



European  
Commission

# Nuclear Decommissioning and Waste Management Programme at the Joint Research Centre, Ispra Site



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## Table of Contents

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A story started more than 50 years ago	4
From past to present	5
Addressing the JRC nuclear liabilities	6
The road towards the “ <i>green field</i> ”	7
Decommissioning	8
Key achievements of the D&WM Programme	9
Radioactive waste management	10
Waste management infrastructure	11
Radioactive waste storage	12
Final disposal	13
Support to research & development	14
Training and knowledge sharing	15

# A story started more than 50 years ago

## Birth of the JRC

The EURATOM Treaty, signed in Rome in 1957 by the six EU founding countries (Belgium, France, Germany, Italy, Luxembourg and the Netherlands), created the European Atomic Energy Community (EURATOM). Since its creation, EURATOM supported the establishment and growth of safe nuclear power related industries to contribute to peace, health and prosperity of Europeans citizens. To support this mission, a Joint Research Centre (JRC), with sites located in four Member States, was established to perform top level research, disseminate findings for policy-making and set uniform safe standards.

JRC-Ispira in the 1970s



## The Ispira nuclear research centre

In 1958 a research centre at Ispira started to be developed. The "Ispira-1" reactor was completed in less than one year.

In March 1959 the reactor started up and in the following month the site was officially inaugurated as a national nuclear research centre by the President of the Italian Republic.

In 1960 Italy ratified the agreement, signed in 1959, to transfer the Ispira Site to EURATOM.

The Ispira-1 reactor



# From past to present

## Development and phase-out of nuclear research

The initial research topics at JRC-Ispira were focused on nuclear reactor and fuel cycle development. As research progressed, a variety of additional experimental facilities, as well as radioactive waste management plant and stores

were completed. The second experimental reactor, ESSOR, whose 80 metres stack is a well-known landmark in the surroundings of the Ispira site, entered its operational phase in 1968. Since the '80s, the EU Framework Programmes for

research and innovation progressively reduced their focus on nuclear R&D, hence most of the installations on the Ispira site are currently shutdown and in a state of safe conservation.

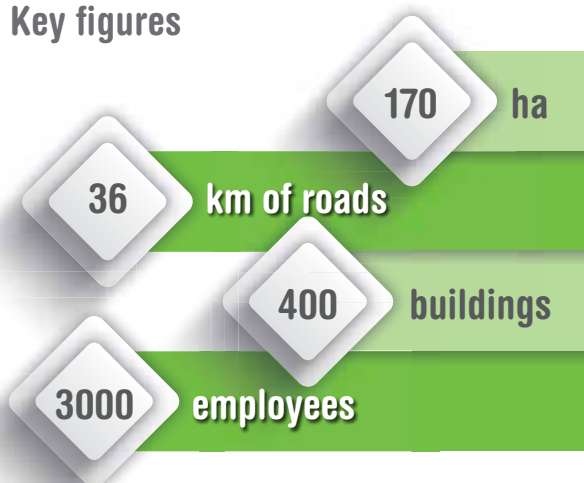
## JRC Ispira today

The JRC mission is to provide customer-driven scientific and technical support for the conception, development, implementation and monitoring of EU policies.

The Ispira site today hosts several research activities in the field of environment and sustainability, health and consumer protection, protection and security of the citizens, energy, transport, nuclear safety and security, nuclear decommissioning.

The site Directorate provides services to facilitate the current and future scientific activities of the research institutes, while ensuring that JRC Ispira acts as a good neighbour to the community at large.

### Key figures



## The JRC Nuclear Decommissioning & Waste Management (D&WM) Programme

The European Commission is committed to protect citizens and the environment from radiological hazards associated with its activities. To this end in 1999, following a Communication to the European Parliament and the Council of the EU, a Decommissioning & Waste Management (D&WM) Programme was started for all its nuclear sites, including JRC-Ispira. To ensure the efficient execution of the Programme, the JRC is supported by a group of independent and impartial nuclear experts.



Visiting the ESSOR reactor



# Addressing the JRC nuclear liabilities

## Nuclear liabilities at JRC-Ispra

The Ispra site Decommissioning & Waste Management (D&WM) Programme includes the management of radioactive waste and nuclear materials coming from past research activities (so-called “historical liabilities”) as well as the decommissioning of operational nuclear installations and of the waste management infrastructure (so-called “future liabilities”).

### DECOMMISSIONING IN BRIEF

Decommissioning entails a stepwise process, starting with the removal of nuclear materials and non-permanent plant items, followed by the dismantling and removal of the remaining radioactive components. Then, after the reduction of any residual radioactivity and the final radiological survey, it ends with the return of the site to a status with no significant radioactive hazard.

According to the International Atomic Energy Agency (IAEA), there are three possible options at the end of the decommissioning process:

1. storage with surveillance
2. restricted site use
3. unrestricted site use  
(the so called “*green field*”).

JRC-Ispra policy is to decommission its shutdown nuclear installations up to the “*green field*”.

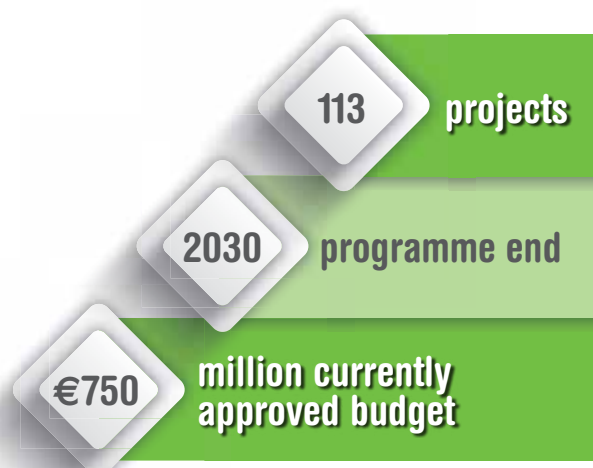
## Implementation of the JRC D&WM Programme at Ispra

The implementation of the D&WM Programme is under the sole responsibility of the JRC, as stated by the EURATOM Treaty, and must comply with the national legislation.

Most of the activities are carried out by specialised contractors with internationally recognised expertise in the field.

The highest existing technological standards are applied.

### Key figures (October 2013)



Reference: COM(2013) 734

# The road towards the “green field”

## Programme activities

The first stage of the programme focused almost exclusively on waste management issues, with decommissioning work being effectively limited to specific studies and licensing procedures. The existing waste management infrastructure was reinforced and nuclear and special materials were transferred and recycled off-site. The current activities focus on the treatment and conditioning of the existing waste as well as on the management and removal of the irradiated and residual nuclear materials.

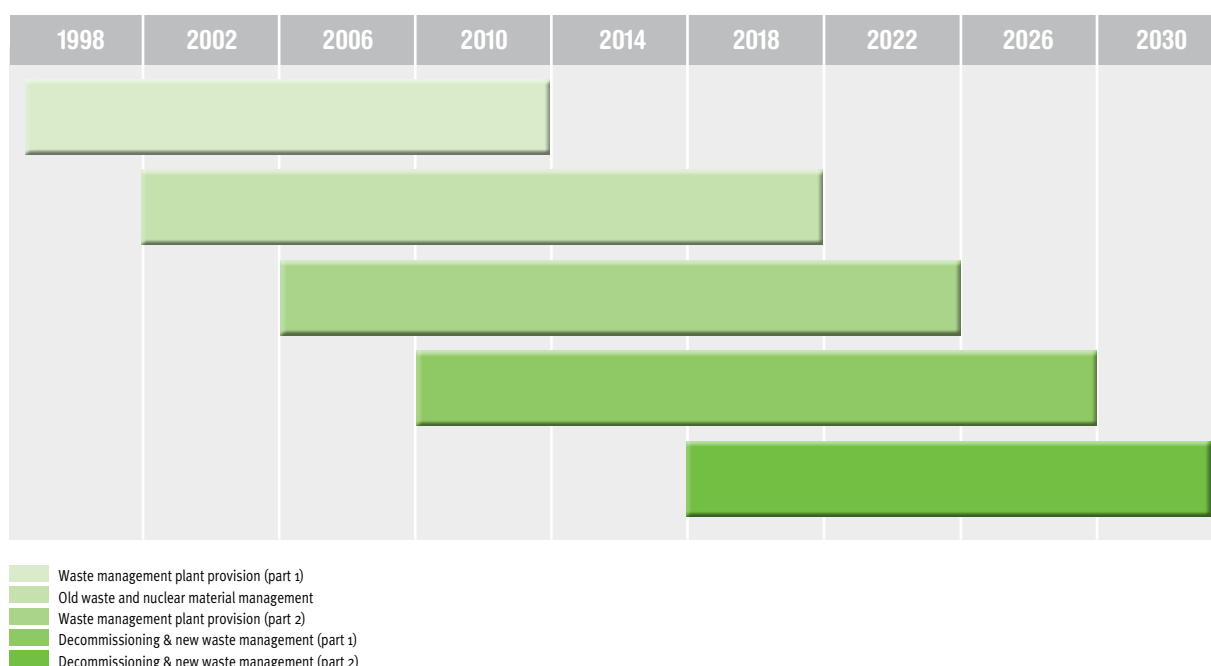
The final steps will concern decommissioning of the nuclear installations, the site clean-up and remediation to the “green field” status. The programme is planned to end by 2030, with a total expenditure not exceeding 1B€.

Further information about the Programme available on the D&WM Programme website:  
<http://dwm.jrc.ec.europa.eu>

### GREEN FIELD

According to an international definition, the *green field* is a condition reached after the decommissioning process where buildings and land are released free of any radiological constraint.

## D&WM Programme Evolution



# Decommissioning

## Nuclear installations in Ispra

All shut down installations on the Ispra site are kept in a state of safe conservation.

Their characterisation has been almost completed and they will be decommissioned up to the “green field”.

After the release of the radiochemical laboratory (RCHL) and the dismantling of the Fuel

Assembly and Release Oven (FARO) facility, the Nuclear Decommissioning Unit plans to proceed with the decommissioning of the hot laboratory (LCSR), the old Liquid Effluents Treatment Station (STRRL) and finally the ESSOR reactor. Other minor installations included in the D&WM

Programme are the ECO reactor and the Cyclotron laboratory. According to an agreement with the European Commission, the decommissioning and dismantling of the Ispra-1 reactor will be the responsibility of the Italian Government.



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- 1 Top view ESSOR reactor
- 2 Former liquid effluents treatment station
- 3 Hot cells facility

### ESSOR

#### The ESSOR Nuclear Island

- Area: 4.5 hectares
- Covered surface: 15 000 square metres
- Volume: 160 000 cubic metres
- Controlled area: 60% of volume

#### The ESSOR Reactor

- Diameter: 45 metres
- Height: 45 metres
- Thermal power output: 25 megawatts
- Operation start: 1968
- Permanent shutdown: 1983



# Key achievements of the D&WM Programme

9

JRC-Ispra D&WM Programme  
Joint Research Centre, Ispra Site

## Key achievements

Several pre-decommissioning and decommissioning activities have been carried out during recent years, including:

- more than 95% of the nuclear materials previously stored at JRC-Ispra have been removed and recycled by third parties abroad;
- decommissioning of the old radiochemistry laboratory (RCHL) was completed in 2010 and the building released from any radiological constraint according to Italian legislation.

The building has been reused to host the JRC Visitors' Centre;

- the fuel Melting test facility (FARO) and the old cementation plant have been completely decommissioned and dismantled in 2014/2015;
- more than 1700 radioactive sources and other hazardous materials including asbestos and alkali metals have been removed from the site and safely disposed or neutralised elsewhere.



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- 1 RCHL Lab. initial status
- 2 RCHL Lab. after removal of equipment and waste
- 3 RCHL Lab. final radiological survey
- 4 JRC Visitors' Center
- 5 A shipment of nuclear material

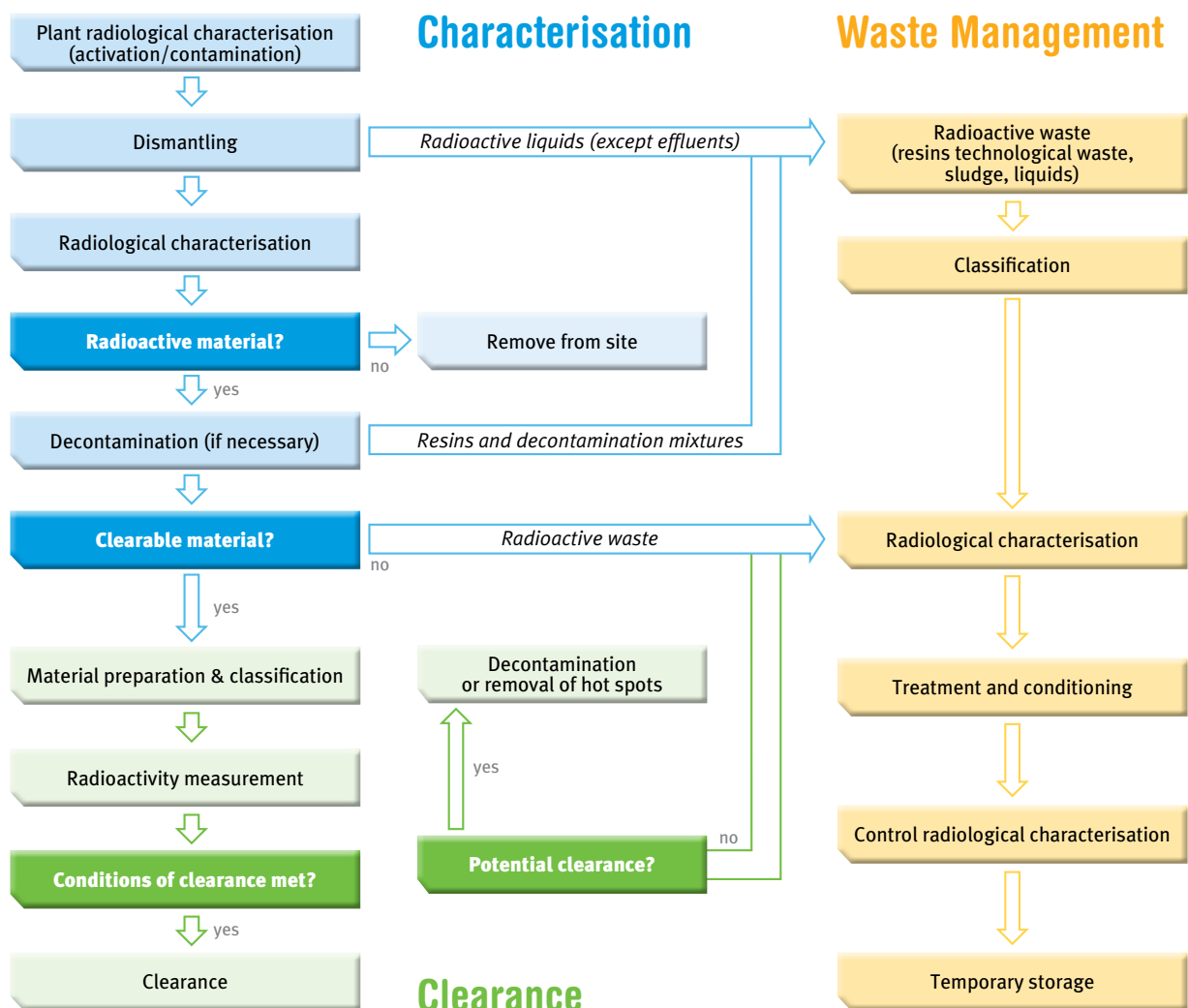
# Radioactive waste management

## Waste management

Waste management covers all technical and administrative activities involved in the handling, sorting, characterisation, treatment, conditioning, storage, transportation and disposal of radioactive waste from a nuclear installation.

The waste management policy of JRC-Ispra is based on three main pillars:

1. minimise the amount of radioactive materials by recycling them within the industry;
2. maximise the quantity of radioactive waste that can be removed from regulatory control;
3. reduce the volume of remaining radioactive waste for temporary storage on the Ispra site, waiting for transfer to the Italian national repository.



## Waste management facilities

Waste management activities require the implementation (including design, construction and commissioning) of facilities for characterisation, (pre-) treatment, conditioning and temporary storage of JRC-Ispra waste. Such facilities are based on proven technologies and are specifically designed for use

by the D&WM Programme. The facilities will be decommissioned and dismantled at the end of the Programme. Wherever considered cost-effective, external waste treatment service providers will be employed to reduce the amount of future liabilities.



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- 1 X-ray digital radiography system
- 2 Waste characterization system
- 3 Abrasive blasting decontamination facility
- 4 Material clearance facility

# Radioactive waste storage

## Temporary storage

An Interim Storage Facility (ISF) was built in 2013 for the temporary storage of low and intermediate level conditioned radioactive waste. To this end a grouting station to immobilise solid waste is going to be built. The ISF is a key asset for the Decommissioning and Waste Management Programme and will boost its completion.

It will only host JRC-Ispra waste, coming either from past research activities or produced from the decommissioning and dismantling activities. In order to properly store waste, *ad hoc* containers have been designed. They will be stacked in layers up to 5 high in the four storage compartments.

The associated final waste packages have been qualified in compliance with Italian UNI Standards.

The final destination of JRC-Ispra radioactive waste will be the future Italian national repository.



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- 1 Interim Storage Facility external view
- 2 Interim Storage Facility internal view
- 3 Handling of waste packages
- 4 A dummy waste package after high temperature tests



# Final disposal

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JRC-Ispra D&WM Programme  
Joint Research Centre, Ispra Site

## The Italian national repository

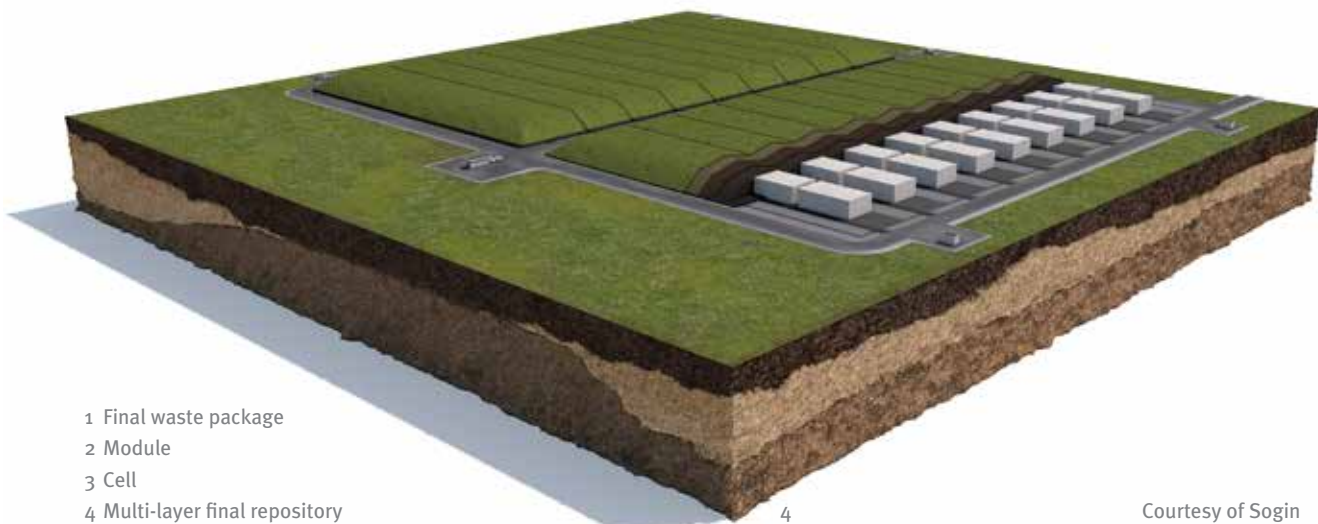
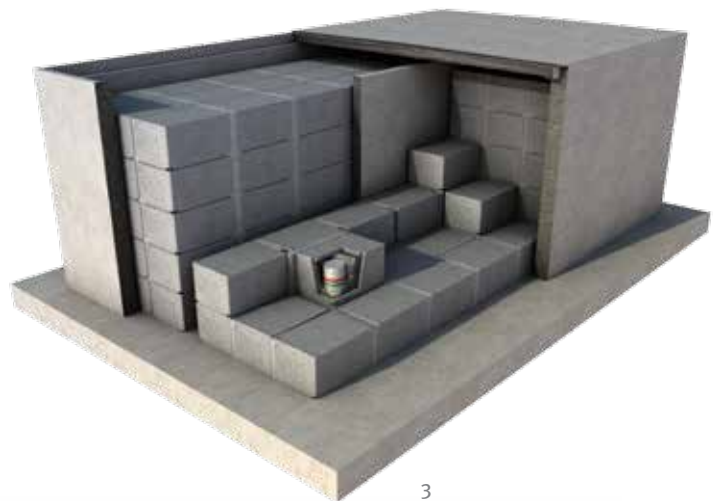
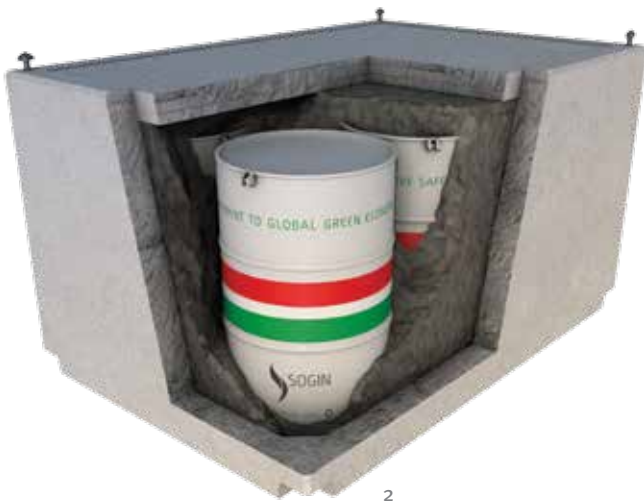
The ultimate destination of JRC-Ispra radioactive waste will be the future Italian national repository (as established in the agreement between the European Commission and the Italian Government, signed in 2009 and according to the Directive 2011/70/EURATOM, transposed by the Decreto legislativo 4 marzo 2014, n. 45).

On June 4<sup>th</sup> 2014 the Italian Nuclear Regulatory Authority issued the final repository siting criteria (developed in the Technical Guide n. 29).

The process for identifying the location of the Italian final disposal site is currently ongoing.

The Italian national repository will be a centralised surface infrastructure aimed at managing all radioactive waste produced in Italy ensuring the highest safety, security and environmental standards. It will be part of a technological park, open to international collaboration, with laboratories devoted to research activities

and training on radioactive waste management and radiation protection.



- 1 Final waste package
- 2 Module
- 3 Cell
- 4 Multi-layer final repository

Courtesy of Sogin



# Support to research & development

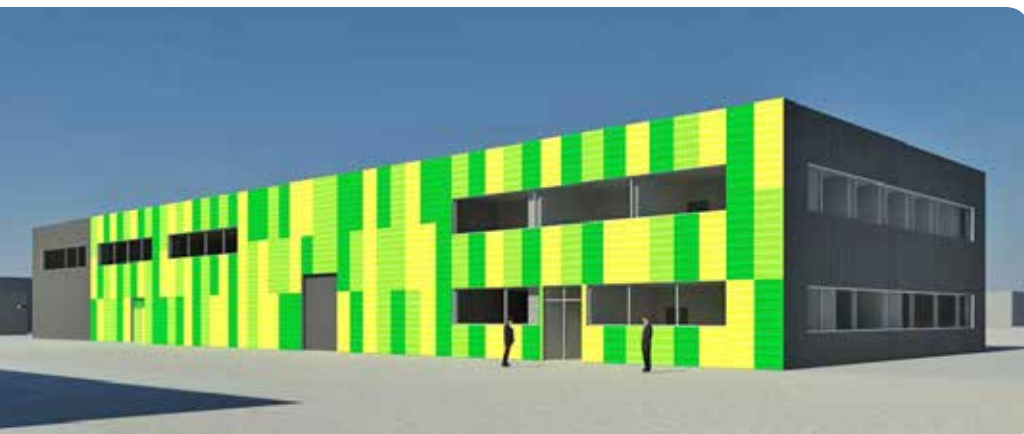
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The decommissioning and waste management market is growing fast, in particular in Europe. There is likely to be a significant impact on employment with an increased requirement for nuclear staff in the decommissioning field,

as well as increased R&D needs. The JRC, thanks to the experience gained in decommissioning activities, will play a key role in partnership with other national and international organisations, especially in the following areas:

- knowledge management and sharing;
- development of innovative technologies and techniques;
- standardisation;
- training.

- 1 Artist's impression of the INS3L building
- 2 MetroDecom project



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## Completion of nuclear research infrastructure: INS3L project

The construction of a new laboratory, INS3L, is planned to start in the short term. INS3L (Ispra Nuclear Safeguards, Security and Standardisation Laboratory) will house some existing nuclear facilities currently located within the ESSOR nuclear area and will continue the activities carried out in the area of nuclear safeguards and nuclear security.

## Trial of innovative techniques: MetroDecom project

During 2016 the ISF hosts the MetroDecom project, in the framework of a programme of international cooperation. The aim of the project is the metrology of radioactive waste in all phases of the post-operative cycle of nuclear installations as well as the characterisation of solid waste, preselection, removal and monitoring inside the waste repository.

# Training and knowledge sharing

15

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## International Summer School in Nuclear Decommissioning & Waste Management

Since 2009 the JRC-Ispira organises the International Summer School in Nuclear Decommissioning and Waste management, targeted towards university level students and young professionals in nuclear field.

The Summer school aims at strengthening education on planning and operating nuclear decommissioning and waste management activities, including safety and legal framework. The activities of the JRC-Ispira International Summer School are integrated in the European Learning Initiatives for Nuclear Decommissioning and

Environmental Remediation (ELINDER) steered by the JRC. Within ELINDER relevant trainings organised at the different European locations are pooled, harmonised and complemented with new topics, in order to ensure high quality of the trainings.

- 1 A workshop in cooperation with IAEA
- 2 Visit of local high school students

## Knowledge sharing & collaboration at International level

The JRC-Ispira is very active in collaboration activities in the field of knowledge sharing in nuclear decommissioning and waste management. Its approach is shared with other JRC sites and its experience put in common at national and international level. JRC Ispira:

- is part of the OECD/NEA Co-operative Programme on nuclear decommissioning;
- shares Italian D&WM experience through a close dialogue with national stakeholders;
- shares EU experiences through the JRC D&WM Expert Group;
- cooperates with the IAEA (International Atomic Energy Agency);
- cooperates with European Universities, Research Centres and Industry within the ELINDER initiative.



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## D&WM PROGRAMME MISSION

The JRC's Decommissioning and Waste Management Programme is aimed at the progressive elimination of the Centre's Historical Liabilities, i.e. those nuclear R&D facilities and radioactive waste management installations that have no future role in supporting the mission of the JRC. The execution of the Programme will not only protect the environment, public and personnel, but will also enable the JRC to eventually reduce operational costs associated with maintaining its obsolete nuclear plants in a state of safe conservation.

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