Roadmap and Performance carried out during Ciemat Site Decommissioning

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Abstract

Ciemat (Research Centre for Energy, Environment and Technology) located in the heart of the Ciudad Universitaria of Madrid, occupies a property of ≈20 Ha. Since its creation in 1951 as JEN, and in 1986 renowned as Ciemat, it has involved on R&D projects in the field of Energy and Environment, i.e., Nuclear Fission, Nuclear Fusion, Fossils Fuels, Renewable Energy. As a consequence of the R&D projects developed between 1951 – 1986 on Nuclear Fission field (fuel design, fabrication, characterization on irradiated fuels, safety studies, etc) and to the diversification of the goals as well, it is necessary to Decommissioning and Dismantling (D&D) from nuclear facilities (nuclear reactor, Hot Cells, Irradiation facility), buildings and soils.
Preparations for D&D included a staged shutdown of operations, planning documentation and licensing for decommissioning. As a prerequisite to Ciemat application for a decommissioning licence and nuclear environmental assessment was carried out according to Spanish Nuclear Council (CSN) and approval of the site decommissioning project was obtained in 2000 and valid until December 31, 2006. Since 2001 – 2003 is underway and focussed on the radiological characterization of the site (divided in pieces of ground), when each piece of ground is characterized a planning for D&D is presented to CSN in order to obtain a licence for actuation.
Nowadays several pieces of ground are decontaminated and modifications have been done in order to achieve a safe state of storage-with-surveillance. Later phases have planned waste management improvements for selected wastes already on temporally storage, eventually followed by final decommissioning of facilities and buildings and cleaning of contaminants from soils and removal of waste from the site.
This paper describes the planning, nuclear and environment assessment and descriptions of decommissioning activities currently underway at Ciemat.

Introduction

Ciemat has been developed a program for decommissioning and dismantling those facilities made from 1951 – 1984 (12 Nuclear and 47 Radioactive facilities) and those buildings and solids that could be contaminated.
This Nuclear facilities were used for the nuclear develop in our country (experimental reactor, fuel fabrication, reprocessing of irradiated nuclear fuel, hot cells, etc.). Whereas the irradiation facilities were more focussed on chemical, biological, radiometric and isotopic analysis, X ray analysis, etc; much older than those are nowadays in Hospitals or Universities. Furthermore of the necessary renewal of the facilities, another reason is that the site is emplaced in Madrid City. At 1951, was the outskirt of the city but nowadays it is just in the middle.
Like many other centres with similar scopes, our society and government (National, regional and municipal) require to us the cleaning as much as possible the site and the environment. Due to this Ciemat has been stabilized a Waste Management Program, which was included in the perceptive documentation sent to the Nuclear Spanish Council (CSN), and the licence of the work was obtained. In this licence the decommissioning and dismantling works are described (time tables, characterization and classification of waste, decontamination techniques, radiological characterization of the sites, temporally storage, transport and management of the waste, etc.).
Since 1985 until 1995 previous work was done. During this period three nuclear and 19 radioactive facilities were closured. At the end of 1995 Ciemat had 6 nuclear facility on security stopped and 17 radioactive facilities on operation, as can be observed on Fig. 1. In the period of 1996 – 2000, 4 Nuclear and 2 radioactive facilities were dismantling. At the end of 2000 Ciemat had 19 radioactive facilities operating (2 of new creation).
Since 2000 up now a Dismantling and Refurbishment project (labelled as PIMIC, Plan Integral de Mejora de Instalaciones del Ciemat, this could be translated as Integral Plan of Improvement of the Ciemat Facilities) has the responsibility of dismantling of 4 nuclear and 2 radioactive facilities, the refurbishment and actualisation of whole Ciemat radioactive facilities, buildings, soils and radioactive waste evacuation. At the end of the PIMIC project (on 2006), all of the waste generated and materials under safeguard will be out from Ciemat.

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Fig. Fig. 3 shows the evolution of the radioactive material inventory since 1984 until nowadays. As can be observed, and it was aforementioned, the strongest reduction was developed since 1990 – 1994. The activities done in the PIMIC project and related to decommissioning, dismantling and refurbishment of nuclear or radioactive facilities involve both cutting of metallic components, vessels, tubes, deposits, etc., and ceramic components (concrete of different nature). This fact has promoted the development of new techniques for cutting of metallic structures as for demolition.
In this project are involved the followed organization: Consejo de Seguridad Nuclear (Spanish nuclear council), Ministerio de Industria, Comercio y Turismo (Industry Minister), Ministerio de Medio Ambiente (environmental Ministery), EURATOM, Madrid mayor's office, ENRESA, neighbour associations and Consorcio Urbanístico de la Ciudad Universitaria. In order to control all the actions involved in this project different committee are designed. The committee and the participants are the following:

- Environmental, Radiological protection and Safety Committee – Ciemat
- Coordination Committee – Ciemat and ENRESA
- Information Committee – CSN, UCM, MIMAM, National Government delegation, Mayor's office, CAM (Regional Government office), ENRESA, Ciemat).

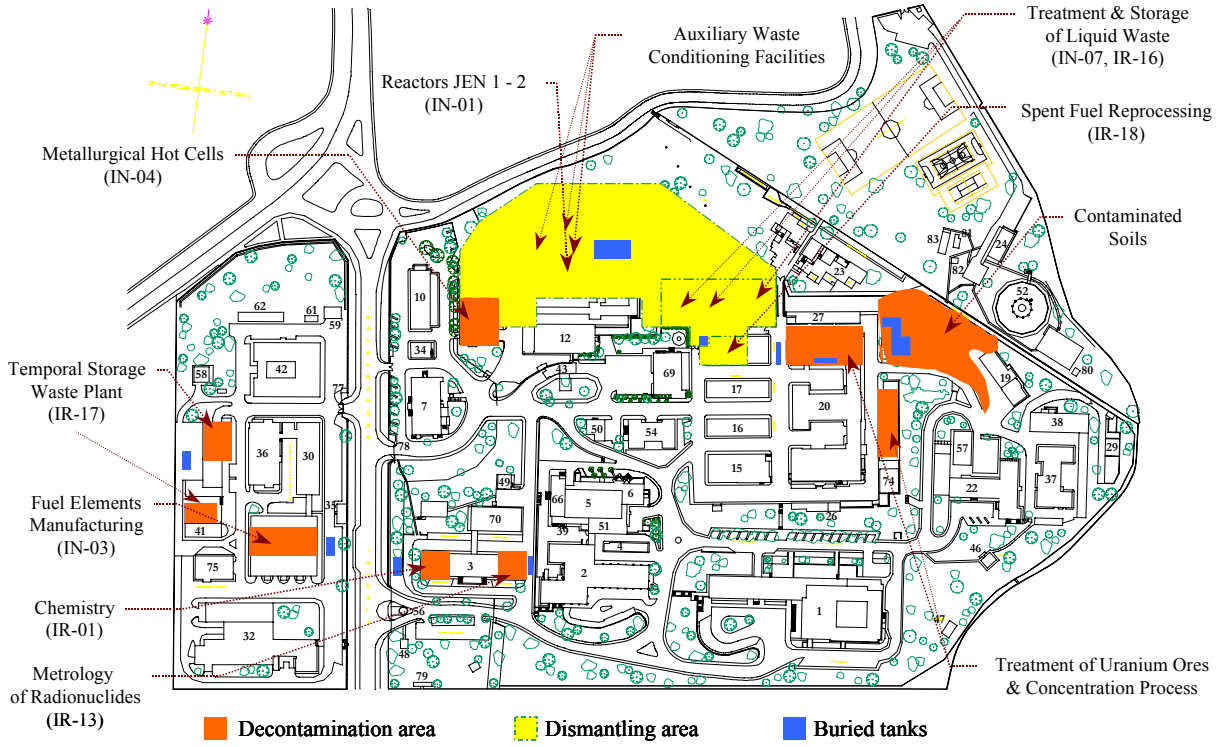

Fig. 1 Ciemat site. This map shows the decontamination and dismantling areas

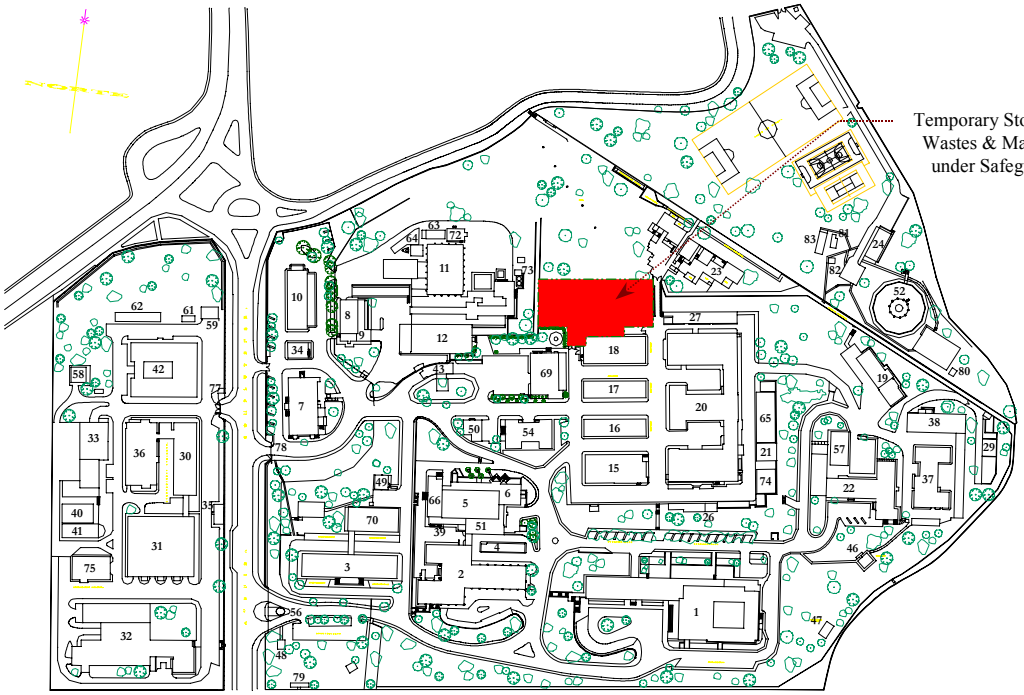

Fig. 2 Future Ciemat Nuclear Facility at the end of the Decontamination and Dismantling project (PIMIC)

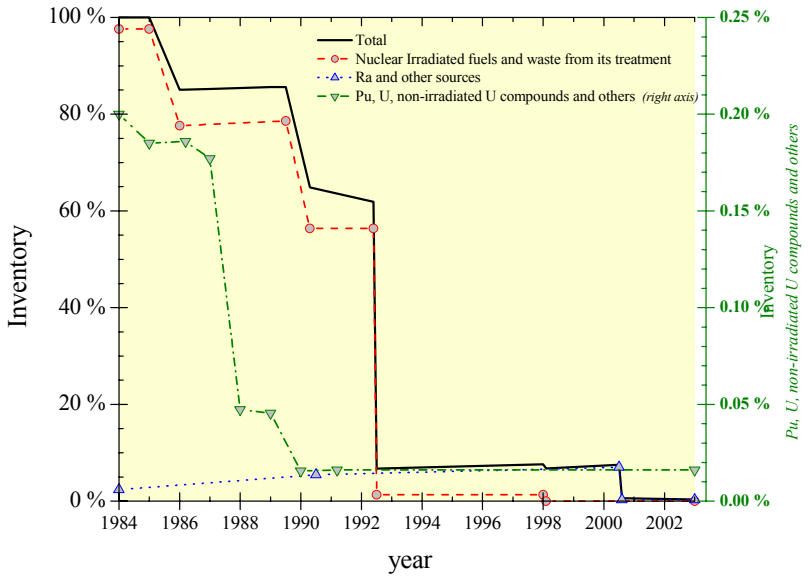

Fig. 3 Evolution of the radioactive material emplaced in Ciemat (Madrid site)

Environmental impact

Table I Spanish National Council Radiological criteria applied for liquid poured away to sewer water

Radionuclide	AIL / Bq	DCW / Bq·l^{-1}	10% DCW / Bq·l^{-1}
^{3}H	1.10E+09	83710	8371
^{60}Co	8.00E+06	448	44.8
^{90}Sr	7.10E+05	54.8	5.48
^{90}Y	7.40E+06	560	56
^{137}Cs	1.50E+06	117	11.7
^{152}Eu	1.40E+07	1087	108.7
^{226}Ra		5.4	0.54
^{230}Th	2.20E+05	7.2	0.72
^{232}Th	2.10E+05	6.6	0.66
^{238}U	2.60E+06	33.8	3.38
^{235}U	2.40E+06	32	3.2
^{234}U	2.40E+06	31	3.1
^{239}Pu	2.20E+06	6	0.6
^{241}Am	1.00E+05	7.3	0.73

AIL: Annual Incorporation Limit
DCW: Derivate Concentration in Water

The main objective of this project is try to minimize, as less as possible, the radiological impact to the human (direct workers, employed and resident area) and environment. For this reason all of each activities are meticulously analysed by experts before to do in order to have a:

- Appropriate schedule
- Study of the potential risk, accidents and consequences (conservative criteria)
- Radiological controls "in situ"
- Dress control and forecast
- Dosimetric control of the workers (internal and external measurement)
- Environmental Radiological Protection Programme (radiation monitor, samples, etc). This programme is mainly focussed on the influence that the fulfilment has on the population.
- Water release control

Other important goal of the project is how to minimize the amount of waste generated. The waste obtained during whole actions was initially classified as a function of the physic state (solid, liquid, sludge and gas). The solid waste is characterized in situ. Those materials clean (from radiological point of view) are treated following the Spanish law of solid waste. The rest of the waste is classified for sending to "el Cabril (Spanish store site for low and medium level waste)". In case of liquid waste two types of management are used. Those liquid wastes with higher activity are stored for sending to el Cabril. However those contaminated water coming from cutting or other operations performed during cleaning operations are storage in the pool of the JEN-1 reactor. This water is poured away following the radiological conditions authorized by CSN (0.1 of the annual incorporation limit of the public members in drink water, Table I). Nowadays 121.7 m^3 of water is poured away to sewer water. The PIMIC project does not consider releasing liquid radioactive waste to Madrid sewer net. The sludge generated on the Ciemat sewer during 50 year of the R&D operation as well as during the cleaning operation of facilities or buildings, will be managed as a function of their humidity and got ready for transport to the final store in el Cabril. The special cases of gases or aerosol are not released to the atmosphere. During the cutting or

cleaning operation special control (detector and sample analysis) are performed for control the release of several radionuclides as: tritium, iodine and the rest of halogen. Focussed on the aerosols, their releases are avoided by the work with filtration and detection system and close rooms with special equipments that have a forced ventilation system. Associated with these safety steps, it is important to point out that the radiological protection committee controls, by detection system, the release due to the PIMIC operations done. These controls are done in the control area of working, outside of this controlled area but inside of Ciemat site and in the neighbour to the Ciemat site too.

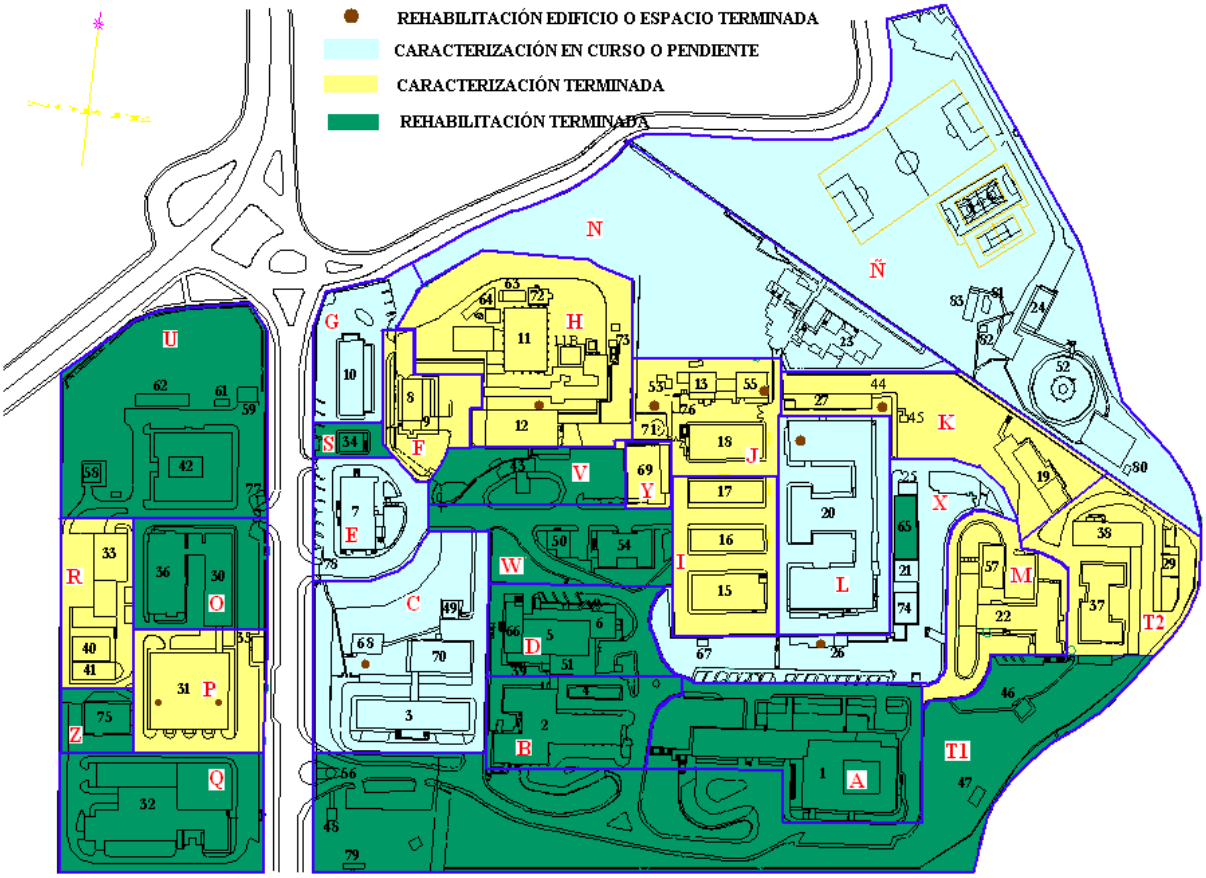

Fig. 4 Ciemat Site map and the piece of ground used in PIMIC project

Ciemat site was divided in 28 piece of ground (Fig. 4). This allows following different steps of the project as a function of the need of actuation (refurbishment, decommissioning, cleaning…). First it is necessary to have a radiological characterization on the area by drilling hole, surface measurements of solids, history of the site, operation and R&D projects performed, etc. Second step is operating on the site and the last one is to have the approval of the radiological protection committee about the cleaning level is achieved.