

# Nuclear activities of the Joint Research Centre European Atomic Energy Community (Euratom)

## Research Infrastructure

2015



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**Abstract**

This report lists the JRC existing Infrastructures for research on the fields of nuclear safety, nuclear security and nuclear safeguards. These infrastructures are located in the four JRC sites where nuclear research is being carried on: Institute for Transuranium Elements in both sites of Karlsruhe (D) and Ispra (I), Institute for Reference Materials and Measurements in Geel (B) and Institute for Energy and Transport in Petten (NL). The report presents the list of facilities classified by site and gives also a short description of the facility and its complementarity.

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# Large Infrastructure available at the Joint Research Centre (JRC)

## 1. Location: JRC- Institute for Transuranium Elements (Karlsruhe, Germany)

### 1.1 Fuels and Materials Synthesis and Characterization facility (FMSC)

**Description:** The Fuels and Materials Synthesis and Characterization (FMFC) facility consists of a series of shielded and unshielded glove boxes for the synthesis and characterization of actinide materials, including nuclear fuels.



**Uniqueness/Complementarity:** FMSC plays a central role for the synthesis of fuel and fuel targets for irradiation testing for member state organisations, mainly through Indirect Actions, within bilateral agreements (AREVA, NNL, etc.). Similar partly complementary capacities exist in LEFCA and ATALANTE (CEA, France), Cumbria and Springfield (NNL, UK), NRG (Netherlands) and SCK-CEN (Belgium). Irradiation in BR2 (Belgium) and HFR Petten (Holland) will in the future be replaced by Jules Horowitz Reactor (France), and PALLAS (Holland), ASTRID (France), MYRRHA (Belgium), ALFRED (Rumania), ALLEGRO (Slovakia / Hungary / Poland), ELECTRA (Sweden).the facility plays a key role in the supply of samples for basic research and open access programmes (ACTINET, TALISMAN, EURACT NMR, etc.) enabling young scientists to broaden their education and training experiences in their own countries.

## 1.2 Materials Research Laboratories (MRL)

**Description:** The Materials Research Laboratories (MRL) comprise a series of unique, mostly home-built experimental installations dedicated to the study of thermodynamic and thermophysical properties of actinides and nuclear materials.

**Uniqueness/Complementarity:** Complementary facility exists, LEFCA in CEA-Cadarache, but this laboratory will be transferred to Marcoule in reduced form and ITU's offer complementary or unique equipment.

## 1.3 Hot Cells (HC-KA)

**Description:** The Hot Cells (HC) constitute a complete set of facilities for handling and treating irradiated nuclear fuels and materials, and for performing detailed scientific investigations covering all aspects related to the safety of nuclear fuels during irradiation under normal and accident conditions. Spent fuel safety after discharge from the reactor is also investigated, including storage, disposal in geologic repository, closed nuclear fuel cycle options including advanced recycling technologies and high level waste management.



**Uniqueness/Complementarity:** The Hot Cells Laboratory is a key European partner of Member State organisations for post-irradiation-examination of irradiated nuclear fuels and materials. The partnership options include Indirect Actions and bilateral agreements with industry, universities, research organisations, TSOs and waste agencies (AREVA, NNL, CEA, SCK-CEN, IRSN, BAM, SKB, ENRESA etc.). Similar, partly complementary capacities for fuel examination exist in Europe mainly in LECA and ATALANTE (CEA, FR), STUDESVIK (SE), SCK-CEN (BE), Sellafield (NNL, UK), NRG (NL); hot cell facilities for analysis of irradiated materials are located e.g. in Rez (CZ), and in Saclay (CEA, FR).

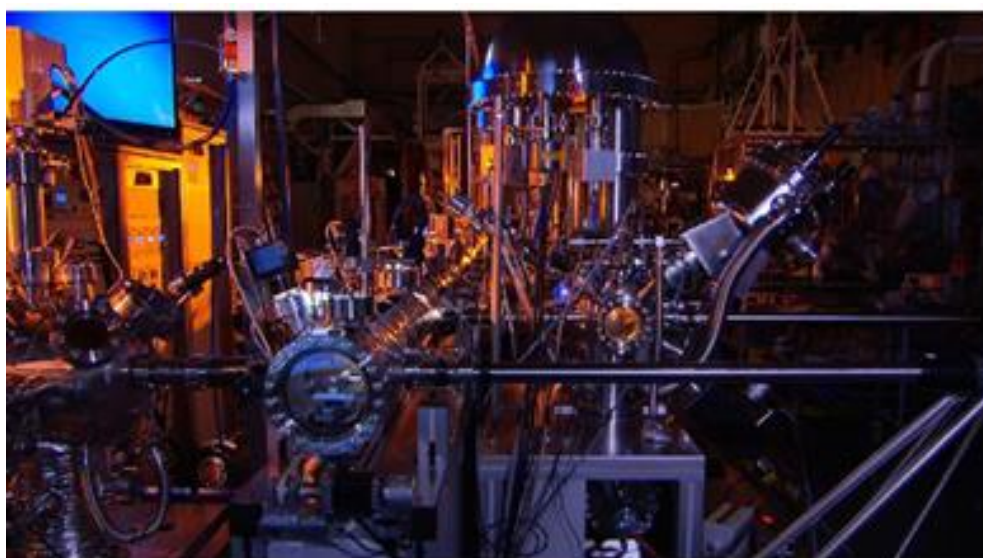
## 1.4 Nuclear and Trace Analyses Lab (NTA)

**Description:** The Nuclear and Trace Analyses (NTA) facility consists of a set of installations (DA and NDA) for the chemical, physical and spectroscopic analysis of actinide and nuclear materials as liquids and solids. The objectives are to support nuclear forensic and safeguards programmes (DG ENER, IAEA) through analyses at ITU and mobile physical inventory verifications, and to study properties and phenomena associated with the materials surface.

**Uniqueness/Complementarity:** In the nuclear forensics area capabilities exist at CEA-DAM, France, and AWE, UK,.. In the nuclear safeguards field, NDA and DA capabilities exist at CEA-DAM, at the Energy Research Centre of the Hungarian Academy of Sciences, at the Nuclear Research Centre Rez, Czech Republic, at FZ Jülich, Germany, and at IAEA, Vienna. Activities are complementary to JRC-ITU.

## 1.5 Fundamental Properties of Actinide Materials under Extreme Conditions (PAMEC)

**Description:** The Fundamental Properties of Actinide Materials under Extreme Conditions (PAMEC) consists of an ensemble of state-of-the-art installations designed for basic research on behaviour and properties of actinide materials under extreme conditions of temperature, pressure, external magnetic field and chemical environment. The facility includes devices for measurements of crystallographic, magnetic, electrical transport, and thermodynamical properties as well as facilities for Np-237 Mössbauer spectroscopy, and a modular surface science spectroscopy station allowing photoemission, atomic force microscopy, and electron scattering measurements

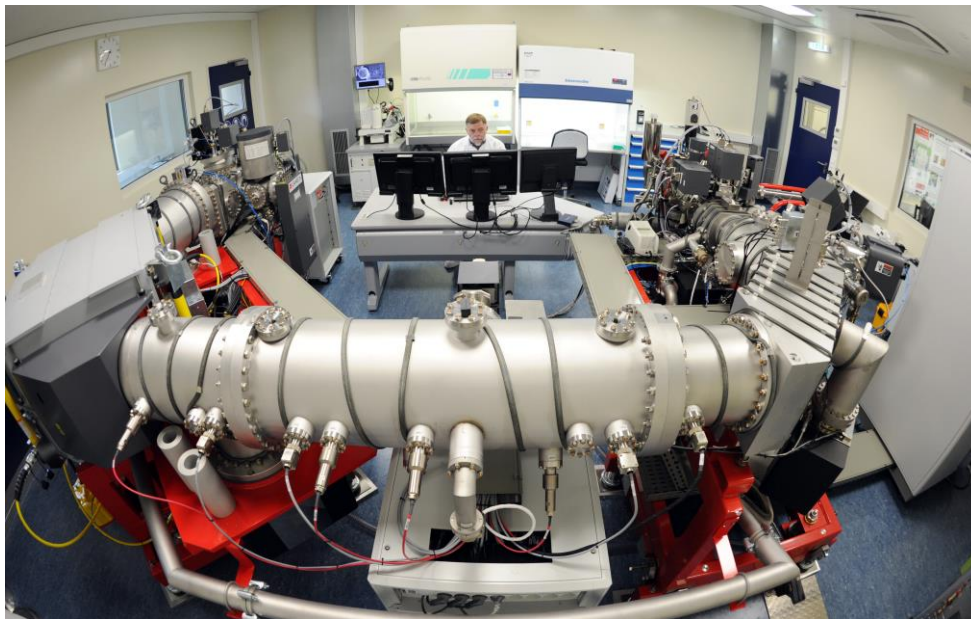


**Uniqueness/Complementarity:** Complementary activities limited to uranium systems are carried out at the Charles University Prague (CZ), at the Institute of chemical sciences of the Rennes University (FR), and at the Institute of Low Temperature and Structure Research, Polish Academy of Sciences, Wroclaw (PL).

Similar facilities exist in Japan (JAEA) and US (LANL,...).

## 1.6 Large Geometry Secondary Ion Mass Spectrometry Laboratory (LG-SIMS)

**Description:** The LG-SIMS laboratory, constructed by JRC and DG ENER, is equipped with a highly sensitive SIMS mass spectrometer to detect minute quantities of uranium/plutonium in micron-sized particles collected for safeguards purposes. Samples to be analysed are sent by IAEA and DG ENER in the context of programmes to detect undeclared nuclear activities or to verify declared ones, respectively. The results provide the uranium enrichment of individual particles. The LG-SIMS laboratory is member of the IAEA Network of Analytical Laboratories.



**Uniqueness/Complementarity:** Particle analysis for safeguards purposes is done also at CEA-DAM, France and AWE, UK, and at IAEA, Seibersdorf, Austria. The EU capabilities are complementary and partly based on other techniques. The IAEA capacity is similar in scope and size.

## 1.7 Euratom On-Site Laboratories at Sellafield and La Hague (OSL & LSS) (operated at Sellafield, UK and at La Hague, France)

**Description:** The OSL and LSS are located at the nuclear reprocessing facilities in Sellafield (UK) and La Hague (France), respectively. The laboratories are operated by JRC-ITU on behalf of DG ENER. Nuclear material (both input and product) is measured by a team of inspector-analysts with NDA and DA methods. Results are transferred to DG ENER to independently assess the nuclear material inventories provided by the operators.



**Uniqueness/Complementarity:** A similar on-site laboratory was built at the Rokkasho reprocessing plant, Japan, using the LSS as the model.

## **1.8 European Nuclear Security Training Centre (EUSECTRA)**

(Located at ITU-Karlsruhe and ITU-Ispira)

**Description:** EUSECTRA offers a unique combination of scientific expertise, specific technical infrastructure and availability of a wide range of nuclear materials, to enable unparalleled training opportunities in the field of nuclear security and safeguards. Training areas for EUSECTRA include border detection, train-the-trainers, mobile emergency response (i.e., MEST), reach-back, creation of national response plans, nuclear forensics, radiological crime scene management, nuclear security awareness and sustainability of a national nuclear security posture. It is based on the JRC facilities at the Ispira and Karlsruhe sites.

**Uniqueness/Complementarity:** EUSECTRA co-operates with EU Member States on nuclear security related training. Capabilities exist also in other EU MS like France, UK, Hungary... However, there is no other installation in the EU with a similar range of capacity.



## 2. Location: JRC-Institute for Transuranium Elements (Ispra, Italy)

### 2.1 Nuclear Facilities Verification Laboratory (NUVER Lab)

**Description:** JRC-ITU develops a series of containment and surveillance techniques for nuclear safeguards using laser based systems. This includes fingerprinting of nuclear containers, change detection, design information verification systems and outdoor verification systems. Research topics also include innovative methods for reviewing surveillance streams, self-localisation and other elements or ambient intelligence, to develop new capabilities for complimentary access inspections



**Uniqueness/Complementarity:** Unique in the application to nuclear safeguards and nuclear security

(main customers IAEA, ENER)

### 2.2 Advanced Safeguards Measurement, Monitoring and Modelling Laboratory (AS3ML)

**Description:** AS3ML laboratory to test and develop innovative integrated solutions for the implementation of safeguards in the different types of nuclear installations. The three main pillars are Measurement of nuclear material, Monitoring the operation of facilities through an extensive collection of data from multiple types of sensors, Modelling the plant operations to derive conclusion on the appropriate operation of the plant according to declarations.

**Uniqueness/Complementarity:** Unique in the application to nuclear safeguards to our knowledge.

(Main customers IAEA, ENER)

### 2.3 PERFORMANCE Laboratory (PERLA) (in the future in INS3L)

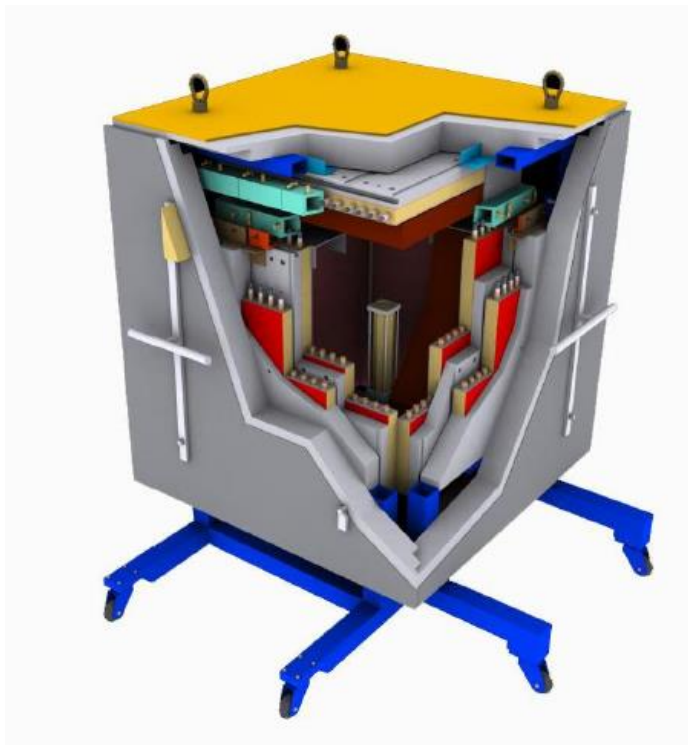
**Description:** PERLA is a laboratory for the assessment and evaluation of performances for all non-destructive assay (NDA) techniques applied in the safeguards of nuclear materials. The laboratory is extensively used for training of nuclear safeguards inspectors (IAEA and DG ENER) and operates de facto as user laboratory for a wide variety of world-wide users (both for R&D and for activities in the area of testing, validation and standardisation).

**Uniqueness/Complementarity:** The experienced staff working at Ispra in the field of NDA performs in PERLA the important training courses for EURATOM inspectors and much additional training on new or modified inspection methods and instruments. We are not

aware of similar NDA training labs being used by DG ENER or IAEA. On a world-scale, yes, IAEA also uses the US-DoE labs (esp. LANL) for NDA training

## 2.4 Pulsed Neutron Interrogation Test Assembly (PUNITA) (in the future in INS3L)

**Description:** PUNITA, the Pulsed Neutron Interrogation Test Assembly (PUNITA), incorporates a pulsed (D-T) neutron generator. As such the instrument finds applications in many different areas although the main research activities concern NDA methods for nuclear safeguards, and for detection of illicit trafficking of nuclear and non-nuclear materials.



**Uniqueness/Complementarity:** A pulsed neutron source exists in Cadarache (FR) with COMPLEMENTARY characteristics. We work together under the strategic collaboration agreement with CEA. The ability of a pulsed neutron source to determine small quantities of fissile materials in matrix materials is the main reason for the strong collaboration between the PUNITA lab and certain decommissioning activities on the Ispra site, in particular the waste characterization of alpha bearing waste as carried out at the WCS facility of the Nuclear Decommissioning Unit (C01) of the Ispra Site Management. Other collaboration between the PUNITA lab and Unit C01 include the hosting of the annual Decommissioning Summer School for students and young professionals, and the competitive project MetroDecom concerning measurement campaigns of real and simulated waste at the Free Release Measurement Facility (FRMF). The Summer School is organized by ITU-E08 but has strong participation from the C01 Unit. The MetroDecom research project has 15 international partners among which are ITU-E08. The benefits of the project for Unit C01 concern verification measurements of actual waste streams on the Ispra site, and the opportunity to gain knowledge about state of the art waste clearance instrumentation.

## 2.5 Illicit Trafficking Radiation Assessment Programme (ITRAP) (in the future in INS3L)

**Description:** The facility is dedicated to perform tests on radiological performances of radiation detection equipment used in nuclear security. It is composed by two laboratories: the static test lab for handheld equipment and the dynamic test lab for portals.

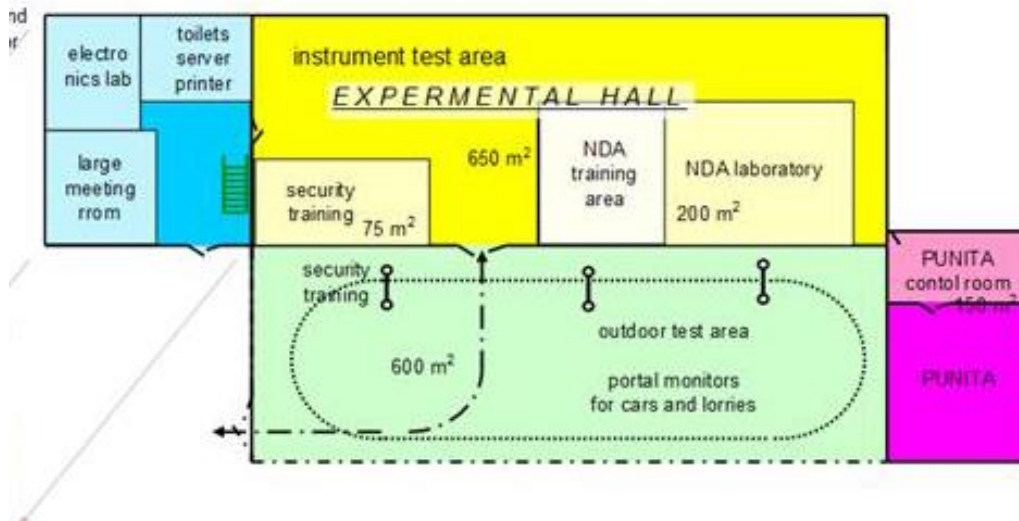


**Uniqueness/Complementarity:** The ITRAP lab has been used as first laboratory in Europe to test equipment versus international standards. The experience gained in the ITRAP+10 project is now in the process to be transferred to identified EU MS laboratories in order to build capacity in equipment testing and certification.

## 2.6 Ispra Nuclear Safeguards, Security and Standardisation lab (INS3L)

**Description:** INS3L stands for Ispra Nuclear Security Safeguards and Standardisation Laboratory. It is a new laboratory building outside the area of the decommissioning project on the Ispra site. It will integrate and house the today laboratories PERLA, PUNITA, ITRAP, EUSECTRA-Ispra. Details on these labs see under their names.

**Uniqueness/Complementarity:** Integrated USER laboratory with easy access to nuclear material for external users.



## 2.7 Tank Measurement Laboratory / Solution Monitoring Laboratory (TAME / SML)

**Description:** The Tank Measurement Laboratory / Solution Monitoring Laboratory (TAME/SML) is concerned with bulk handling facilities, which proposes challenges to the performances of inventory quantification and density characterisation (incl. eg. continuous flow mode tank calibration). Measurements are combined with a solution monitoring software and form the basis for near-real time nuclear material accountancy and control, that is utilised in the parts of the nuclear fuel cycle with high strategic importance. The facility is also used to training correspondingly the safeguards inspectors



**Uniqueness/Complementarity:** Unique in the application to nuclear safeguards to our knowledge.

Main customers: IAEA, ENER, MSs

## 2.8 Sealing and Identification Laboratory (SILab)

**Description:** The Sealing and Identification Laboratory (SILab) is a laboratory for the development, testing and commissioning of security systems used for nuclear and commercial applications and devoted to increase the security of the citizen. The laboratory serves institutional clients like the International Atomic Energy Agency (IAEA), the Directorate General for Energy (DG ENER). Latest developments include ultrasonic bolt seals, US seals combined with fiber optics and low cost electronic seals. Training on application of seals is also provided in the laboratory.



**Uniqueness/Complementarity:** The laboratory serves institutional clients like the International Atomic Energy Agency (IAEA), the Directorate General for Energy (DG ENER)). It is a unique facility to our knowledge

## 2.9 Information Analysis and Methodologies for Nuclear Security and Non-Proliferation (IANUS)

**Description:** The laboratory gathers and collects trade data and open sources in support to information analyses, methodologies and studies for nuclear security and non-proliferation, including the development of the underpinning IT tools. Data sources include import-export databases, open sources drawn from news monitoring, scientific and technical reports, and satellite imageries. Trade data sources are collected in databases and accessed/visualized via advanced business intelligence tools (Tableau). A Nuclear Security Media Monitor developed in collaboration with IAEA is used for information alerts. Relevant information is stored on a

news repository and retrieval system. The laboratory comprises a space for collaborative analyses.

**Uniqueness/Complementarity:** Unique R&D in open laboratories; Providing input to EU and IAEA and also e.g. to the EEAS-INTCEN which works in a classified environment

## 2.10 Radioactivity on the Environment Monitoring (REM)



**Description:** The general aim of the REM action is to support the European Commission in collecting, validating and reporting information on the radiological situation of Europe's environment, in view of providing qualified information to policy makers and the public, as well as to the scientific community for further research. To obtain these objectives REM develops and maintains information exchange systems for monitoring routine (REMdatabase) situations and in the event of radiological/nuclear accident (ECURIE, EURDEP, ENSEMBLE). The emergency room hosts the test and development servers for the emergency systems ECURIE and EURDEP. For the sake of redundancy of the information exchange systems there are also operational servers (mirrored) to REM in Luxembourg (DG ENER D.1).

**Uniqueness/Complementarity:** Unique in Europe. Also working in close collaboration with the IAEA.

### 3. Location: JRC-Institute for Reference Materials and Measurements (Geel, Belgium)

#### 3.1 Neutron time-of-flight facility for high-resolution neutron data measurements (GELINA)

**Description:** GELINA is a pulsed white neutron source where the time-of-flight (TOF) method is used to determine the energy of the neutrons. GELINA is the neutron TOF facility with the best energy resolution in the world. Measurements form the basis for a wide range of evaluated neutron cross-section data, needed for the safety assessments of present-day and future nuclear energy systems.

**Uniqueness/Complementarity:** Measurements play a major role in establishing and improving the evaluated nuclear data files maintained at the OECD-NEA databank and at IAEA. They focus on nuclear reaction standards and on reactions relevant for the safe operation of current reactors (Gen. II, III) and the design of improved new concepts (Gen. IV reactors).

Researchers from Member States and abroad can get access to the JRC nuclear data facilities and radioactivity laboratories via the Open Access programme EUFRAT. Selection of the experiments from external users is based on peer review by international experts representing the stakeholder community.



#### 3.2 Mono-energetic neutron beam facility for nuclear data measurements (Van de Graaff Accelerator)

**Description:** The 7 MV Van de Graaff facility for the production of continuous and pulsed proton-, deuteron- and helium ion beams is serving as a source of well characterised quasi-monoenergetic neutrons. The accelerator is complementary with GELINA. In 2016, the Van de Graaff will be replaced by a Tandem accelerator. The project will lead to increased reliability, stability and reproducibility. The machine can also cover a wider spectrum of experimental conditions.

**Uniqueness/Complementarity:** JRC is the major provider of neutron cross-section data for nuclear energy in Europe. The combination of GELINA and the Van de Graaff accelerator makes JRC one of the few laboratories in the world which is capable of producing the required accuracy for neutron data needed for the safety assessments of present-day and innovative nuclear energy systems. The Van de Graaff accelerator is also part of the EUFRAT Open Access programme.



### 3.3 Laboratories for primary and secondary standardisation of radionuclide activity (RADMET )

**Description:** Radionuclide laboratories equipped with a variety of instruments, many of them unique in their kind, focusing on measurements of nuclides relevant for current and future reactors, waste management, decommissioning, and nuclear medicine. They encompass reference measurements, radionuclide analysis of environmental and industrial samples and laboratory inter comparisons.

**Uniqueness/Complementarity:** The RADMET laboratories serve needs of DG ENER (e.g. Art. 35 EURATOM Treaty), DG SANCO/ENV (radioactivity in food and environment), the IAEA and standardisation institutions and metrology institutes (e.g. BIPM - Consultative Committee for Standards of Ionizing Radiations). They play also a central role in the world-wide harmonisation of radioactivity measurements. The RADMET laboratories are also part of the EUFRAT Open Access programme.

### 3.4 Underground laboratory for ultra-low level gamma-ray (HADES)

**Description:** JRC is operating ultra-low level gamma-ray spectrometry equipment in the 225 m deep underground laboratory HADES (High Activity Disposal Experimental Site), which is located close to the JRC-IRMM at the premises of the Belgian Nuclear Research Centre SCK•CEN. JRC rents the laboratory space in HADES from the partnership EURIDICE (European Underground Research Infrastructure for Disposal of nuclear waste In Clay Environment).



The cosmic ray flux in HADES is 10000 times lower compared to above ground and the background reduction is about the same. Typically mBq-levels of activity are measured in HADES. HADES measurements cover a wide field from radioprotection, fundamental physics and fusion research to characterisation of reference materials and tracing radionuclides in the environment.



**Uniqueness/Complementarity:** The ultra-low level gamma-ray spectrometry measurements in HADES complement the measurements in the RADMET laboratories (see above) and serve the same stakeholders. Researchers from Member States and abroad can get access to HADES via the EUFRAT Open Access programme.

### 3.5 Laboratories for the development and production of well characterised nuclear targets (**Nuclear sample preparation**)

**Description:** The Nuclear sample preparation laboratory provides well-defined and well-characterised:

- actinide and stable targets needed for nuclear cross section measurements.
- specialised thin backings for fission fragment spectroscopy.
- radioactive sources for decay data measurements;
- evaporated fissile targets (only provider in Europe).

**Uniqueness/Complementarity:** High-quality nuclear samples are crucial for the measurements for the nuclear databanks maintained at OECD-NEA and at IAEA, relevant for the safe operation of current reactors and the design of improved new concepts. The Nuclear sample preparation laboratory is one of the few laboratories in Europe that is able to provide well-defined and well-characterised actinide and fissile targets. Customers are researchers using GELINA and the Van de Graaff accelerator and researchers from international nuclear data collaborations (n\_TOF at CERN, CHANDA, CEA, CNRS, JAEA...).

### 3.6 Nuclear reference materials laboratories (**Nuclear Reference Material and Measurement Facility**)

**Description:** The nuclear reference materials laboratories encompass:

- Mass spectrometry equipment
- Chemical sample preparation equipment in glove boxes
- Substitution weighing equipment in glove boxes
- Robot systems for dispensing of radioactive solutions
- Equipment for production of reference particles and UF<sub>6</sub> reference measurements.

The laboratories are used for provision of certified nuclear reference materials, for state-of-the-art reference measurements on nuclear material and environmental samples and for the organisation of Inter-laboratory comparisons on samples analysed in fissile material control and for environmental traces characteristic for the nuclear fuel cycle.

**Uniqueness/Complementarity:** JRC is charged by the EURATOM Treaty, DG ENER and European Safeguards with the performance of reference measurements and the provision of specific nuclear reference materials which have to be prepared under special laboratory conditions.

## 4. Location: JRC-Institute for Energy and Transport (Petten, The Netherlands)

### 4.1 High Flux Reactor (HFR Petten)

**Description:** The high flux reactor (HFR) is a tank in pool type light water-cooled and moderated and operated at 45MW. The reactor provides a variety of irradiation facilities and possibilities in the reactor core, in the reflector region and in the poolside facility, as well as neutron beams. The HFR is owned by the JRC but operated by the Dutch Nuclear Research and consultancy Group (NRG).

**Uniqueness/Complementarity:** The high flux reactor (HFR) is one of the most powerful multi-purpose materials testing research reactors in the world, and a key facility for

medical isotope production at a global scale. It is owned by the JRC but operated by the Dutch Nuclear Research and consultancy Group (NRG). The JRC exploits the HFR through various fuel and structural materials irradiation experiments, through residual stress measurements by neutron diffraction and through neutron radiography of components.

The HFR serves the execution of the Institutional projects IntAG-LWR, MaCoSyMa, as well as several Indirect Actions and Third-Party Work. Currently there are two fuel irradiation experiments ongoing (in cooperation with ITU, NRG and CEA) as well as an RPV materials irradiation.



### 4.2 Structural Materials Performance Assessment laboratories (SMPA)

**Description:** The Structural Materials Performance Assessment laboratories (SMPA) comprise a set of facilities used for the mechanical performance characterisation, life assessment and qualification of structural materials for present and next generation nuclear systems, with a strongly pre-normative research orientation. The test installations include 3 servo-hydraulic and 5 electro-mechanical universal test machines for (thermo-)mechanical tests, low-cycle fatigue, and fracture mechanics tests, 10 uniaxial creep rigs, 4 small-punch creep rigs, 2 Charpy test rigs, a dedicated test rig for thermal fatigue tests of tubular components. Depending on the application, temperature control ranges from cryogenic (liquid nitrogen) to high temperatures (induction heaters and resistance furnaces).

**Uniqueness/Complementarity:** The facility represents a versatile 'work horse' of the F.4 unit serving the execution of various Institutional projects like DATA, IntAG-LWR, MaCoSyMa, PreMaQ, SANuC, as well as several Indirect Actions like ARCHER, MATTER, MULTIMETAL, NUGENIA+, and MATISSE. A clear European dimension is reflected by the fact that the facilities are mainly used for pre-normative research, in order to develop codes-of-practice

and documentary standards (ISO, CEN), participate to round robin and validation testing exercises, and develop component design codes. The facilities have been continuously upgraded to comply with the needs of the work programme.

### 4.3 Laboratory for the ageing of materials in light water reactor environments (AMALIA)

**Description:** The Laboratory for the ageing of materials in light water reactor (LWR) environments (AMALIA) serves aqueous corrosion and stress corrosion cracking investigations of relevance to materials degradation of components in LWR environments. It encompasses four recirculating water loops with 6 autoclave systems, all featuring full water chemistry control. The autoclaves ( $T_{max} = 650^{\circ}\text{C}$ ,  $p_{max} = 360 \text{ bar}$ ) are equipped with environmental mechanical testing facilities (slow strain-rate tensile tests, crack initiation and crack growth rate tests, fracture mechanics, cone-mandrel tests), electrochemistry, electric impedance, DC potential drop, and acoustic emission monitoring, to assess coolant compatibility in BWR, PWR, SCWR reactor environments.

**Uniqueness/Complementarity:** The AMALIA laboratory is a state-of-the-art facility serving the execution of the Institutional projects DATA, IntAG-LWR, PreMaQ, SANuC, SCRASMEX, as well as the Indirect Actions SCWR-FQT, and NUGENIA+. The autoclave systems with mechanical test rigs are unique in their high temperature capabilities and in that they feature proprietary bellows-based pneumatic test control developed in cooperation with VTT. In particular, the miniaturised bellows-based rigs for mechanical testing in aqueous environments represent an innovative in-house development which together with its extended temperature capabilities and the unique instrumentation make the AMALIA lab the only place where certain tests can be performed in Europe, e.g. pressurisation and depressurisation tests on fuel pin mock-ups, or crack growth rate tests in SCW as an accelerating medium for PWR corrosion assessment. These advanced technologies are going to be adapted for stress-corrosion cracking tests in high-temperature liquid lead environments (under development).



#### 4.4 Microstructural analysis laboratories (Microstructural Analysis)

**Description:** The microstructural analysis laboratories encompass state-of-the-art facilities for microstructural characterisation and materials degradation studies, including scanning electron microscopy, transmission electron microscopy and atomic force microscopy, 3D X-ray tomography, X-ray diffraction, thermo-electric power and Barkhausen noise measurements, and micro and nano-indentation hardness measurements. These facilities are shared with the Energy Conversion and Storage Technologies Unit F.2.

**Uniqueness/Complementarity:** The microstructural analysis facilities represent a cross-cutting users' laboratory serving the execution of several institutional projects (IntAG-LWR, MaCoSyMa, PreMaQ, SANuC) as well as the Indirect Actions (MATTER, SCWR-FQT, NUGENIA+, MATISSE). The facilities have been recently upgraded by a powerful 3D X-ray tomograph with comprehensive image analysis and defect visualization capabilities for cracks, creep damage, grain boundary decohesion, dimensional analysis etc. The nano-indentation facility covering a temperature range from – 150°C to + 700°C and featuring also an AFM is currently being commissioned



## Nuclear activities of the Joint Research Centre, European Atomic Energy Community (Euratom) Research Infrastructure

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**EUR 27458 Joint Research Centre**

## JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

*Serving society*  
*Stimulating innovation*  
*Supporting legislation*

