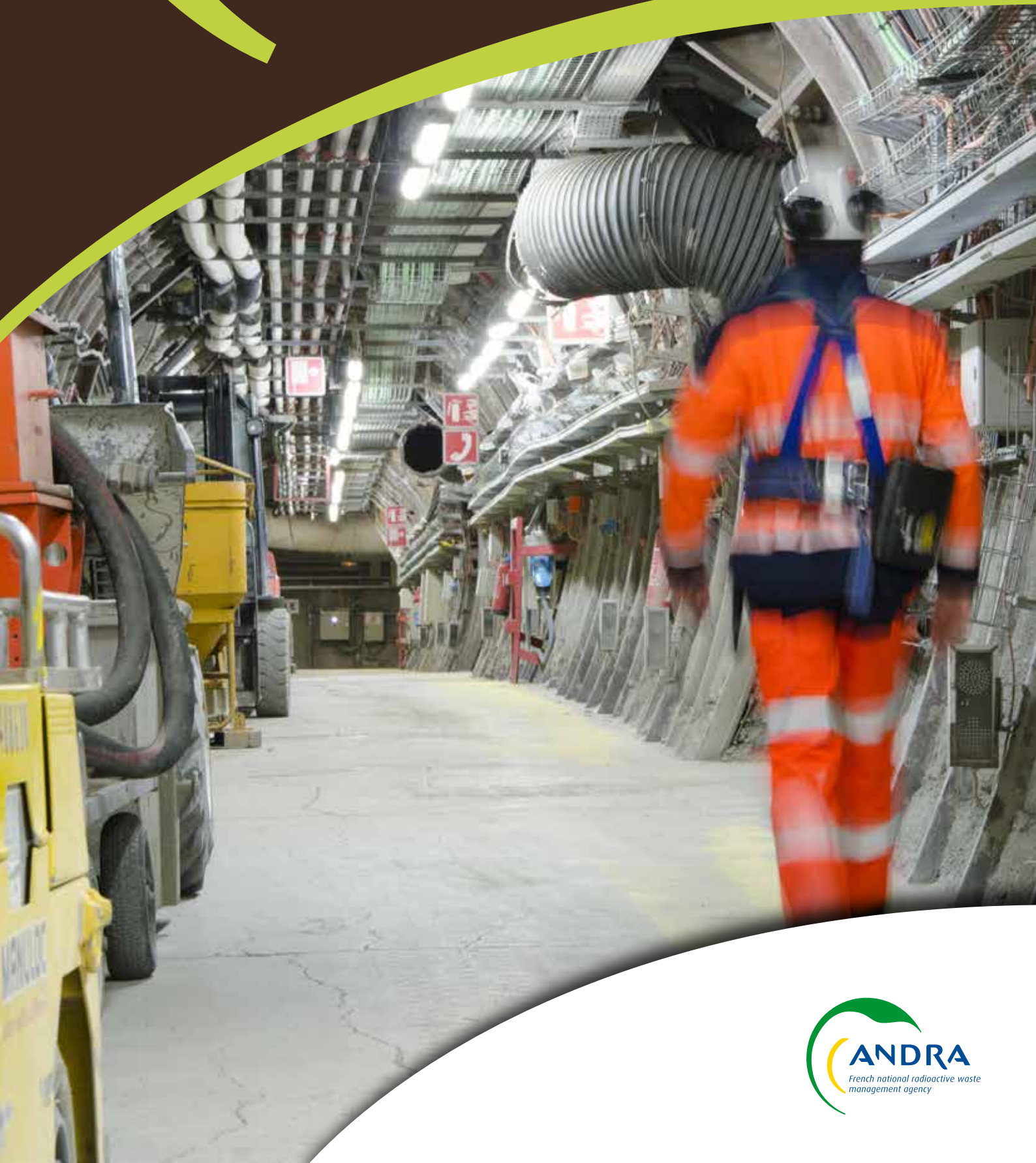
Andra in Meuse & Haute-Marne



ANDRA
French national radioactive waste management agency

Contents

Editorial

In 2006, following many years of research, studies and assessments of various radioactive waste management solutions, the French Parliament opted for deep geological disposal and asked Andra to design a deep geological disposal facility for high-level waste (HLW) and intermediate-level, long-lived waste (ILW-LL) - a project known as Cigeo. This is why Andra has been present in the Meuse and Haute-Marne areas for over twenty years.

Starting with the Underground Research Laboratory in Bure (in the Meuse area), Andra has gradually expanded the Meuse & Haute-Marne Centre (CMHM) facilities since 2000. In 2007, the Perennial Observatory of the Environment (OPE) was set up to better understand the changes with time to the natural environment surrounding Andra's facilities and, in 2009, the Technological Exhibition Facility opened in Saudron, Haute-Marne, to present Cigeo, the geological disposal facility project.

Finally, the Environmental Specimen Bank opened in 2014 for the conservation of environmental samples taken in connection with OPE activity for at least one hundred years.

In addition to contributing to the development of these two areas by creating jobs and purchasing from local suppliers, Andra has been committed to working alongside local stakeholders for the last twenty years, and has since then become an integral part of economic, social and cultural life in the region. If the Cigeo Project is approved, the site will become a leading industrial, educational and research hub for the region.

David Mazoyer
Director of the Meuse & Haute-Marne Centre

Did you know?

Every person in France indirectly produces **2 kg of radioactive waste each year.** Of this, **20g are HLW and ILW-LL.**

Andra and radioactive waste

Every year, France generates tens of thousands of cubic metres of radioactive waste. This waste comes from the various sectors which utilise the properties of radioactivity, including nuclear power generation, defence, industry, healthcare and research.

At present, Andra operates two waste disposal facilities in the Aube area, where 90% of the radioactive waste produced annually is managed. For safety reasons, the remaining 10% cannot be disposed of at these surface facilities.

Some of this waste, known as high-level waste (HLW) and intermediate-level long-lived waste (ILW-LL), is highly radioactive and can remain hazardous for hundreds of thousands of years. A suitable solution must be implemented to manage such waste, as defined in the Act of 28 June 2006: reversible disposal in a deep geological formation.

ANDRA

Andra, the French National Radioactive Waste Management Agency, is a public agency tasked with developing and implementing safe solutions for the management of all types of radioactive waste in France in order to protect current and future generations from the hazards posed by such waste. Andra is independent of radioactive waste producers and is supervised by the French Ministries for Energy, the Environment and Research.

As on 31 December 2016, 645 people were employed by Andra across 5 sites:

- **Head Office** in Châtenay-Malabry, Île-de-France,
- **Andra's two Aube industrial facilities:** the Aube disposal facility (CSA) in the towns of Soulaines-Dhuys, Ville-aux-Bois and Epothémont, and the Industrial facility for grouping, storage and disposal (Cires) in Morvillier and La Chaise,
- **The Manche disposal facility (CSM)** at Digulleville in the Manche area,
- **The Meuse & Haute-Marne Centre** (CMHM), comprising the Underground Research Laboratory and the Environmental Specimen Bank in Bure, Meuse, and the Technological Exhibition Facility in Saudron, Haute-Marne.

RADIOACTIVE WASTE

Radioactive waste refers to radioactive substances for which no subsequent use is planned or intended. It contains radioactive atoms called radionuclides, such as caesium, uranium, iodine, cobalt, radium and tritium, to name but a few. Depending on the quantity and nature of these radionuclides, the waste will remain more or less radioactive for varying lengths of time.

At the end of 2015, there was a total of approximately 1,508,000 m^3 of radioactive waste in France.

CATEGORIES OF RADIOACTIVE WASTE

In France, radioactive waste is classified according to five categories: high-level waste (HLW), intermediate-level long-lived waste (ILW-LL), low-level long-lived waste (LLW-LL), low- and intermediate-level short-lived waste (LILW-SL), and very low-level waste (VLLW).

This classification is based on a number of criteria including, most significantly, the level of radioactivity and half-life.

The volume of HWL and ILW-LL that may be disposed of at the Cigeo Geological Disposal Facility is estimated as follows:

- 10,000 m^3 of HLW,
- 73,000m^3 of ILW-LL.

This represents less than 4% of the total volume of waste resulting from the operating and future dismantling of France's current nuclear power plant fleet, but accounts for 99% of its radioactivity.

Deep geological disposal

Deep geological disposal consists of isolating radioactive waste from humans and the environment for very long periods of time, in rock strata several hundred metres below ground level which act as a natural barrier, passively ensuring safety in the long term, i.e. without depending on human intervention and without becoming a burden on future generations.

Did you know?

30% of HLW and **60%** of ILW-LL waste **planned for disposal at Cigeo has already been produced.**

1 ILW-LL packages in a concrete disposal container

2 A HLW package

Andra in Meuse & Haute-Marne:
key implementation stages

THE ACT WHICH CREATED ANDRA

On 30 December 1991, the French Parliament passed a law on research into radioactive waste management. Under this Act, Andra was set up as a public body and tasked with conducting studies into the deep geological disposal of HLW and ILW-LL, primarily by building underground research laboratories. To this end, between 1994 and 1996, Andra studied the geology of the various French departments [administrative division of France] that offered to host a research laboratory. Four sites were selected based on their geological characteristics: an argillaceous layer in three departments (Gard, Meuse and Haute-Marne) and a granite mountain range in the fourth departments (Vienne). The results revealed that the geological features of the Meuse and Haute-Marne areas, which were grouped together on account of the continuity of the argillaceous layer studied, were particularly suitable.

At the end of 1998, the French government announced that the Meuse & Haute-Marne site had been selected as the location of an underground research laboratory, while the site in the Gard was ruled out and the results of the study on the Vienne site were deemed inconclusive.

2000: CONSTRUCTION OF THE UNDERGROUND RESEARCH LABORATORY BEGINS

The geological surveys carried out in the area bordering the Meuse and Haute-Marne areas confirmed the feasibility of an argillaceous, or clay rock, stratum, formed in the Callovo-Oxfordian period and which has remained stable for 160 million years; a homogeneous layer that is 130 metres thick and located at a depth of around 500 metres.

In 1999, following a public inquiry, Andra was granted authorisation to build and operate an underground research laboratory in Bure, Meuse. Excavating the shafts of the Underground Research Laboratory began in 2000.

1 The shaft sinking zone at the Underground Research Laboratory, February 2001

2 Map of the Transposition Zone (outlined in blue) and the ZIRA (outlined in red)

3 Aerial view of the Laboratory, October 2002

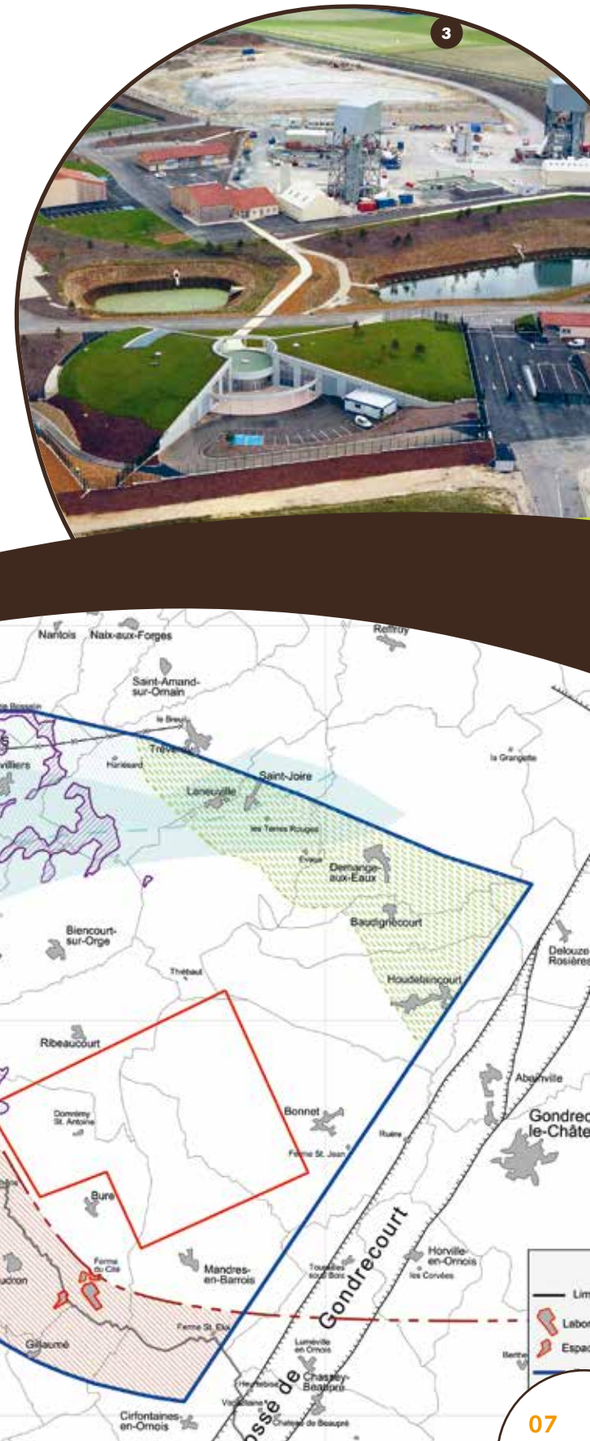
RESEARCH WHICH HAS BORNE ITS FRUIT

The studies undertaken by Andra, particularly those performed from the surface or in the drifts of the Underground Research Laboratory, have enabled it to demonstrate the feasibility and safety of deep geological disposal in the sector studied.

The results of the studies, submitted to the French government in a report entitled *Dossier 2005*, helped to identify an area of 250 km² around the the Underground Research Laboratory, known as the **"transposition zone"**. The properties of the geological stratum found in this zone and likely to be used for disposing of waste packages are similar to those observed at the Laboratory. The National Assessment Board (CNE) and the French Nuclear Safety Authority (ASN) have assessed the *Dossier* and confirmed Andra's results.

FOR MORE INFORMATION

THE HISTORY OF CIGEO VIDEO



Andra in Meuse & Haute-Marne:
key implementation stages

IN 2006, FOLLOWING A PUBLIC DEBATE ON RADIOACTIVE WASTE MANAGEMENT IN FRANCE, A SECOND LAW APPROVING THE CHOICE OF DEEP GEOLOGICAL DISPOSAL WAS PASSED.

Based on the results of the research, its assessment and the first public debate, the Act on the sustainable management of radioactive material and waste, passed on 26 June 2006, adopted deep geological disposal as the reference solution for the long-term management of high-level and intermediate-level long-lived waste.

Following this decision, Andra was tasked with conducting studies to design and develop a deep disposal facility which, if approved, may begin operation in 2025. The Act also made Andra responsible for leading studies into storage of waste and coordinating them with research into deep geological disposal, given their complementary nature. It also ruled on the continuation of research into partitioning and transmutation carried out by CEA.

IN 2009, ANDRA PROPOSED A 30 KM² UNDERGROUND ZONE WITHIN THE TRANSPOSITION ZONE, REFERRED TO AS THE "ZONE OF INTEREST FOR DETAILED SURVEY", or ZIRA, to be used to pursue studies for siting the disposal facility. After consulting France's Nuclear Safety Authority, the National Assessment Board, elected officials and the Local Information and Oversight Committee, the French government approved the ZIRA and authorised Andra to conduct a new series of geological surveys.

THE PROJECT WAS NAMED CIGEO AND ENTERED THE INDUSTRIAL DESIGN PHASE IN 2010.
The same year, following a public inquiry, Andra was granted authorisation to continue operating the Underground Research Laboratory until 2030.

At the end of 2012, Andra produced a conceptual industrial design for the Cigeo facility, which was then submitted for public debate.

IN 2014, FOLLOWING THE PUBLIC DEBATE, ANDRA PRESENTED THE DEVELOPMENT PLANS FOR THE CIGEO PROJECT. Taking into account the opinions and expectations expressed during the public debate and by its assessors, continuing the stepwise approach initiated by the Act of 1991, Andra decided to pursue the Cigeo Project subject to four modifications, while refining its position on reversibility and making commitments concerning disposal facility safety, regional development and cost management.

ACT NO. 2016-1015 OF 25 JULY 2016 DEFINES THE CONCEPT OF REVERSIBILITY FOR THE FACILITY, LEAVING OPTIONS OPEN both in technical terms and in terms of governance for future generations, given that they will have to operate the disposal facility for at least a hundred years.

FOR MORE INFORMATION

CIGEO.COM WEBSITE

THE OUTCOME OF THE PUBLIC DEBATE

1 Experimental Drift Two opened in 2009

2 Monitoring an experiment

3 Press conference to launch the public debate in April 2013

Did you know?

In 2011, the 2011/70/EURATOM **European Directive** of 19 July establishing a Community Framework for the responsible and safe management of spent fuel and radioactive waste stated that **at this time, geological disposal represents the safest and most sustainable option** as the end-point of high-level waste management.

Andra in MEUSE & HAUTE-MARNE,
a scientific and technological research centre dedicated to an industrial project

THE UNDERGROUND RESEARCH LABORATORY: A UNIQUE TOOL

The Underground Research Laboratory is the only research tool of its kind in France. Located 490 metres underground, it enables scientific and technological research to be carried out directly within the Callovo-Oxfordian clay layer.

The Laboratory's underground facilities include:

- **two shafts** with an effective diameter of 4 and 5 metres, excavated at depths of up to 503 and 508 metres respectively, which create a link between the underground facilities and the surface;
- **an experimental drift** measuring 41 metres in length in the upper part of the argillite layer, at a depth of 445 metres, used for observation and measurements,
- **a 1,700-metre network of drifts** located at a depth of 490 metres below the surface, at the centre of the argillaceous layer.

The research carried out by Andra at the Laboratory is mainly based on setting up scientific experiments, in collaboration with many partners, and on conducting technological tests directly within the rock formation.

THE TECHNOLOGICAL EXHIBITION FACILITY, AT THE CORE OF INDUSTRIAL DESIGN

The 4,000 m² Technological Exhibition Facility is an experimentation and public information centre built to present the Cigeo project through exhibitions, scale models and industrial prototypes of technological solutions that may be used in the future deep geological disposal facility.

THE CORE SAMPLE LIBRARY

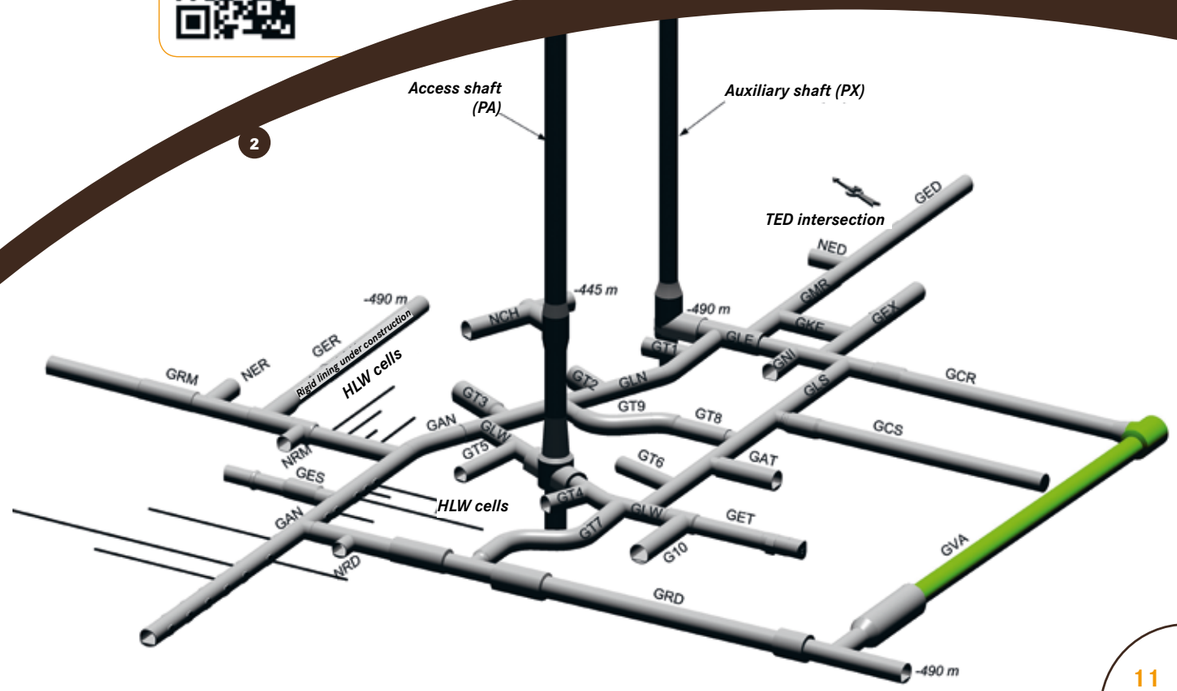
Located in Gondrecourt-le-Château, this 7,000 m² building houses the geological core samples collected during the borehole drilling campaigns carried out in France during the search for suitable rock formations for the disposal of radioactive waste: argillaceous rock in the Aube, Aisne and Gard areas; granite formations in the Vienne area; and sandstone, limestone, marls and clays in the Meuse and Haute-Marne areas. These samples constitute an invaluable source of information, and are regularly consulted by experts in the Earth Sciences.

Did you know?

Designed for scientific and technical studies carried out as part of the disposal facility project, **the Laboratory does not contain any radioactive waste** and, in accordance with the decree granting its construction licence, **no waste can be disposed of there.**

FOR MORE INFORMATION

VIRTUAL TOUR OF THE UNDERGROUND RESEARCH LAB



1 Excavating a large-diameter drift in the Laboratory

2 Map of the Underground Research Laboratory drifts

3 Technological Exhibition Facility

Andra in MEUSE & HAUTE-MARNE,
a scientific and technological research centre dedicated to an industrial project

THE PERENNIAL OBSERVATORY OF THE ENVIRONMENT (OPE), ITS MEASUREMENT STATIONS AND THE ENVIRONMENTAL SPECIMEN BANK

In 2007, Andra set up the “Perennial Observatory of the Environment” (OPE). One aim of the OPE is to establish the initial state of the current environment around the future disposal facility, for a ten-year period, and then to monitor any changes to it throughout the construction and operating life of the Cigeo Facility, in addition to regulatory environmental monitoring. The OPE is a unique facility that reflects the exceptional nature and operating life of the Cigeo Project.

The OPE, along with its measurement equipment and protocols, was defined in collaboration with expert scientific organisations that are renowned in their fields, such as INRA and AirLorraine, among others. Many of these organisations are tasked with performing measurements and analyses.

The zone studied by the OPE covers a surface area of 900 km² surrounding Andra's current facilities in Meuse and Haute-Marne. Within this zone, more detailed studies are being conducted on a reference sector of around 240 km², encompassing the zone proposed by Andra for the Cigeo Facility's location.

In order to define the initial state of the environment and then monitor any changes to it, **the various types of natural environment are monitored by:**

- observation stations,
- regular sampling,
- satellite images.

1 The Environmental Specimen Bank

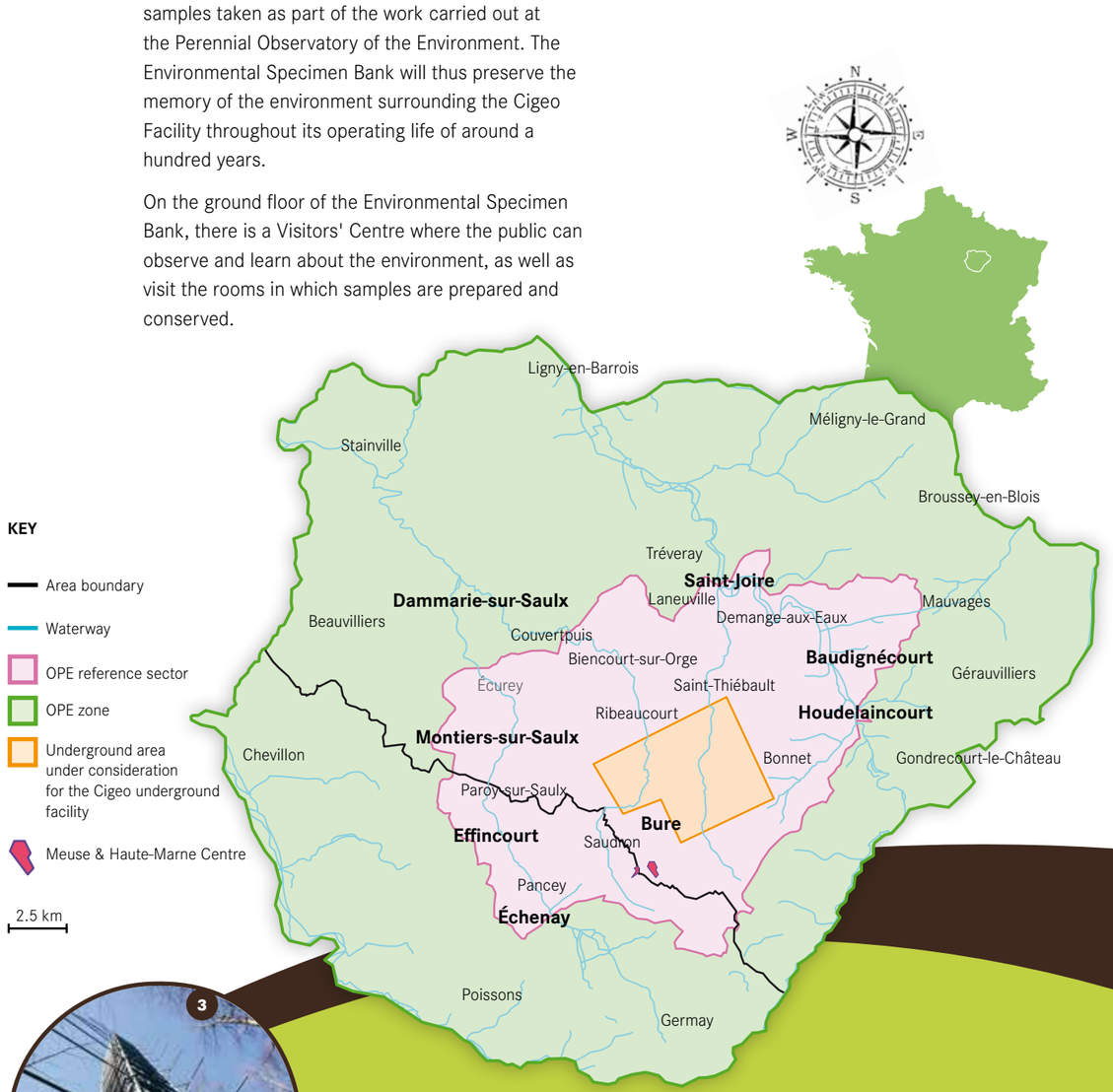
2 Handling samples in a cryogenic unit

3 An observation station in Montiers-sur-Saulx Forest

IN 2014, ANDRA OPENED AN ENVIRONMENTAL SPECIMEN BANK IN BURE.

This hi-tech building is designed and equipped for the preparation and long-term conservation of samples taken as part of the work carried out at the Perennial Observatory of the Environment. The Environmental Specimen Bank will thus preserve the memory of the environment surrounding the Cigeo Facility throughout its operating life of around a hundred years.

On the ground floor of the Environmental Specimen Bank, there is a Visitors' Centre where the public can observe and learn about the environment, as well as visit the rooms in which samples are prepared and conserved.



Did you know?

Thanks to all the OPE networks, **85,000 units of data are collected every year,** which are then managed in **a database** (Géosciences).

Andra in Meuse & Haute-Marne,
Committed to regional development

A strong, dynamic, local presence in Meuse and Haute-Marne

EMPLOYMENT AND TRAINING

Andra's activities in the Meuse and Haute-Marne areas have created 360 direct jobs (as on 31/12/2016) and contribute to creating jobs indirectly, particularly through its suppliers and service providers in the region.

Andra is also involved in training young people, through partnership agreements with the Universities of Lorraine and Champagne-Ardenne, as well as with local vocational colleges. It also runs work-study programmes and internships for students and supports doctoral theses on subjects related to its activities.

LOCAL PURCHASING

For several years, Andra, in liaison with Energic ST 52/55 (an association that brings together companies working in the energy and public works sectors), has organised an annual meet-up with local SMEs to enable them to learn about its purchase needs and procedures and prepare for future contracts. In 2016, purchase contracts with local suppliers* worth nearly 12.8 million euros (excluding VAT) were signed, not including subcontracting and one-off non-contract procurement.

ACCORDING TO A SURVEY OF ANDRA EMPLOYEES WORKING AT THE CMHM SITE, 40% LIVE WITHIN 20 KM OF THE CMHM AND 80.6% WITHIN 45 KM

**Local suppliers means suppliers based in Haute-Marne, Meuse, Aube or La Manche*

1 Annual meet-up with local companies

2 EDF National Archives, Bure

Did you know?

According to Andra's estimates, between **1,300 and 2,300 people** will work on building the first facilities at the Cigeo site **between 2019 and 2025.**

Economic support for the region

In return for developing a project considered of national importance, Article L. 542-11 of the French Environment Code (based on the Act of 28 June 2006) requires companies that generate radioactive waste (EDF, AREVA and CEA) to contribute to funding a public interest group in each French department. To this end, in 2016, the Haute-Marne and Objectif Meuse public interest groups each received 30 million euros in funding.

In addition to these financial obligations, radioactive waste generators have committed to long-lasting partnerships with all stakeholders in Meuse and Haute-Marne, with a view to favouring development in the region. They invest directly in industry and services, for instance in setting up facilities such as the EDF platforms in Velaines and Saint-Dizier, the buildings housing EDF's national archives in Bure and Areva's national archives in Houdelaincourt, and CEA's Syndièse Project in Saudron. They also support local companies by helping to develop their specialised skills in the energy sector, thus enabling them to grow their business with nuclear operators. In addition, they lead campaigns to manage energy demand and are involved in training young people.

Andra in Meuse & Haute-Marne:
Committed to regional development

INDUSTRIAL AND SCIENTIFIC TOURISM

With over 10,000 visitors a year, the CMHM has become a major tourist attraction in the region.

Guided tours are held year round and open days and tours of the drifts are organised several times a year so that local residents can visit the Underground Research Laboratory and talk with Andra employees (for more details, call +33 (0)3 29 75 53 76 or send an email to visite.55.52@andra.fr).

A large number of foreign delegations are also interested in coming to find out more about the activities that take place at the CMHM and the Cigeo Project.

SHARING SCIENTIFIC AND TECHNOLOGICAL CULTURE

One of Andra's priorities is to share scientific and technological culture.

To this end, it organises exhibitions and events for schoolchildren and the general public. Andra regularly holds science and culture exhibitions and events at its premises, which are free and accessible to all.

ACTIVE SUPPORT FOR LOCAL ASSOCIATIONS

By sponsoring events and projects every year, Andra contributes to enriching social and cultural activities in the Meuse and Haute-Marne areas.

Andra has adopted a sponsorship charter aimed at giving support to local initiatives. Events and projects must be related to five subject areas: promoting and sharing scientific and technological culture, the environment and discovering nature, memory and safeguarding our heritage, solidarity between generations and, lastly, local community initiatives.

In 2016, Andra sponsored 200 projects with a total funding of over 200,000 euros.

1. A street art project with Oh'Is, an association in Joinville
2. An international conference on "Constructing Memory" in Verdun
3. The *Forest Discoveries* Exhibition
4. September 2015 Open Day

Andra in Meuse & Haute-Marne
tomorrow...

**The decision to start Cigeo Facility construction will be taken following a procedure that will be triggered once Andra submits the licence application, probably in 2019.
This procedure entails an assessment of the licence application by the French Nuclear Safety Authority (ASN) and the National Assessment Board (CNE), consulting with the local authorities that are directly involved, and a public inquiry. If Cigeo is approved, construction could begin in around 2022, with operating scheduled to start in around 2025, provided that the ASN grants an operating licence.**

BOOSTING LOCAL DEVELOPMENT

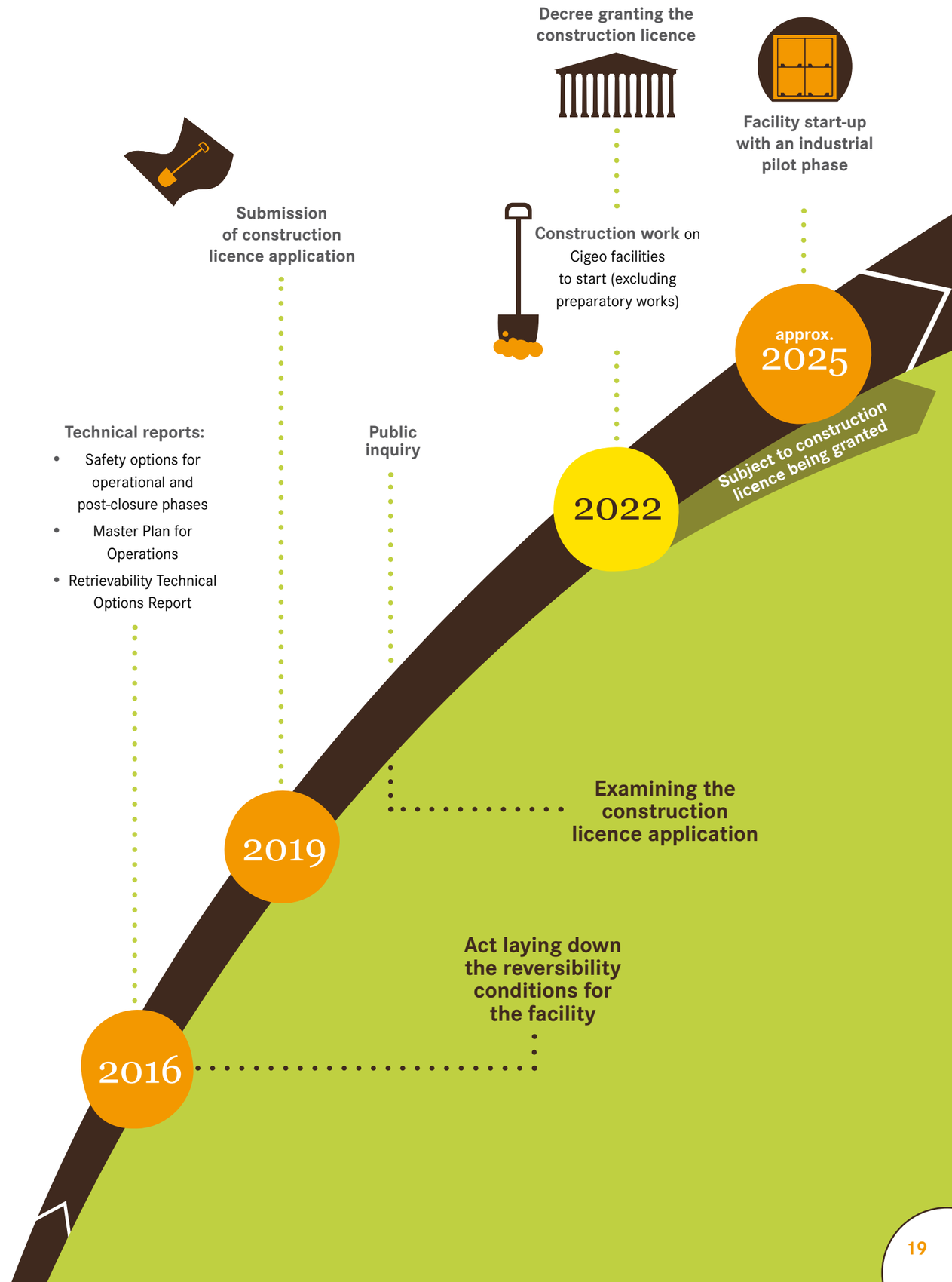
Developing an industrial project of the magnitude of the Cigeo Project involves preparing the area where the facilities will be located. Not only must the necessary infrastructure be built (means of transport, water, electricity and gas supplies, digital networks, etc.), but a strategic framework for employment, economic development and attracting new residents to the area must be implemented.

The French Prime Minister tasked the Prefect of Meuse with drawing up a local development contract in consultation with local stakeholders. Work on the local development contract began on 6 July 2016 and is providing a means of coordinating action between a large number of local stakeholders: the Meuse and Haute-Marne prefectures, decentralised government services, Meuse and Haute-Marne parliamentarians, local authorities, public authorities for cooperation between municipalities (EPCI), the mayors of Bure, Mandres-en-Barrois and Saudron, the Pays Barrois and Nord Haute-Marne land development plans (SCOT), industrial advisory boards, the Objectif Meuse and Haute-Marne public interest groups, as well as EDF, CEA, AREVA and Andra.

An action plan is being developed and is due to be finalised in 2017.

AN OUTSTANDING SCIENTIFIC RESEARCH HUB

Andra's research infrastructure in the Meuse and Haute-Marne areas (the Underground Research Laboratory, the Perennial Observatory of the Environment, the Environmental Specimen Bank and the Technological Exhibition Facility) forms a unique and outstanding scientific research hub, not only in France but worldwide. The Underground Research Laboratory and the OPE together form the "Structure for the observation and memory of the environment and the Earth", or SOMET, which was certified as a research facility in 2012 by the French Ministry of Higher Education and Research. The OPE is also AllEnvi-certified as a long-term environmental research, monitoring and testing system (SOERE). Andra makes these facilities available for multidisciplinary research, much of which is outside the field of radioactive waste management. They are truly remarkable tools for higher education and training, and can be used by students in disciplines including Science of the Universe and Environmental Science, as well as Metrology, Underground Construction and the Humanities and Social Sciences.



Come and visit the Meuse & Haute-Marne Centre

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