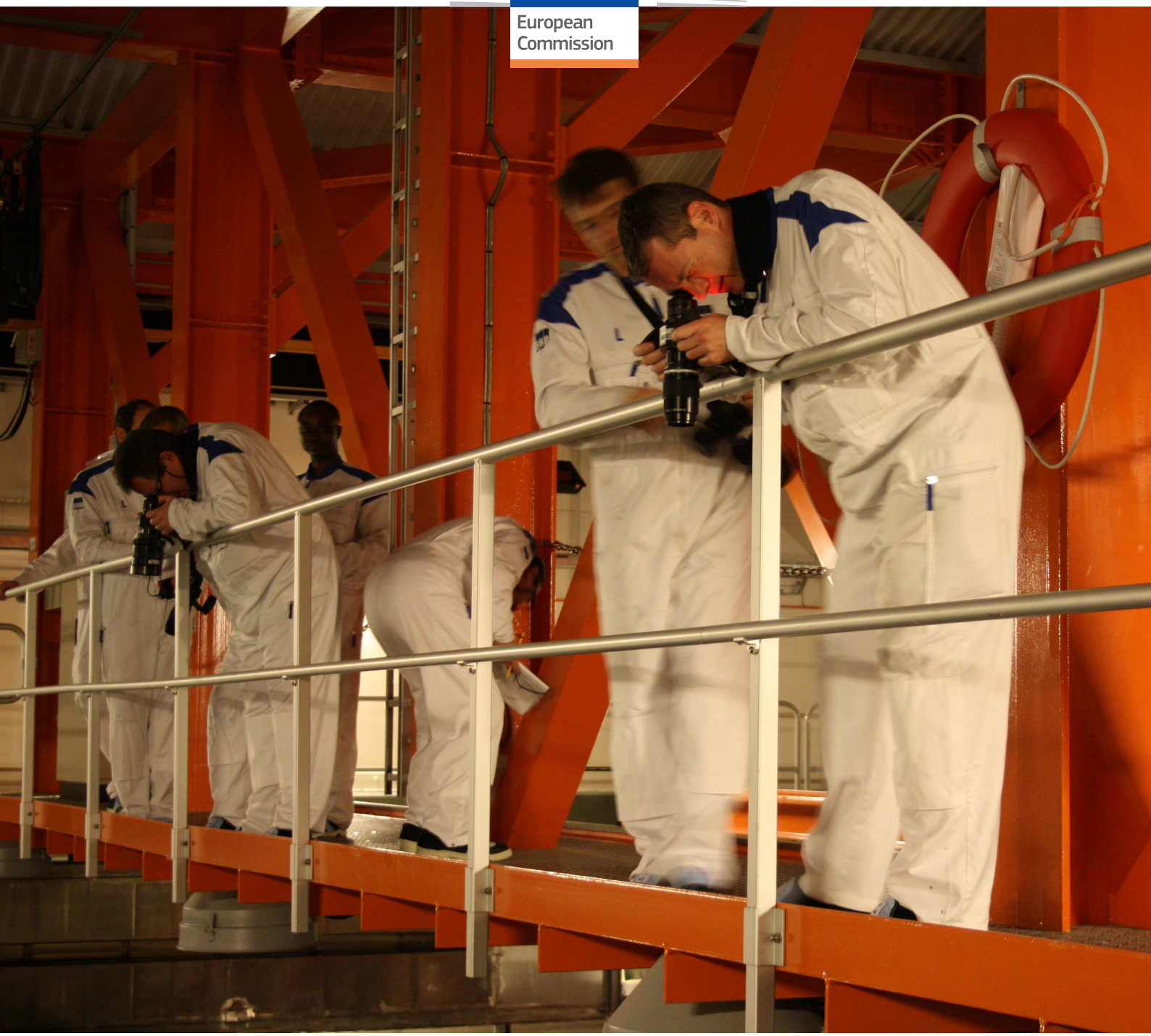
European Commission



Nuclear Safeguards

Energy

For more information:
ec.europa.eu/energy/nuclear/safeguards

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The Euratom Treaty, signed in 1957, laid the foundation for the peaceful use of nuclear materials and technologies in the European Community. Chapter VII of the Treaty established a nuclear material control system and assigned to the European Commission the responsibility of satisfying itself that fissile nuclear materials (plutonium, uranium and thorium) are not diverted from their intended use as declared by the users. These users range from uranium enrichment, fuel fabrication, nuclear power generation and reprocessing plants to holders of small stocks of materials in industry, research or medicine. This nuclear material control system is also known as “Euratom Safeguards”.





Euratom Safeguards in a Nutshell...

- Euratom Safeguards in the European Union (EU) have two main objectives: ensuring that nuclear material is not diverted from its intended use as declared by the users, and guaranteeing that the Community complies with its international obligations concerning the supply and use of nuclear materials, including the non-proliferation of nuclear weapons.
- The Euratom Treaty obliges operators of nuclear installations to supply the European Commission regularly with detailed information about their installations and the nuclear material in their possession.
- The Commission has wide-ranging powers to apply nuclear safeguards. It can, for instance, send inspectors to all places in the EU where declared nuclear materials are located. In case of infringements, the Commission can impose sanctions directly on the users of nuclear materials.
- The Directorate-General for Energy is the department within the European Commission responsible for implementing Euratom Safeguards.

Euratom copper-brass seals awaiting integrity checks

Euratom safeguards:

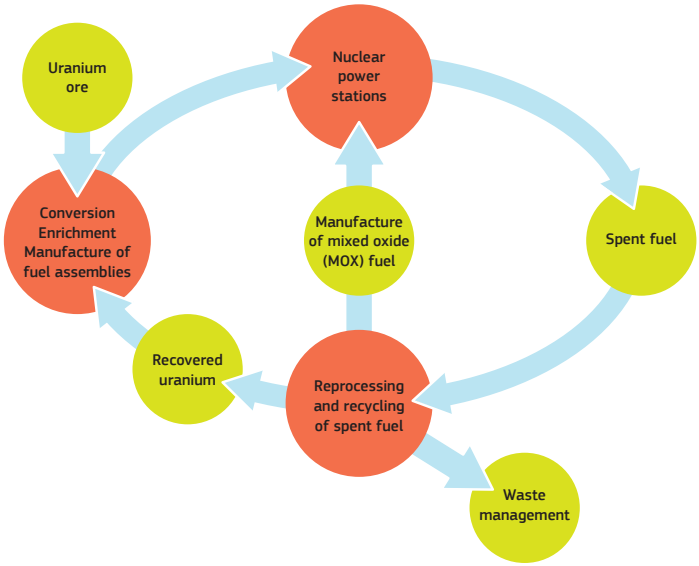
What is involved?

All substances containing plutonium, uranium or thorium are subject to Euratom Safeguards. Most of the nuclear material subject to safeguards is used in the nuclear fuel cycle. This cycle starts with the mining of ore, continues through the intermediate stages of uranium conversion, enrichment, fabrication of fuel elements for electricity generation in nuclear power reactors, and the reprocessing and storage of irradiated fuel elements, and ends with the final disposal of waste.

Euratom Safeguards oblige the holder of nuclear materials to apply a high level of control over these materials. European Commission nuclear inspectors perform verifications on the quality and effectiveness of the nuclear operator's control systems and on the correctness of the declarations on operations, nuclear material movements and inventories. The inspectors' tasks involve verification of the nuclear material accountancy, taking measurements on the nuclear material and performing audits of the control systems. These tasks require highly qualified, reliable and specially trained personnel.

The Nuclear Fuel Cycle

The nuclear fuel cycle covers all the activities related to the generation of electricity using nuclear fuel, starting with the mining of uranium ores and finishing with the disposal of nuclear waste. Irradiated fuel from the nuclear reactors can be reprocessed in order to recover the remaining fissile material for reuse in the production of energy.



The stages of the nuclear fuel cycle:

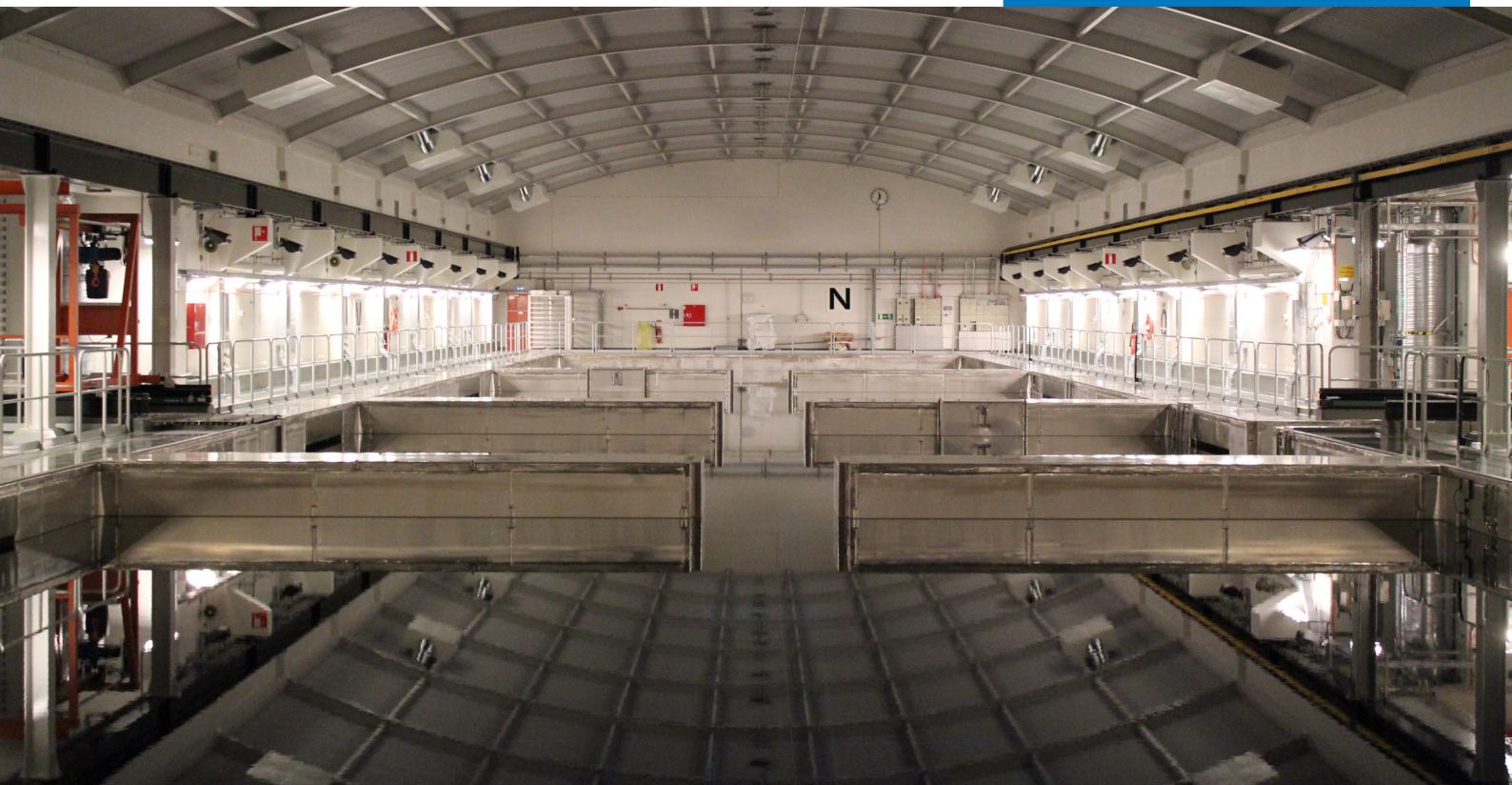
- **Mining:** Uranium ore is extracted from the earth's crust
- **Conversion:** A chemical process which converts uranium ore into uranium hexafluoride, the product used in enrichment installations.
- **Enrichment:** A process to increase the content of the isotope uranium 235 in uranium hexafluoride to make it useable as fuel in nuclear reactors.
- **Fabrication of Fuel assemblies:** The process by which enriched uranium is sintered into small pellets that are stacked into rods and grouped together in an assembly to produce a fuel element.
- **Electricity generation:** The core of the nuclear fuel cycle - controlled fission of uranium atoms inside the nuclear reactor produces heat. This heat is used to produce steam, which turns a turbine connected to an electricity producing generator. The generator produces electricity which is distributed on the power grid.
- **Disposal of spent fuel:** When taken out of the reactor, the irradiated fuel elements emit radiation and continue to release heat. The spent fuel is therefore stored under water in an intermediate storage area so it cools down and its radioactivity gradually decreases.
- **Reprocessing:** A recycling process to separate uranium and plutonium from the highly radioactive fission products in the spent fuel, thereby making it possible to reuse the uranium and plutonium in new fuel elements.

There should be no confusion between nuclear safeguards, nuclear safety, nuclear security and radiation protection.

The term 'nuclear safeguards' is often confused with nuclear safety, the physical protection of nuclear installations or the protection of human beings and the environment against ionising radiation. And yet, nuclear safeguards are quite distinct from these other three areas.

- **Nuclear Safeguards** ensures the peaceful use of nuclear materials by a system of nuclear material accountancy implemented by nuclear operators, the declarations they make to the safeguards authorities and the verification measures performed by these safeguards authorities. When safeguards authorities operate at supranational or international level, they provide guarantees about the peaceful use of nuclear materials in a state to third states.
- **Nuclear Safety** is assured by means of standards for the design, construction, and maintenance of nuclear installations aimed at their safe operation. Nuclear safety therefore concerns the technical and operational aspects of installations. The Chernobyl disaster is an illustration of the result of failing to comply with many safety rules. Nuclear safety is traditionally regarded as being the responsibility of the installation operators, under the authority of their national regulatory bodies. The European Commission has established a common framework of safety standards for the whole of the EU.
- **Nuclear Security** is intended to protect the occupants, the content and the nuclear installations themselves against unauthorised access, theft and sabotage. It involves making installations secure through physical protection measures, such as access checks, intrusion prevention, alarm systems, presence of security staff, etc. Physical protection is currently the responsibility of the Member States.
- **Radiation protectio**n is the term used to describe the health protection of workers in the nuclear sector, the general public and the environment against the dangers arising from ionising radiation. The radiation protection standards set limits for doses, exposures and maximum permitted contamination, requires the medical monitoring of workers and requires the monitoring of radiation levels in the environment. These standards are issued by the European Commission, who also has the right to carry out inspections in the Member States to verify that these standards are correctly implemented.

CLAB – the central interim storage facility for spent fuel in Sweden



Who is responsible for safeguarding nuclear material?

Since 1957, Euratom Safeguards have been the responsibility of the European Commission, pursuant to the Treaty establishing the European Atomic Energy Community, i.e. the Euratom Treaty.

Within the Commission, the Directorate-General for Energy implements safeguards. To this end, it has established a centre of expertise for defining policies and managing the Community safeguards responsibilities. This is based in Luxembourg and relies in particular on a body of safeguards inspectors.

At the international level, nuclear safeguards are part of the regime concerning the non-proliferation of nuclear weapons. Since 1970, they have been the responsibility of the International Atomic Energy Agency (IAEA), a United Nations organisation based in Vienna (Austria) to which all EU Member States belong.

Whereas the IAEA distinguishes between nuclear weapon states and non-nuclear weapon states, the Commission inspects all the civilian nuclear installations of the nuclear fuel cycle in the EU - also in France and the United Kingdom, who are the only EU Member States which possess nuclear weapons.

Closely related to nuclear safeguards are the activities of the Euratom Supply Agency. This agency, which is an independent body supervised by the Commission, ensures equal access to resources and implements a common nuclear material supply policy throughout the European Union.

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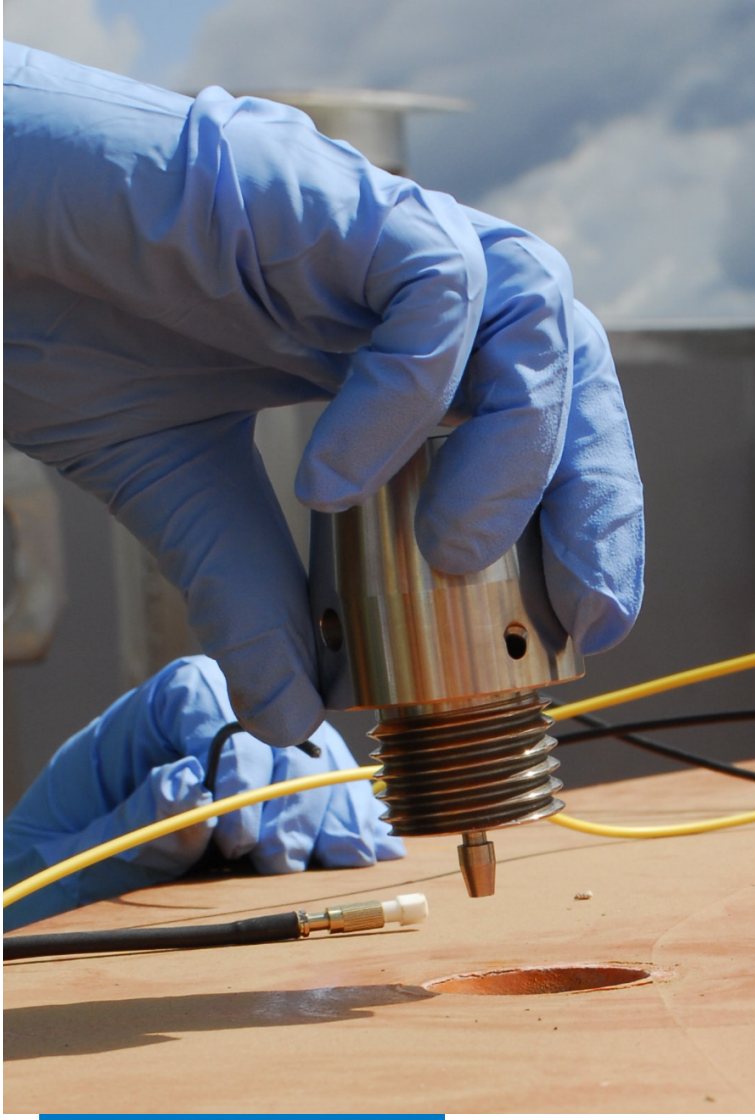


Placing a seal on a spent fuel cask

Tasks assigned to the European Community by the Euratom Treaty

The aim of the Euratom Treaty was to raise the standard of living through the development and use of nuclear energy. The Treaty allows Europe to develop its knowledge and the means needed to exploit nuclear energy for peaceful purposes. In particular, it gives the Community the following tasks:

- to promote research and ensure the dissemination of technical knowledge;
- to establish uniform safety standards for the protection of the health of the general public and workers;
- to facilitate investment and encourage business initiatives;
- to ensure the regular and fair supply of ore and nuclear fuels;
- to guarantee that nuclear materials are not diverted to purposes other than those for which they are intended;
- to exercise property rights over special fissile material;
- to create a common market in specialised material and equipment;
- to promote peaceful use of nuclear energy thanks to relations with third countries and international organisations.

How is the control of nuclear material organised?

To enable the Commission to control the nuclear material within the EU, operators of installations which use or hold such material must comply with certain legal regulations.

- They must communicate to the Commission the basic technical characteristics of their installation in reply to a detailed questionnaire. Any change in these characteristics should be notified to the Commission for subsequent verification.
- They must maintain a high standard of nuclear materials accountancy and control. In this context, the operators are also required to send, each month, accounting reports to the Commission. These formal statements as well as the quality of the nuclear materials accountancy and control systems are verified by the Commission inspectors in headquarters and on-site at the installations.
- Operators must carry out an inventory once a year. This physical stocktaking should report all nuclear material and be submitted to the Commission. The inventory will be subject to a detailed verification on-site by the Commission inspectors.

For its part, the Commission has considerable powers to carry out verification duties assigned to it by the Euratom Treaty.

- All nuclear installations and material within the EU are subject to inspection. The only exception concerns nuclear materials used for national defence purposes by two Member States: France and the United Kingdom.
- The Commission may send inspectors anywhere in the EU. These inspectors have the right of access at all times to nuclear material in the installations concerned.
- The Commission may impose sanctions on people and undertakings failing to meet safeguards obligations imposed upon them by the Treaty or Community law. These sanctions range from a substantiated warning to the withdrawal of nuclear materials from an installation.

The Directorate-General for Energy organises safeguards. It administers all accounting reports and operator notifications. Inspectors check operator declarations both at Commission headquarters and during inspections at the nuclear installations. They verify that the declared records correspond with the physical reality. To this end, the Directorate-General for Energy maintains an infrastructure that allows its inspectors to perform these consistency checks. In this way, it makes available to them the necessary technical equipment such as measurement instruments, seals, surveillance cameras, sample-taking and monitoring equipment. Analysis of nuclear material samples taken by inspectors is performed in collaboration with the Commission's Joint Research Centre (JRC).

High Performance Trace Analysis sampling at an enrichment plant

Reading an ultra-sonic seal bolt

The tools used by the nuclear inspectors

A wide range of technical instruments allow the inspectors to independently verify that the quantities of nuclear material present in the installations correspond to the accounting figures declared to the Commission. The purchase and maintenance of this equipment, which is part of the activities of the Directorate-General for Energy, is funded via the Community budget. The apparatus includes measurement and sealing equipment and surveillance systems.

How do the inspections take place?

The inspectors are officials of the Commission who have been selected on the basis of their specific technical background and once recruited, have successfully followed a specific training programme. They go to the nuclear installations to verify that the operators are keeping nuclear material under tight control. During their inspection visits they check the quality of the operators' nuclear materials accounting and control systems and verify the nuclear material accounts and related justification documents as well as the physical stock. This work is based on documents, the use of measurements, verification of surveillance recordings or sealed stocks, and the taking of samples, etc. When making inventory checks, particular attention is paid to the comparison between the stocks physically present and the quantities reported in the companies' nuclear material accounts. The aim is to detect any shortcomings or misreporting.

The main objective of the activity is to confirm that nuclear materials are used as intended and not diverted by operators for purposes such as illicit trafficking or for making a nuclear bomb.

Some 200 experts work for the Directorate-General for Energy in Luxembourg in the services dealing with nuclear energy; more than half of them are safeguards inspectors performing regular on-site verifications.

The training of the inspectors includes a number of technical courses as well as courses related to auditing techniques and radiation protection. A trainee inspector will only be nominated inspector when he completes successfully all the obligatory courses. The inspection of nuclear installations, by its very nature, entails close proximity to sources of radioactivity. To limit exposure as far as possible, the inspectors are subject to strict radiation protection control procedures. Individual dosimeters permit the recording of radiation doses received during inspections. These are registered in individual radiation passports. Inspectors also have regular compulsory medical examinations.

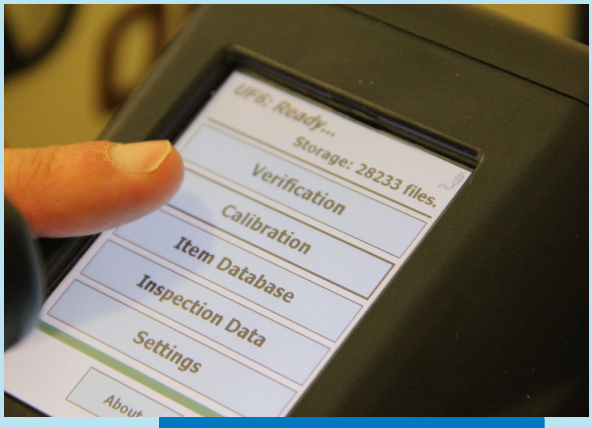
International cooperation

At an international level, safeguards agreements between the Community, its Member States and the International Atomic Energy Agency (IAEA) lay down the conditions under which the IAEA and the Euratom Safeguards systems carry out their joint inspections, ensuring that there is no duplication of efforts and best use is made of available resources. In order to be credible, each organisation must be able to draw its own independent conclusions. Moreover, regular exchanges of information, know-how and experience between the two organisations are arranged.

Cooperation between the Commission and the IAEA also extends to the training of inspectors, the sharing of analytical samples, the results of sample analysis, and the sharing of instruments. The European Commission Support Programme assists the IAEA with research and development of methods, tools and techniques for nuclear safeguards.

Whereas the IAEA performs inspections in the Member States of the European Union which do not possess nuclear weapons, the Commission is the only party to inspect all the civilian installations in the EU Member States including those with nuclear weapons, i.e. France and the United Kingdom. This makes the Commission's system unique.

Euratom nuclear laboratories in Luxembourg



Hand-held detector for measuring uranium

Verifying spent fuel with a Cerenkov Viewing Device

Why is monitoring essential?

The provisions of the Euratom Treaty adopted in 1957 allow for effective and efficient safeguards in all EU nuclear installations. This has made it possible to manage the secure development and peaceful use of nuclear energy for over half a century in Europe. The possession of nuclear material by ill-intentioned persons, groups or companies would be disastrous for the health and safety of the general public, the stability of the economies and world peace.

The provisions of the Euratom Treaty and of secondary legislation based on the Euratom Treaty oblige nuclear operators to maintain the highest levels of safety, security and safeguards. Operators are required to establish, implement and maintain a high-quality nuclear material management system. They are, in particular, required to know at any moment the location and state of all the nuclear material in their plants.

The nuclear safeguards verification activities performed by the European Commission services permit a continuous evaluation of this essential requirement on the holders of nuclear material. This evaluation is carried out through the monitoring of nuclear material flows and inventories, including direct verifications at all nuclear installations.

ec.europa.eu/energy/nuclear/safeguards

Euratom inspector performing in-field verifications

'Next Generation Surveillance System cameras ready for installation on-site