2016	11	0.02	0.00	< 1	n/d	n/d	0.0
2017	9	0.15	0.02	< 1	n/d	n/d	0.0
TOTAL COLLECTIVE DOSE, mSv p:		85.73					1.7

WASTE MANAGEMENT: PRODUCTION

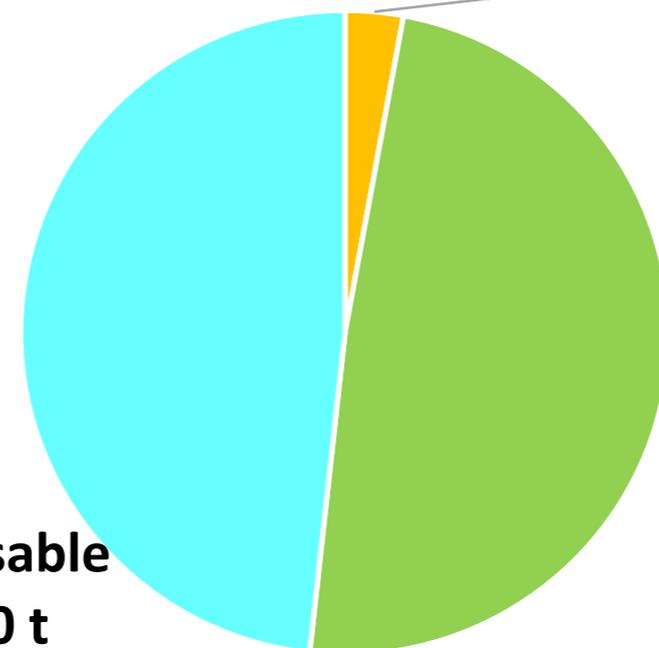
PIMIC Waste production



PIMIC-R
1186 t
10%



PIMIC- Dismantling



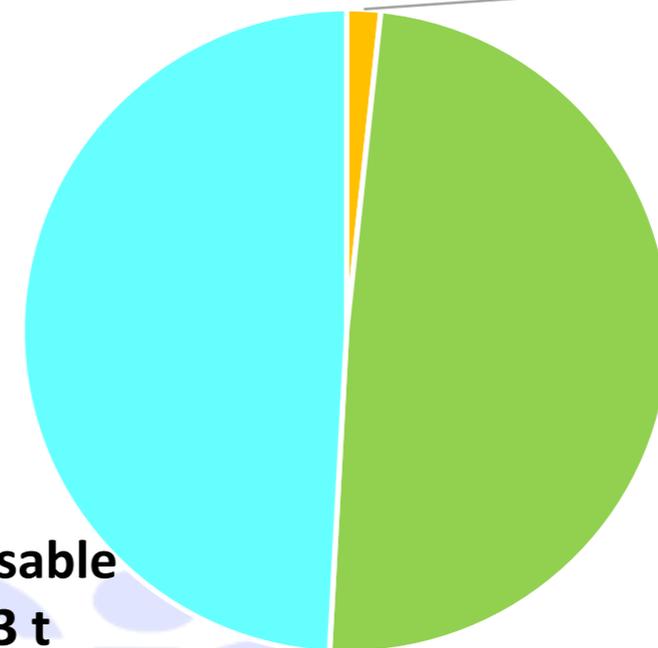
LILW
315 t
3%

VLLW
5325 t
49%

Releasable
5260 t
48%



PIMIC- Rehabilitation



LILW
20 t
2%

VLLW
583 t
49%

Releasable
583 t
49%

MATERIALS MANAGEMENT: WASTE CHARACTERIZATION TOWARDS CLEARANCE



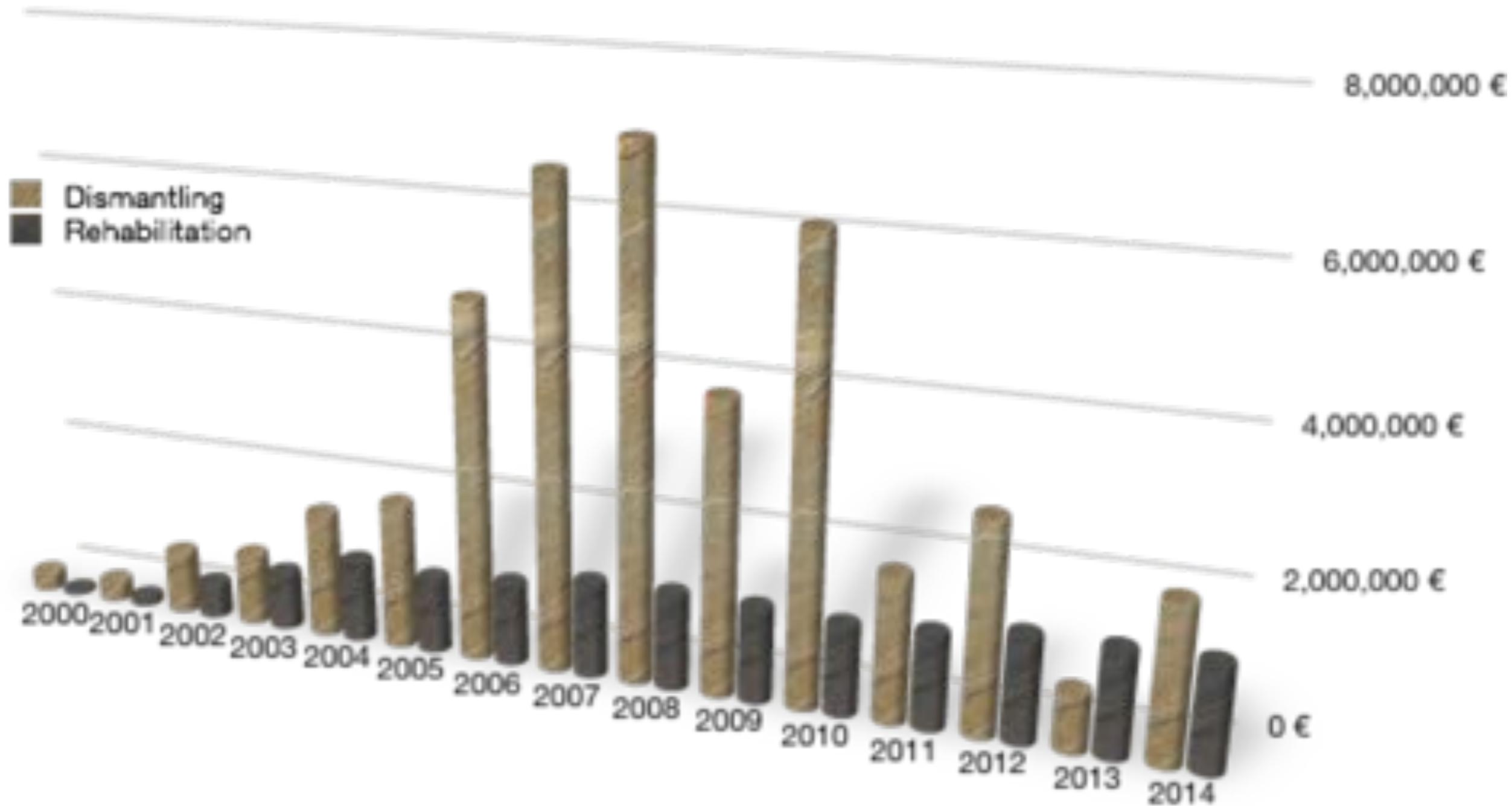
**Segmented gamma Spectrometry:
ISOCS & Box Counter**



**External & Internal
Gamma Spectrometry**

- The implementation of approved methodology based on gamma spectrometry validated against discrete simple radiological analysis provide a safe and effective cost-benefit solution for the D&D waste management.
- In the PIMIC, about 6000 t of clearable waste have been safely free released to the environment, estimating a saving cost of around 6 M€.

FINANCIAL ASPECTS: Total PIMIC Budget around 60 M€ (at the moment!)



CONCLUSIONS

- PIMIC main objective is to safely refurbish buildings and areas that were devoted in the past to nuclear and radioactive facilities.
- Some areas are now fully operative as new radioactive or conventional facilities, and other are expected to host outstanding facilities for fusion research.
- The radiation protection and ALARA programmes have ensured that the doses received in the PIMIC projects have been low.
- ALARA has also been applied to waste management for optimization and doses reduction to the public.
- Waste production has reached 13,000 t, but about half of them have been freely released to the environment under clearance methods approved by the Spanish regulator.
- The spent PIMIC Budget in the period 2001-2018 is about 60 M€.
- PIMIC-Rehabilitation is still in progress with no deadline expected in the next years due to budgetary aspects.

