

Andra

An overview of radioactive waste management in France





Contents

Pages 2–3

**French National Agency for Radioactive
Waste Management (Andra)**

Pages 4–5

Radioactivity and radioactive waste

Pages 6–7

**Radioactive waste classification
and disposal concepts**

Pages 8–9

The lifecycle of radioactive waste

Pages 10–11

Andra sites

Page 12

Glossary

**Key dates of radioactive waste
management in France**



*Disposal of radioactive waste packages
at the Aube Disposal Facility (CSA)*



French National Agency for Radioactive Waste Management (Andra)

Andra is a public industrial and commercial institution established by the Act of 30 December 1991.

Its remit was expanded by the Planning Act of 28 June 2006 on the sustainable management of radioactive materials and waste, and further specified by the 2016 Act on the reversibility and creation procedures of Cigéo.

Independent of radioactive waste producers, Andra is overseen by the ministers responsible for energy, research and environment.

Andra's mission

Andra is responsible for the design and implementation of safe and responsible long-term management solutions for all French radioactive waste, in order to protect present and future generations from the risks associated with this waste.

Andra's activities

Andra's missions consist of:

- **Designing, operating and monitoring existing disposal centres (in the Aube and Manche departments) as well as developing future facilities, especially Cigéo, the deep geological disposal facility project.**
- **Supporting public policies** through the National Inventory of Radioactive Materials and Waste and studies related to radioactive waste management.
- Remediating sites contaminated by radioactivity and collecting legacy radioactive objects.
- Preserving and transmitting the memory of Andra's disposal facilities.
- **Informing and engaging in dialogue** with all stakeholders, both in France and internationally.



Andra's funding

The funding for Andra's activities is structured as follows:

- The Cigéo project is funded by the three major operators in the nuclear sector (EDF, CEA and Orano) through a **dedicated research tax** and a **special contribution** to fund facility design studies and preparatory works;
- The operation and monitoring of disposal facilities, waste collection, consultancy services and the promotion of expertise in France and abroad are funded through **commercial contracts**;
- The public service mission—in particular the production and publication of the National Inventory of Radioactive Materials and Waste, the collection of legacy radioactive objects owned by private individuals, and the remediation of legacy contaminated sites—is funded by a **state subsidy**.

Key figures

Approx. 800 employees

5 sites:

- **headquarters** in Châtenay-Malabry;
- **2** operational surface disposal facilities in the Aube department: the Industrial facility for grouping, storage and disposal (Cires) and the Aube disposal facility (CSA);
- **1** disposal facility in the closure phase in the Manche department: Manche disposal facility (CSM);
- **1** facility in the Meuse/Haute-Marne departments (CMHM) comprising:
 - an **underground research laboratory (URL)**,
 - a **technological facility**,
 - an **environmental specimen bank**.



Aerial view of the Manche Disposal Facility (CSM)



Radioactivity and radioactive waste

Radioactivity

Radioactivity is a natural phenomenon. It is the property of certain unstable atoms, known as radionuclides, to transform spontaneously into other atoms while emitting radiation.

The radioactivity of an element decreases naturally over time at varying rates, depending on the nature of the radionuclides.

Since its discovery, the properties of radioactivity have been used in numerous applications: power generation, chemistry, biology (cell studies), geology, archaeology (radiocarbon dating), agriculture and medicine (cancer diagnosis and treatment), among others.

It also has multiple industrial uses, such as food preservation (irradiation), weld inspection in metallurgy, sterilisation of medical equipment, and fire detection. All of these activities produce waste, some of which is radioactive.

Radioactive waste and disposal

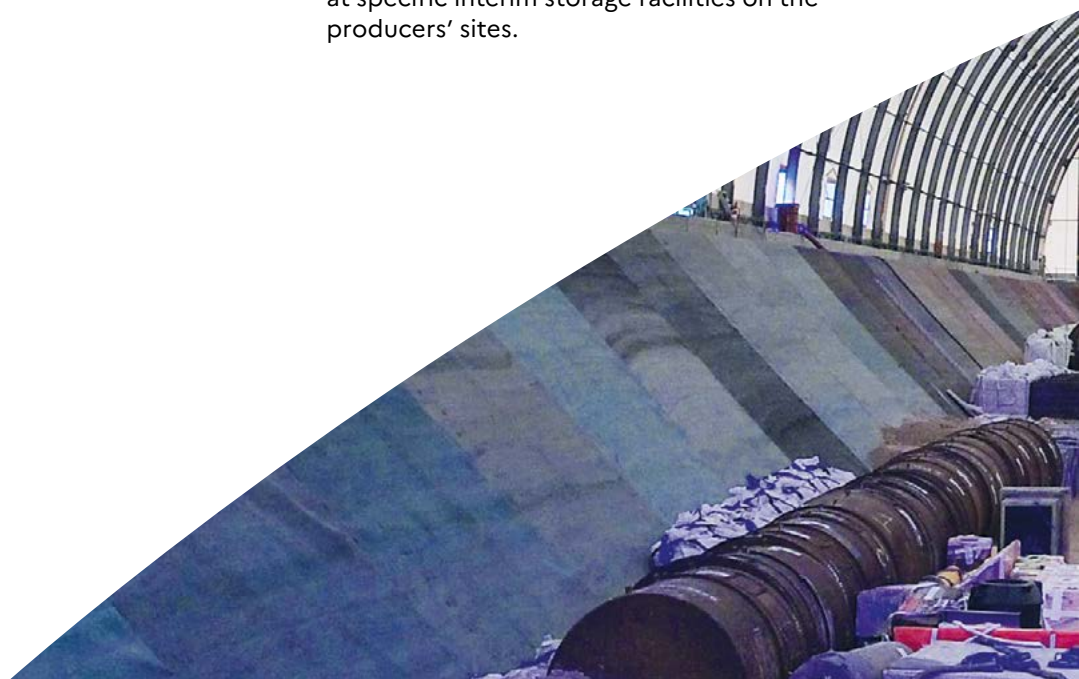
Radioactive waste contains radioactive substances that cannot be reused or reprocessed and must be managed in a specific manner. This waste is highly diverse in nature, including rubble, scrap metal, gloves, filters, resins, lab coats, pipettes, vials, needles and legacy objects such as old alarm clocks, radium water fountains, and lightning rods.

Radioactive waste can originate from the operation and maintenance of nuclear facilities, their decommissioning, the reprocessing of spent fuel from nuclear power plants, the remediation of legacy sites contaminated by radioactivity, research activities, industrial processes, medical examinations and treatments, or even be owned by private individuals, like legacy radioactive objects dating back to the early twentieth century.

To protect human health and the environment from the risks associated with radioactive waste, France, like other countries that have developed nuclear power plants, has opted for the disposal of each category of waste in a tailored disposal solution. The objective is to isolate the waste until its radioactivity has decreased sufficiently through natural decay and no longer presents a risk.

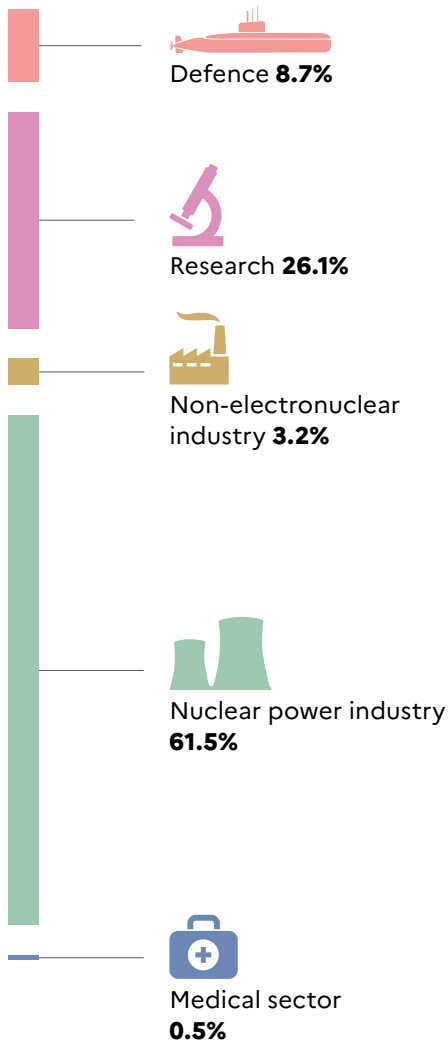
Surface disposal facilities already exist in France. They are operated by Andra and more than 90% of the radioactive waste produced annually in the country is disposed of in these facilities.

For the remaining waste, solutions are currently being studied. In the meantime, this waste is stored at specific interim storage facilities on the producers' sites.



Breakdown of existing radioactive waste by economic sector

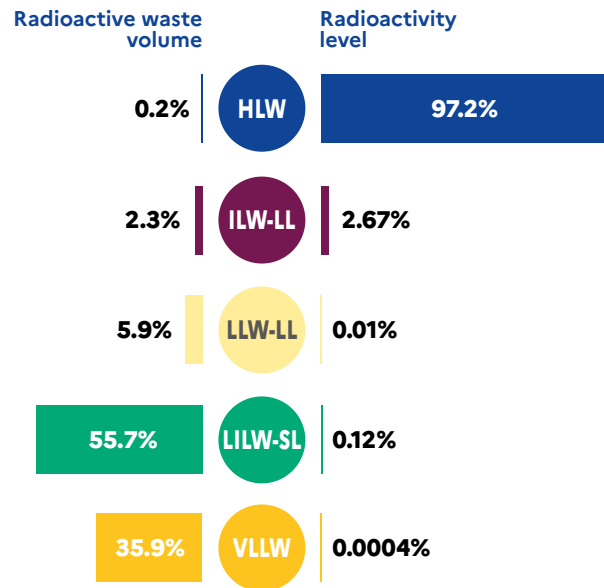
Source: National Inventory of Radioactive Materials and Waste, figures at the end of 2024



Percentages have been calculated based on exact figures, then rounded.

Breakdown of volume and radioactivity level by waste category

Source: National Inventory of Radioactive Materials and Waste, figures at the end of 2021



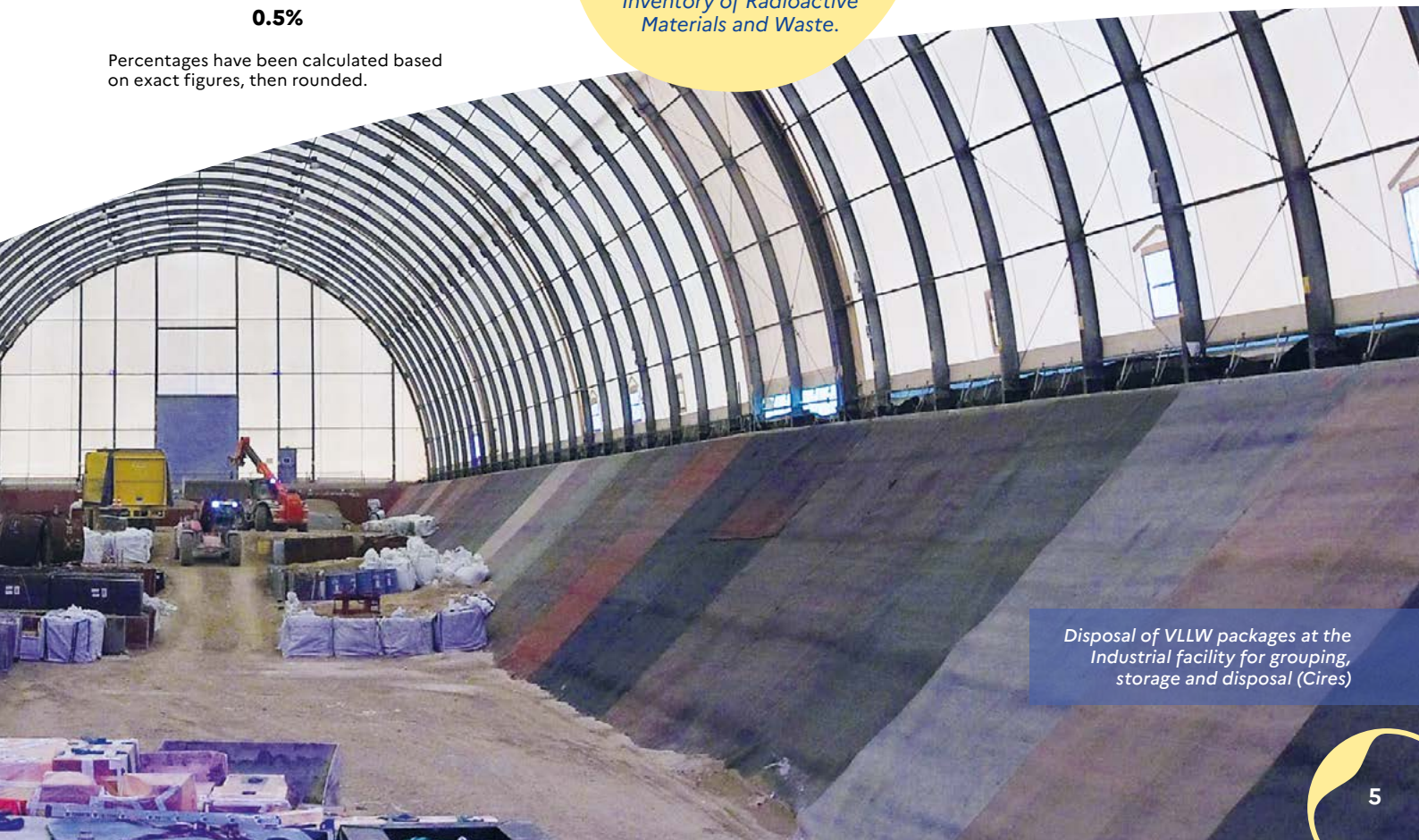
These assessments cover radioactive waste currently or intended to be disposed of by Andra.

Other waste categories subject to specific management methods are also listed in the *National Inventory of Radioactive Materials and Waste*.



1,890,000 m³
of radioactive waste had been produced in France as of the end of 2024

Source: National Inventory of Radioactive Materials and Waste



Disposal of VLLW packages at the Industrial facility for grouping, storage and disposal (Cires)



Radioactive waste classification and disposal concepts

In France, there are five categories of waste.

The classification is based on the waste's level of radioactivity and half-life, which determine the appropriate management and disposal solution.

Very Low-Level Waste (VLLW)



Very low-level waste originates mainly from the operation and decommissioning of nuclear facilities. Some also comes from the remediation of legacy sites contaminated by radioactivity.

VLLW consists of inert waste (concrete, rubble, soil, etc.) or metallic waste. It is disposed of at the surface at the Industrial facility for grouping, storage and disposal (Cires), which opened in 2003.

Upon arrival at the site, some of the waste undergoes specific treatment before disposal:

- Plastic or scrap metal is compacted to reduce its volume.
- Liquid waste (contaminated water, sludges) is solidified and rendered chemically inert. The waste is then conditioned in drums or *big bags*.

Once conditioned, these waste packages are tagged and stacked in disposal cells excavated into a clay layer a few metres deep. When a cell is full, it is sealed with a capping system composed of sand, an impermeable geomembrane and clay.

Low and Intermediate-Level Short-Lived Waste (LILW-SL)

This waste originates either from maintenance (clothing, tools, filters, etc.) and the operation of nuclear facilities, or from research and medical activities in laboratories and hospitals.



This waste, which mainly contains short-lived radionuclides, is disposed of since 1992 at the Aube Disposal Facility (CSA). This facility replaced the Manche Disposal Facility (CSM) which had been in operation from 1969 to 1994.

Prior to disposal, some waste is compacted or solidified, then stabilised with concrete.

The resulting waste packages consist of 15% to 20% waste and 80% to 85% concrete. They are disposed of in reinforced concrete vaults, measuring 25 metres in length and 8 metres high.

Once full, these vaults are sealed with a concrete slab, made watertight with a layer of impermeable resin. Finally, a permanent clay cover several metres thick, equipped with an impermeable membrane, is placed over the vaults to ensure long-term protection.

Low-Level Long-Lived Waste (LLW-LL)

LLW-LL consists of very diverse materials:

- **Radium-bearing waste:** largely originating from non-electronuclear industrial activities (use of radium in the early 20th century, remediation of contaminated sites, rare earth extraction, etc.).

- **Graphite waste:**



already produced or to be produced during the decommissioning of first-generation natural uranium graphite gas (UNGG) reactors.

- **Bituminised waste:**

resulting from the treatment of radioactive effluents.

- **waste from the operation and maintenance of nuclear facilities:** rubble, plastics, metal, plaster, paint, etc.

- **Uranium conversion treatment residue (RTCU):** produced during the first stage of the uranium enrichment process.

Several complementary solutions tailored to the radiological and chemical specificities of this waste are being considered. Among these, Andra is working on a near-surface disposal project to host part of this waste at a potential site in the Vendevre-Soulaines community in the Aube department.

High-Level Waste (HLW) and Intermediate-Level Long-Lived Waste (ILW-LL)

High-level waste (HLW) and intermediate-level long-lived waste (ILW-LL) originate primarily from the nuclear power sector and associated research activities, as well as, to a lesser extent, national defence activities.



- **HLW** corresponds mainly to the highly radioactive residues arising from the reprocessing of spent fuel (primarily from electricity generation and, to a very small extent, from national defence activities).

- **ILW-LL** is varied in nature. It includes the metallic cladding structures around the fuel (hulls and end caps) or residues linked to the operation and maintenance of nuclear facilities.



Cigéo: The deep geological disposal project for HLW and ILW-LL

Cigéo is the French project designed by Andra for the disposal of high-level and intermediate-level long-lived waste (HLW and ILW-LL) in a deep geological formation. It is designed to accommodate waste generated by all existing nuclear facilities throughout their operation and decommissioning.

The fundamental objective of Cigéo is to protect people and the environment from the risks associated with this waste, while limiting the burden placed on future generations. It is the result of over 30 years of research, three Acts of Parliament and several national public debates.

If authorised, Cigéo will be located in the Meuse/Haute-Marne departments, within a clay layer located around 500 metres underground. This clay layer has been studied extensively, notably at Andra's Underground Research Laboratory.

Pending the commissioning of Cigéo, the HLW and ILW-LL packages already produced are stored in interim dry storage facilities at their production sites, primarily at La Hague, Marcoule and Cadarache.

Andra's Underground Research Laboratory
in Meuse/Haute-Marne



The lifecycle of radioactive waste

Radioactive properties are used mainly
in five economic sectors:
nuclear power industry, national
defence, research, non-electronuclear
industry and the medical field



**Treatment and
conditioning***
of most radioactive
waste directly by
its producers



**Transport of radioactive waste
to Andra's surface disposal
facilities in Aube**



Reception of waste
by Andra on the
disposal site



Sorting
of waste by producers
at their production sites

**Production
of radioactive
waste**

**LILW-SL
and VLLW**

**Very
Short-Lived
Waste:**
Radioactive
half-life of less
than 100 days

**HLW,
ILW-LL and
LLW-LL**

On-site radioactive decay
followed, after clearance,
by management as
conventional waste



**Interim storage at the production site
(for nuclear power industry waste)
or in dedicated facility at Cires
(for non electronuclear industry waste)**
pending the commissioning of dedicated
disposal facilities



* To ensure waste packages meet the requirements for disposal at Andra's facilities, they must comply with waste acceptance criteria defined by Andra e.g. on their weight, radionuclide content, radiological activity and associated risks. This data is recorded under a unique identification number linked to a barcode, which acts as an "identity card" for each package, enabling full traceability and the ability to locate its exact position within the disposal facility. To ensure the quality of conditioning and compliance with these waste acceptance criteria, Andra regularly carries out audits at the waste production sites.



Site memory preservation
and transmission
to future
generations



Radiological inspections

*of packages, their contents
and their compliance
with Andra's waste
acceptance criteria*



**Closure of
disposal
facilities**



**specific treatment
of some packages
before disposal**
(e.g., compaction,
solidification)



**Disposal
of packages**



**Monitoring of disposal
sites and their
environment**
*both during operation
and after closure*

In-depth inspections
*of some packages
randomly sampled
on delivery*



*Radiological Screening of a vehicle upon arrival
at the Aube Disposal Facility (CSA)*



Andra's sites

The Manche Disposal Facility (CSM)

Covering an area of approximately 15 hectares, France's first disposal facility received 527,225 m³ of low and intermediate-level waste between 1969 and 1994.

It is currently in the closure phase.



MANCHE DISPOSAL FACILITY
BP 807 Digulleville • 50440 La Hague

To visit the facility:

+ 0033 810 120 172 (local call rate)

For more information, visit:

<https://international.andra.fr/operational-facilities/manche-disposal-facility-csm>

Andra's industrial facilities in the Aube department

The Industrial facility for grouping, storage and disposal (Cires)



With a surface area of 52.5 hectares and an authorised disposal capacity of 950,000 m³, this facility has disposed of very low-level waste (VLLW) since 2003. Since 2012, it has also provided grouping and storage, mainly for waste from non-electronuclear power industries, as well as sorting and treatment services since 2016.

The Aube Disposal Facility (CSA)



Covering 95 hectares with an authorised disposal capacity of 1,000,000 m³, this facility is dedicated to the disposal of low and intermediate-level short-lived waste (LILW-SL) and has been operating since 1992. It succeeded the Manche Disposal Facility (CSM), building on decades of experience.

Key Figures for the Aube surface disposal facilities (as of end 2025)

- **504,445 m³ of waste** disposed of at Cires since 2003, representing **53.1%** of the facility's total authorised disposal capacity.
- **396,044 m³ of waste** disposed of at CSA since 1992, representing **39.6%** of the facility's total authorised disposal capacity.

ANDRA INDUSTRIAL CENTRES IN AUBE
BP 7 • 10200 Soulaines-Dhuys

To visit the facilities:

+0033 800 31 41 51 (free call from a landline)

For more information, visit:

<https://international.andra.fr/operational-facilities/csa-aube-disposal-facility>
and

<https://international.andra.fr/operational-facilities/cires-very-low-level-waste-disposal-and-industrial-facility-non-electronuclear-radwaste-grouping>

**Andra's sites are
open to the public
free of charge all
year round.**

Water quality
monitoring station
established as part of the
Perennial Observatory of the
Environment (OPE)

Andra's Meuse/Haute-Marne Facility (CMHM)

The Underground Research Laboratory



Established in 2000 and located at a depth of 490 metres, the Underground Research Laboratory is a unique research tool for the Cigéo deep geological disposal project, intended for the disposal of high-level (HLW) and intermediate-level long-lived waste (ILW-LL). Its underground drifts allow for the in situ study of a clay layer formed 160 million years ago, as well as various concepts and techniques that may be implemented within Cigéo.

If authorised, Cigéo will be located near the Underground Research Laboratory, but the two facilities will be fully independent of each other.

Key figures for the Laboratory

- **2.5 km of experimental drifts.**
- **Over 80 experiments** within the underground drifts.
- **Over 30,000 measurement points.**

MEUSE/HAUTE-MARNE FACILITY (CMHM)

(Underground Research Laboratory, Technology Exhibition Facility, Environmental Specimen Bank)
Route départementale 960 - BP 9 - 55290 Bure

To visit the facility:

+0033 3 29 75 53 73 (free call from a landline)

For more information, visit:

<https://international.andra.fr/meusehaute-marne-facility-cmhm>

Technological Exhibition Facility



The Technological Exhibition Facility is a 4,000 m² exhibition and experimental facility designed to present the Cigéo project through displays, scale models and industrial prototypes likely to be implemented in the future deep geological disposal facility.

The Environmental Specimen Bank



Andra's Environmental Specimen Bank preserves the chemical and radiological records of the environment surrounding the potential Cigéo site. It is a key tool of the Perennial Observatory of the Environment (OPE), which inventories biodiversity and monitors ecosystem evolution across a 900 km² study area.

Environmental monitoring of the facilities

Prior to the commissioning of its sites, Andra established an environmental baseline to describe their primary characteristics and surroundings. This baseline serves as a reference for analyses conducted during the operational phase, as well as during the closure and post-closure monitoring phases. Through extensive sampling and analyses of water, air, soil, flora and fauna, Andra can assess the environmental impact of its activities and verify that this impact is negligible.

Each year, more than 5,000 environmental samples are taken on and around Andra's facilities in Aube and Manche. These samples undergo approximately 35,000 radiological and physico-chemical analyses.

If the Cigéo project is authorised, a monitoring plan will also be implemented around the facility, under the supervision of the French Authority for Nuclear Safety and Radiation Protection (ASN). This regulatory monitoring will be bolstered by observations conducted as part of the Perennial Observatory of the Environment, which brings together a suite of observation, experimentation and conservation tools. This certified observatory is a member of numerous national and international scientific networks.

A

Activity

The level of radioactivity, measured in becquerels.

Atom

The fundamental building block of matter. Each atom consists of a nucleus (protons and neutrons) and orbiting electrons.

B

Becquerel (Bq)

The unit of measurement for the level of radioactivity, named after Henri Becquerel, who discovered radioactivity at the end of the 19th century.

D

Disposal

A long-term industrial management solution for radioactive waste. The safety of disposal relies on three components: the **waste packages** containing the waste, the **disposal structures** in which the packages are placed, and the **geology** of the site, which acts as a natural barrier.

Disposal structure

The structure in which the waste packages are disposed of.

R

Radiation

Radioactive atoms emit radiation at various energy levels. There are three main types of radiation with varying degrees of penetration: **Alpha radiation**: its range in the air is a few centimetres and it can be stopped by a simple sheet of paper; **Beta radiation**: which penetrates several metres through the air. It is stopped by a sheet of aluminium or a pane of glass; **Gamma radiation**: of the same nature as X-rays but with much higher energy; it is stopped by several centimetres of lead or several decimetres of concrete.

Radioactive half-life

The average time required for a radioactive substance to naturally lose half of its activity. Consequently, the activity of a radioactive substance is divided by four after two half-lives, and by eight after three half-lives. After ten half-lives, the activity is reduced by a factor of 1,000. A distinction is made between waste containing radionuclides with a short half-life (less than or equal to 31 years) and those with a long half-life (greater than 31 years). The 31-year threshold is determined by the radioactive half-life of caesium-137. It is generally considered that short-lived waste no longer presents a radiological risk after 300 years.

Radioactive waste

Radioactive substances for which no further use is intended or foreseen.

Radioactivity

Most atoms (such as hydrogen, for example) are stable and are not radioactive. Others, like plutonium or tritium, are unstable and spontaneously transform into other atoms (whether stable or not). During this transformation, they release excess energy in the form of radiation until they reach a stable state: this phenomenon is known as radioactivity.

Reversibility

According to the Act of 28 June 2006, deep geological disposal of high-level and intermediate-level long-lived waste must be reversible for at least 100 years. According to the Act of 25 July 2016, reversibility is the ability of successive generations either to continue construction and operation of the successive disposal units, or to reassess previously made choices and develop management solutions.

S

Sievert (Sv)

The unit of measurement for biological effects on human health resulting from exposure to radioactivity. According to regulations, the annual dose linked to nuclear industry activities must be kept as low as possible and must not exceed 1 mSv for the general population. By way of comparison, in France, the average annual exposure to natural radioactivity is 3 mSv, while artificial radioactivity (primarily from medical exposure) accounts for 1.5 mSv.

Storage

An interim waste management solution for radioactive waste prior to its disposal.

W

Waste package

A container in which radioactive waste is placed, generally immobilised within a "matrix" (such as concrete or glass).



Key dates of radioactive waste management in France

1969

Operation of the Manche Disposal Facility (CSM) starts under the responsibility of the CEA.

1979

Creation of Andra within the CEA.

1991

The Act of December 30, France's first legislation regarding the management of radioactive waste. It grants Andra its status as a public industrial and commercial institution, independent of radioactive waste producers.

1992

Operation of the Aube Disposal Facility (CSA) starts.

1994

Last waste package disposed of at the Manche Disposal Facility.

2000

Construction of the Meuse/Haute-Marne Underground Research Laboratory begins.

2001

First four-year contract between the State and Andra, defining the Agency's objectives.

2003

- Commissioning of the VLLW disposal facility (Cires).
- Decree authorising the transition of the Manche Disposal Facility to its monitoring phase.

2005

Submission to public authorities of a summary report (the 2005 File) on the feasibility and safety of reversible deep geological disposal for HLW and ILW-LL.

2005–2006

Public debate on general options for the management of HLW and ILW-LL.

2006

Parliamentary debate and the Act of 28 June, which expanded Andra's missions and established reversible deep geological disposal as the reference solution for the long-term management of HLW and ILW-LL.

2007

Establishment of the Perennial Observatory of the Environment (OPE).

2010

Government approval of the approximately 30 km² zone proposed by Andra for further studies to site the Cigéo project.

2011

Launch of the Cigéo industrial design phase.

2012

Commissioning of interim storage and grouping facilities for non-electronuclear industry waste at the Cires, in the Aube department.

2013

Public debate on the Cigéo project, organised by the National commission for public debate (CNDP).

2016

- The Act of 25 July, setting out the conditions for the creation of a reversible deep geological disposal facility for HLW and ILW-LL.
- Andra submits the safety option report for Cigéo to the ASN.
- Commissioning of the sorting and treatment facility for non-electronuclear waste at the Cires.

2018

Commissioning of the Waste Package Inspection Facility (ICC) at the CSA.

2022

Declaration of public interest of the Cigéo project.

2023

- Submission of Cigéo creation licence application.
- Publication of the new edition of the *National Inventory of Radioactive Materials and Waste* (<https://international.andra.fr/radioactive-waste-france/managing-complex-inventory>).

2024

- The project to increase the disposal capacity of Cires (Acaci project) is authorised by prefectural order.
- Submission of a technical and safety options report regarding the near-surface disposal project on the site of the Vendeuvre-Soulaines community of communes.

2025

ASN deems the Cigéo safety demonstration satisfactory at the stage of a creation licence application.



**AGENCE NATIONALE POUR LA GESTION
DES DÉCHETS RADIOACTIFS**

1-7, rue Jean Monnet
92298 Châtenay-Malabry cedex France
www.andra.fr

