ACTIVITY REPORT 2016

ANDRA
French national radioactive waste management agency

CONTENTS

EDITORIALS

2016 has been a key year for Andra. The French Parliament reaffirmed its support for the Cigeo project by passing the Act on reversibility and Cigeo creation procedures, having taken into account the requests expressed during the 2013 public debate. Following on from earlier laws in 1991 and 2006, the adoption of the 2016 Act confirms Parliament's commitment to the Cigeo project.

The Cigeo project also enjoys ongoing support from the French government, as demonstrated by the Prime Minister's initiative to launch work on the local development contract and by the high-level committee meeting chaired by the Minister of State for Industry.

Finally, in 2016, Andra took another step forward in its dialogue initiatives, by forming an Ethics and Society Committee, which I am honoured to sit on. This Committee, formed of independent and well-qualified public figures, has a vital role to play in providing Andra with insight on the ethical and societal issues associated with its work, but also in assessing its dialogue and stakeholder engagement actions.

CHRISTOPHE BOUILLON,
CHAIRMAN OF THE GOVERNING BOARD

2016 has been an important year for Andra for several reasons. The Cigeo project moved forward tangibly throughout the year, entering the next step in the engineering process, the detailed design phase. We also submitted the Cigeo Safety Options Report to the French Nuclear Safety Authority (ASN). These are significant steps forward and we are now actively preparing for the forthcoming construction licence application. Tragically, 2016 also saw a fatal accident in Andra's Underground Laboratory. This tragedy reminds us all that tunnelling work remains a dangerous activity. Andra has also had to deal with several incidents of malicious damage by opponents of the Cigeo project in the Lejuc woodlands. We will need to do all we can to ensure optimum planning of our operations, from a physical, legal and security standpoint, because we are determined to make a success of Cigeo in the public interest. We do intend to do this in the context of constructive and democratic dialogue with all stakeholders who are willing to engage with Andra, just as we did in 2016 with the consultations on the connection structure between Cigeo's two surface installations.

In order to demonstrate our expertise in radioactive waste management, we have to continually provide evidence of our industrial excellence. This is why in 2016 we established a new Directorate of Industrial Operations, and inaugurated the sorting and treatment installation at our waste collection, storage and disposal facility in the Aube department. Finally, 2016 was a year of reflection and discussion about major forthcoming challenges in radioactive waste management, including the LLW-LL project and issues around decommissioning waste management.

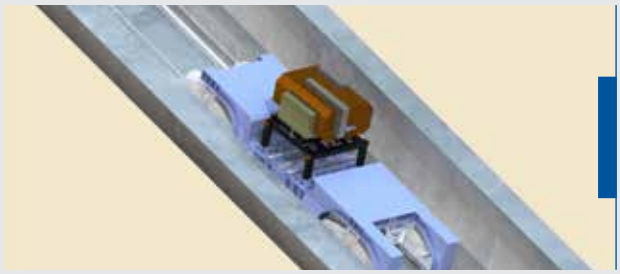
PIERRE-MARIE ABADIE,
CEO OF ANDRA

HIGHLIGHTS

JANUARY
ORDER SETTING THE COST OF CIGEO PROJECT AT €25 BILLION

FEBRUARY
PUBLICATION OF A POSITION PAPER ON REVERSIBILITY

MARCH
START OF A CLEAN-UP PROJECT AT A RADIOACTIVE CONTAMINATION SITE IN BORDEAUX



APRIL
CIGEO PROJECT SAFETY OPTIONS REPORT SUBMITTED TO FRENCH NUCLEAR SAFETY AUTHORITY (ASN)

MAY
START OF GEOTECHNICAL SURVEYS IN THE LEJUC WOODLANDS

JUNE
SORTING AND TREATMENT INSTALLATION INAUGURATED AT THE ANDRA INDUSTRIAL WASTE COLLECTION, STORAGE AND DISPOSAL FACILITY IN THE AUBE DEPARTMENT

JULY

ACT ON REVERSIBILITY AND CIGEO CREATION PROCEDURES ADOPTED BY THE FRENCH PARLIAMENT

AUGUST

CSA WASTE DISPOSAL FACILITY SAFETY REVIEW SUBMITTED TO FRENCH NUCLEAR SAFETY AUTHORITY (ASN)

SEPTEMBER

2016 ANDRA OPEN DAY AT THE MEUSE/HAUTE-MARNE CENTRE AND THE WASTE COLLECTION, STORAGE AND DISPOSAL FACILITY IN THE AUBE DEPARTMENT ATTENDED BY MORE THAN 1500 VISITORS

OCTOBER

145 REPRESENTATIVES OF BUSINESSES IN THE MEUSE, HAUTE-MARNE AND AUBE DEPARTMENTS ATTEND THE "BUY LOCAL" DAY ORGANISED BY ANDRA AND THE ENERGIC 52/55 ASSOCIATION AT THE MEUSE/HAUTE-MARNE CENTRE

NOVEMBER

PRIZES AWARDED TO THREE ART PROJECTS FOLLOWING THE SECOND ANDRA "ART AND MEMORY" CALL FOR PROJECTS

DECEMBER

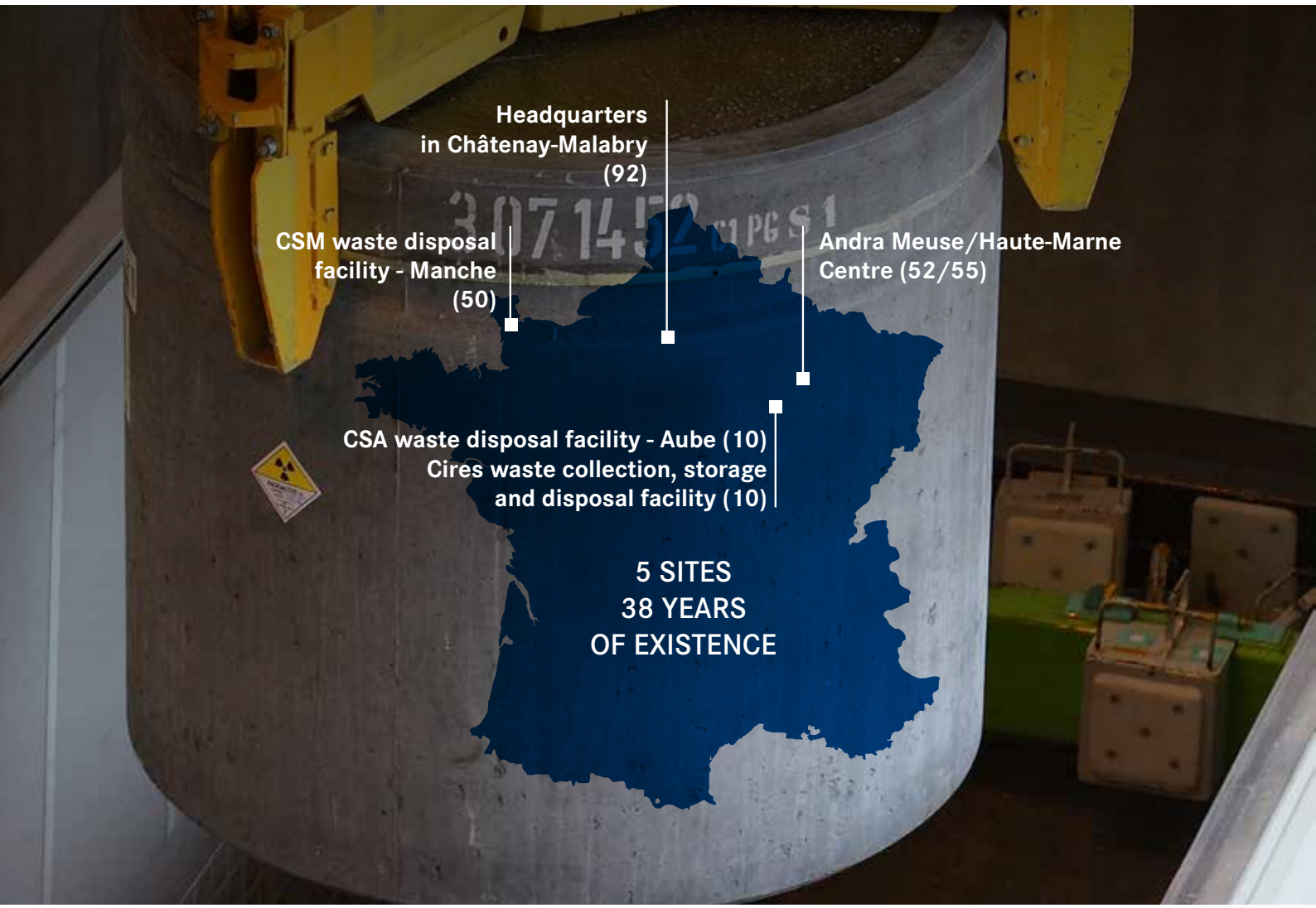
MEETING OF THE HIGH-LEVEL CIGEO PROJECT COMMITTEE, CHAIRED BY CHRISTOPHE SIRUGUE, MINISTER OF STATE FOR INDUSTRY

ANDRA'S MISSION

Andra is a public establishment responsible for the long-term management of radioactive waste generated in France. As part of this task, Andra mobilises its expertise and know-how to serve the public interest, with a view to identifying, implementing and ensuring safe management solutions for all French radioactive waste, thereby protecting present and future generations from the associated risks.

Andra performs its mission through various activities:

- **OPERATING THE TWO EXISTING SURFACE DISPOSAL FACILITIES,** in the Aube department: the CSA waste disposal facility for low- and intermediate-level short-lived waste (LILW-SL), and the Cires waste collection, storage and disposal facility for very low-level waste(VLLW);
- **MONITORING** the CSM waste disposal facility (Manche), the first French surface disposal facility for low- and intermediate-level radioactive waste, which is now closed;
- **STUDYING AND DESIGNING DISPOSAL SOLUTIONS** for types of waste that currently lack a disposal solution, namely:
  - low-level long-lived waste (LLW-LL),
  - high-level waste (HLW) and intermediate-level long-lived waste (ILW-LL): the Cigeo project;
- **PROVIDING A PUBLIC SERVICE BY:**
  - collecting old radioactive objects in the hands of individuals (items form old radioluminescent clocks, radium objects for medical use, natural salts for laboratory work, certain minerals, etc.),
  - cleaning up sites contaminated by radioactivity such as, for example, Marie Curie's old laboratories,
  - producing, every three years, the National Inventory of radioactive materials and waste on French soil. The most recent edition was published in 2015;
- **INFORMING AND PROMOTING DIALOGUE WITH ALL AUDIENCES;**
- **PRESERVING THE MEMORY OF ITS SITES;**
- **SHARING AND PROMOTING ANDRA'S KNOW-HOW INTERNATIONALLY.**



ORGANISATION CHART
AS AT 01/07/2017

01 I CHRISTOPHE BOUILLON
CHAIRMAN OF THE GOVERNING BOARD

02 I PIERRE-MARIE ABADIE
CEO

03 I PATRICK LANDAIS
DIRECTOR OF DEVELOPMENT, INNOVATION AND INTERNATIONAL AFFAIRS

04 I FRÉDÉRIC LAUNEAU
DIRECTOR OF THE CIGEO PROJECT

05 I MARC LEGUIL
DIRECTOR OF ENGINEERING

06 I DAVID MAZOYER
DIRECTOR OF THE MEUSE/HAUTE-MARNE CENTRE

07 I FRÉDÉRIC PLAS
DIRECTOR OF RESEARCH AND DEVELOPMENT

08 I FABRICE PUYADE
DIRECTOR OF HUMAN RESOURCES

09 I VALÉRIE RENAULD
DIRECTOR OF COMMUNICATION AND DIALOGUE WITH SOCIETY

10 I GAËLLE SAQUET
CORPORATE SECRETARY

11 I SORAYA THABET
DIRECTOR OF SAFETY, ENVIRONMENT AND SOLUTIONS STRATEGY

12 I PATRICE TORRES
DIRECTOR OF INDUSTRIAL OPERATIONS

ANDRA DEFINES STRATEGIC PRIORITIES

Once every four years, Andra signs a contract with the French government. This provides Andra with a set of objectives in line with the goals and timelines established in the 2006 Programme Act and the National Radioactive Materials and Waste Management Plan (PNGMDR). In 2016, Andra worked in a concerted manner to define strategic priorities for the 2017-2021 contract.

The 2017-2021 contract of objectives will be a key strategic management tool for Andra, with six cross-cutting strategic priorities that cover all the Agency's activities: transform Andra; put environment and societal dialogue at the heart of our work; make a success of Cigeo together; confirm Andra's industrial excellence and contribute to the excellence of the industry; develop, capitalise and pass on knowledge; consolidate the model of an authoritative leading public agency working for safe and appropriate waste management.

A TEAM EFFORT

These strategic priorities are the fruit of a collaborative effort over a period of more than nine months in 2016, involving Andra management and all staff. Input from external stakeholders such as waste producers, assessment bodies, partners and NGOs also fed into the process, along with the findings of an internal audit. These strategic discussions highlighted the fact that Andra's challenges over the next few years will not be merely technical or political. Andra is going to need to change on both a cultural and managerial level.

THREE LONG-TERM CHALLENGES

The collective strategic discussions within Andra identified three long-term challenges related to organisational culture. These issues seem essential as Andra enters a period where action and decision-making will become more important than technical demonstrations. The first challenge is to recognise and promote the value of a journey of dialogue. This will require increasingly robust analysis, beyond mere scientific and technical expertise. It will mean more systematic and pertinent assessment of risks and opportunities in all their aspects, and involvement of other stakeholders in the decision-making process. The second challenge focuses on decision-making processes. These decisions are complex and tied in with many, often contradictory issues. This requires the terms of the decisions to be defined early enough at the right level, it requires time to be taken to analyse, reformulate and prioritise the issues in order to reach a decision and justify it with the appropriate arguments. The final challenge is to define the need correctly, in order to promote a pragmatic approach to performance. Andra is a public establishment with a mission to serve the public interest. This creates an overall duty of industrial, economic and societal performance that is uncompromising on safety.

ETHICS AND SOCIETY COMMITTEE: A NEW BODY FOR DIALOGUE

A new body was established within Andra in late 2016 - the Ethics and Society Committee. This group reports to Andra's Governing Board and is responsible for providing insight into ethical and societal issues, but also for assessing its dialogue and stakeholder engagement actions in relation with Andra's activities and projects.

The Ethics and Society Committee is a response to Andra's commitment, following the 2013/2014 public debate, to engage civil society within the Cigeo project: *"Andra decides to set up a multidisciplinary committee tasked with providing insight into how societal issues can be taken into account in the work of the Agency."*

AN INDEPENDENT COMMITTEE

Committee members met for a first plenary session in December 2016. The first priority action they identified was to work together to draw up rules to ensure the full independence of the body.

They then established a work programme for the next few years in line with the wide range of ethical and societal issues associated with radioactive waste management and especially the Cigeo project. These issues include intergenerational relationships and responsibilities, how to act in a context of uncertainty, open and democratic governance of major projects and environmental and territorial ethics.

A VARIETY OF EXPERTISE

The thirteen committee members who will support Andra in its dialogue initiatives have been identified both as upstanding citizens and qualified public figures. A range of expertise is represented in the group, in areas such as health, environment, legal issues, governance and participation, science and technology, economics, territorial issues. The committee also includes representatives from democratic bodies (CNDP [1], HCTISN [2], CESER [3]).

Andra's Governing Board has appointed a Chair and a Deputy Chair, who will alternate their presidency of the board, year on year:

- for 2017: Jean-Pierre Aubert as Chair and Rémi Barbier as Deputy Chair;
- for 2018: Rémi Barbier as Chair and Jean-Pierre Aubert as Deputy Chair.

[1] French National Public Debate Commission.
[2] French High Committee for Transparency and Information on Nuclear Safety.
[3] Regional Economic, Social and Environmental Council

MEMBERS OF THE ETHICS AND SOCIETY COMMITTEE

JEAN-PIERRE AUBERT,
CHAIR OF THE ETHICS AND SOCIETY COMMITTEE IN 2017
Auditor General for Economy and Finance, Secretary General of the Mutations - Anticipations - Innovation Research Group at IAE Paris (Sorbonne Business School).

RÉMI BARBIER,
DEPUTY CHAIR OF THE ETHICS AND SOCIETY COMMITTEE IN 2017
Professor at the National School for Water and Environmental Engineering, University of Strasbourg, Director of the Territorial Water and Environment Management research unit (GESTE)

PAULINE ABADIE
Lecturer in Private Law at the Institute of Ethical Wealth Law at Jean Monnet Faculty (University Paris Sud)

CHRISTOPHE BOUILLON
Chair of the Andra Governing Board

AGNÈS BUZYN [4]
Consultant Haematologist, Chair of the French National Authority for Health (HAS)

MARIE-PIERRE COMETS
Chair of the French High Committee for Transparency and Information on Nuclear Safety (HCTISN), Director of the Innovation and Business Relations Department at the French National Centre for Scientific Research (CNRS)

JEAN-NOËL DUMONT
Representative of Andra employees

SAIDA LAÂROUCHI-ENGSTRÖM
Vice President of SKB, the Swedish Nuclear Fuel and Waste Management Company

CHRISTIAN LERMINIAUX
Director of Chemistry at ParisTech, Delegate-General of the French National Association of Research and Technology (Anrt)

CHRISTIAN LEYRIT
Chair of the French National Public Debate Commission

PATRICK TASSIN
Chair of the Grand Est Regional Economic, Social and Environmental Council

JAD ZAHAB
Founder and President of the French Students' Parliament

STÉPHANE ZUBER
Researcher at the French National Centre for Scientific Research (CNRS) affiliated with the Sorbonne Economics Centre (CES), Associate Researcher at the Paris School of Economics (PSE)

[4] Left the Committee in May 2017. Appointed Minister for Solidarity and Health

TRIPLE CERTIFICATION FOR ANDRA

In November 2016, the Afnor standards body granted renewal of Andra's three certifications, covering its quality management, environmental management and occupational health & safety management systems.

This triple certification means that an external body recognises that Andra's work in several areas complies with the applicable standards - its organisational structures and quality management system (ISO 9001), its environmental management system (ISO 14001) and its occupational health & safety management system (OHSAS 18001).

COVERING ALL ANDRA'S ACTIVITIES

These certifications are internationally recognised, and required Andra to undergo a week-long audit. Four Afnor auditors conducted interviews with over 50 people in total, from top managers to their staff teams and Andra service providers. The audit covered all Andra's many activities and visited the various sites - head office, facilities and centres in the Aube, Manche and Meuse/Haute-Marne areas, and a radioactive contamination site that Andra is responsible for cleaning up.

SEVERAL STRENGTHS REPORTED

Afnor's report confirmed the successful outcome of the audit. It highlighted Andra's many strengths, such as industrial operations, relationships with service providers and communication with parties interested in its work. Afnor also noted some areas for improvement, for instance in the information communicated to waste producers about the way their radioactive waste is treated.

NEW DIRECTOR AT MHM CENTRE

A new chapter in 2016 at Andra's Meuse/Haute-Marne Centre (MHM). In September, David Mazoyer, an Engineer of the Corps of Bridges, Waters and Forests, succeeded Jean-Paul Baillet, who retired after seven years at the helm of MHM.

David Mazoyer is a man with significant field and project management expertise, who knows the Grand Est region well and has experience in dealing with local authorities. Before becoming Director of MHM, he was based in Nancy as Deputy Territorial Director for North-East France with VNF, the French Waterways Agency. Previous roles included managing a regional road operations department for Routes Est. His previous experience has involved working with local politicians and government bodies on river and road projects, in the Meuse and Haute-Marne departments. His appointment to lead the MHM Centre is therefore a real boost for the successful integration of Cigeo within its territorial environment.

PASSING ON THE BATON

As new Director of the Andra Meuse/Haute-Marne Centre, David Mazoyer has succeeded Jean-Paul Baillet, who is retiring. Jean-Paul Baillet was recruited in 2000 as Andra Corporate Secretary, before becoming Andra Deputy CEO and Director of MHM Centre. A significant amount of construction work has taken place on the site under his leadership, both at ground level and in the Andra Underground Laboratory. He also worked hard to acquire most of the land needed for the Cigeo project in the Meuse and Haute-Marne areas through amicable deals, without requiring any compulsory purchases.

CONTROLLING COSTS

The Andra cost-cutting plan, which was launched in 2015, was continued in 2016, with an ongoing ambition of cutting operating expenditure by 5% year on year against forecast levels. The performance and savings culture is developing, and Andra beat its objective for the second year running (€4.4 million saved, a 15% reduction).

The cost-cutting plan across its five sites is Andra's proactive strategy for managing its financial resources, spending correctly and collectively analysing all potential sources of reduction, while maintaining performance levels. In 2016, the previous year's work was continued, and travel expenses in particular were cut by 22%, by increasing the use of videoconferencing, increasing the proportion of car-sharing in employee travel (1.7 people per car), and by reducing the amount of vehicle hire (down 6%).

RATIONALISING SPENDING

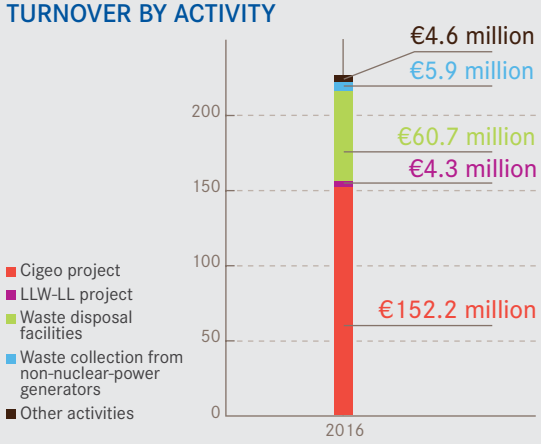
For Andra, rationalisation is chiefly a matter of common sense: encouraging employees to take training courses in groups, centralising the management of subscription fees to learned societies or increasing the service life of computers from 5 to 6 years before they are replaced. These initiatives have no impact on working conditions. Andra also asked the French government to modify the calendar of payments from waste producers for Cigeo. Rather than paying a single lump sum, payments will now be more closely linked to Andra operating expenses, in order to avoid needlessly tying up cash.

UNAVOIDABLE COSTS

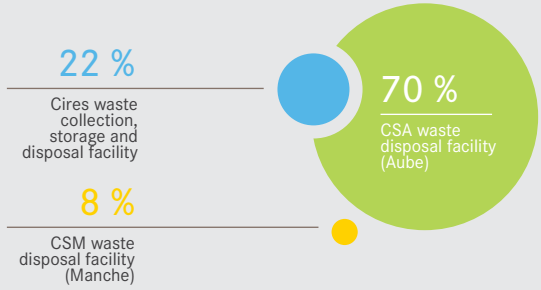
In 2016, Andra also looked at subcontracted services, and whether they are always necessary. Could the work be done in house? Or not done at all? Andra teams analysed all outsourced services over the last two years, in areas such as design, evaluation, construction work and equipment supply. A number of best practices were identified to ensure these contracts are properly managed.
In total, Andra made savings of €4.4 million on its operating costs in 2016. This is above the target set, despite additional costs incurred for IT security and physical site security.

FINANCIAL DATA FOR 2016

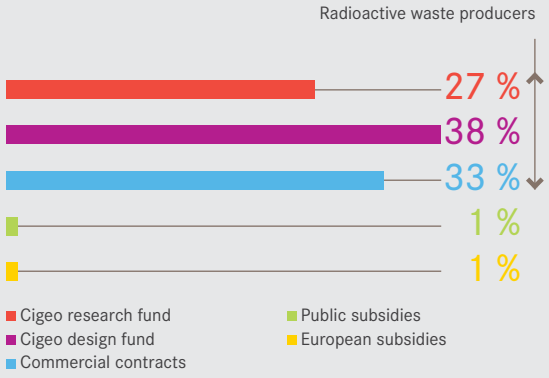
TURNOVER BY ACTIVITY



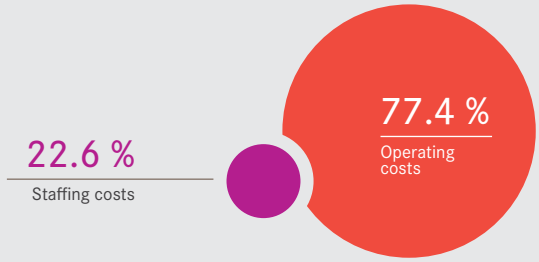
TURNOVER BY FACILITY



SOURCES OF INCOME



COST BREAKDOWN



PURCHASING POLICY AT THE HEART OF PERFORMANCE

One of Andra's objectives is to achieve responsible, sustainable purchasing to ensure value for money and compliance with public procurement regulations. In 2016, higher performance was achieved in purchasing, *by* a variety of optimisation initiatives and an increasing collaboration with local businesses.

Purchasing performance is one of Andra's key challenges. In 2016, the number of orders placed for a value of under €1200 was reduced by 32%, with framework agreements put in place instead, a much more appropriate strategy. Improving purchasing performance is also about getting the best prices, which is why the Andra has enhanced its collaboration with the French government central purchasing body UGAP, particularly for general services and IT, especially when this led to better purchasing terms than Andra would have negotiated on its own. In 2016, the value of purchases made *via* the purchasing platform was nearly €1.4 million, twice as much as the previous year, thanks to systematic consultation with UGAP.

MEETING WITH LOCAL BUSINESSES

Andra's sites are located in the Manche, Aube, Meuse and Haute-Marne areas of France, and it is very keen to engage with the local economy. It sends out invitations to tender to businesses in these four departments whenever possible, in compliance with procurement regulations. As every year, Andra organised a "Buy Local" day for nearby small businesses at the Meuse/Haute-Marne Centre, with the association Energic 52/55. The event was a chance to remind local businesspeople of the opportunities for future contracts related to the Cigeo project. Andra and its main ('Tier 1') suppliers also ran thematic workshops to present short-term needs (maintenance, engineering, construction work, etc.) or to explain the procurement procedures and ways to tender for Andra contracts.

GROWING LEVELS OF LOCAL PURCHASING

Beyond these events, 2016 also saw a ramp-up of the local purchasing policy. More than €21 million (excl. VAT) was committed by Andra in contracts with businesses from the four local departments, €4 million increase on 2015 and €7 million more than in 2014. There is clear evidence of the quality of service provided by these local partners. Last year, in tender processes where at least one local company bid, the local business was successful in 80% of cases. More broadly speaking, purchases from small businesses accounted for 30% of all purchasing in 2016. In order to pursue efforts to enable small businesses to bid for its contracts more easily, Andra has signed up to the simplified public procurement system, so companies can tender using no more than their corporate registration number (SIRET).

WORKING AT ANDRA

In managing French radioactive waste, Andra actively seeks to recruit and retain the talent required to develop and maintain high-level technical, scientific and industrial expertise. In 2016, Andra's human resources policy focused on preparing for future challenges through recruitment and training. Dialogue with staff representatives also continued and led to a number of significant advances.

Staff numbers at Andra stabilised at 645 employees as at the end of December (excluding PhD students). The 29 new recruits replaced colleagues leaving the organisation, and created the opportunity to reshape a number of positions to prepare for the objectives and challenges of coming years. Recruitment focused on technical jobs such as design engineering, but also support positions in areas such as financial control, purchasing and legal.

SKILLS MANAGEMENT: A KEY ISSUE FOR ANDRA

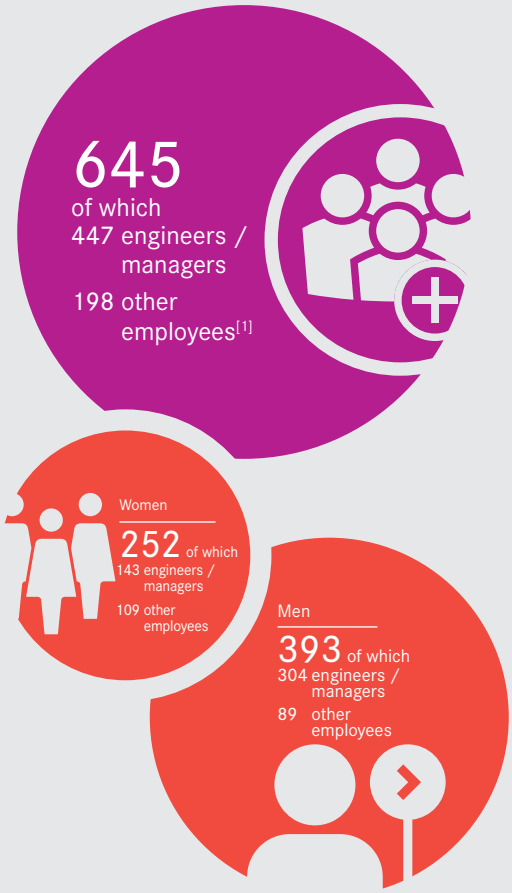
Andra's activities require a high level of technical proficiency, and the organisation has always set aside a significant budget for staff training. In 2016, approximately 4% of payroll costs were used for Andra employees' continuing professional development competencies and to develop new technical skills. Management training sessions were also delivered in order to prepare managers to meet future challenges.

HIGH-QUALITY INDUSTRIAL RELATIONS

Andra maintains high-quality dialogue with staff representatives around strategic priorities for the organisation. In 2016, these negotiations led to the signature of a pay agreement and implementation of an agreement on teleworking, increasing the number of employees authorised to work off site to 12%. Andra and staff representatives also signed an amendment to the time-savings account and an agreement on travel expenses payable for journeys made by bicycle. All these initiatives highlight Andra's commitment to corporate social responsibility.

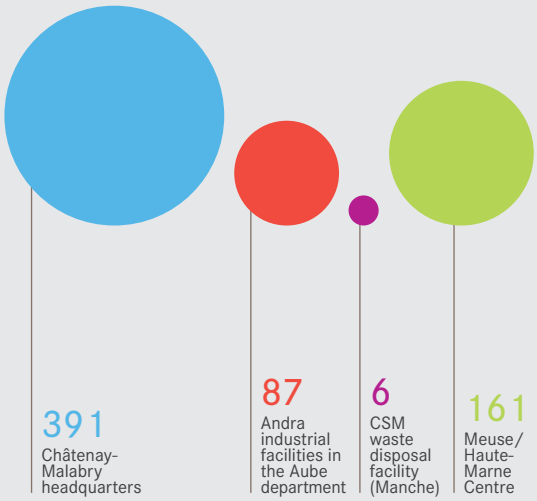
WORKFORCE

STAFF NUMBERS IN 2016



[1] Workers, employees, technicians and supervisors.

STAFF NUMBERS PER SITE



Knowledge and outlook

A SIGNIFICANT PROCESS OF REFLECTION TOOK PLACE IN 2016 ON ANDRA'S RADIOACTIVE WASTE MANAGEMENT STRATEGY.

The aim is to ensure the strategy is consistent across all waste categories, proportionate to the level of danger posed by each category,and at the forefront of environmental best practice. The biggest challenge in the future will be the management of decommissioning waste. The waste volumes, particularly very low-level waste, will be significant, and this requires thought and discussion even now, regarding the appropriate management solutions. The last two editions of the three-yearly French National Radioactive Materials and Waste Management Plan (PNGMDR), in 2013-2015 and 2016-2018 has identified this as a significant challenge. The strategic priorities set forth in the plan have helped Andra and other players in the nuclear industry carry out the necessary studies to prepare for the radioactive waste management needs of the future.

2016: REVIEW OF THE NATIONAL RADWASTE PLAN 2013-2015

Andra has made a significant contribution to the 2013-2015 French National Radioactive Materials and Waste Management Plan (PNGMDR), and work on this plan was concluded in 2016. We present a review the studies Andra carried out for the latest version of the plan.

The National Radioactive Materials and Waste Management Plan (PNGMDR) was instituted by an Act of French Parliament on 28 June 2006 and is drawn up once every three years. It serves to review radioactive substance management policy, assess new needs and define strategic goals for the future. The 2013-2015 edition incorporates the requirements of the European Directive of 19 July 2011, which establishes an EU framework for the safe, responsible disposal of spent fuel and radioactive waste. It also includes a presentation of the designs and plans for the period after disposal facilities close, as well as a description of the mechanism to secure the financing of nuclear costs over the long term.

TEN REPORTS PRODUCED

The 2013-2015 Plan involved Andra in various studies, submitting ten different reports to the government. In-depth research was carried out on the following themes: management of low-level long-lived radioactive waste (LLW-LL); tritiated waste; recycling of construction rubble and ferrous metal waste; design of additional storage facilities to complement disposal facilities; optimisation of existing waste management solutions; management procedures for certain categories of waste that have no current solution; management of waste that will be produced at the Malvési uranium concentrate conversion plant. Finally, Andra also submitted an industrial masterplan to meet the needs for new disposal capacities for very low-level radioactive waste (VLLW).

ANDRA CONSULTED FOR ADVICE

As part of the PNGMDR process for 2013-2015, Andra, as a public expert in radioactive waste management, was consulted by the government for the first time to assess reports produced by other players in the nuclear industry. Andra issued ten opinions on reports by Areva, CEA and EDF on subjects such as high-level waste and intermediate-level long-lived waste package storage needs, transport of such packages to Cigeo and the management procedures planned by Eurodif Production for the radioactive waste that will be generated in decommissioning the Georges-Besse plant.

2016-2018 NATIONAL RADWASTE PLAN: SHARED AND TRANSPARENT PRODUCTION PROCESSES

Work on the 2016-2018 French National Radioactive Materials and Waste Management Plan (PNGMDR) was completed in 2016. This edition places a particular emphasis on assessing the harmfulness of radioactive materials and waste and consolidating the plans relating to VLLW production over different time-scales. Work on the Plan was coordinated by the Directorate-General for Energy and Climate[1] and the Nuclear Safety Authority (ASN), and carried out by a task force comprising Andra, various waste producers, environmental protection associations and representatives of elected politicians and supervisory authorities. For the first time, the 2016-2018 edition was submitted to the Environmental Authority for its opinion and for a public consultation prior to publication. The final draft of the PNGMDR was also submitted for assessment to the French Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST). This transparent, collaborative process has resulted in a comprehensive document that provides a shared overview of the management of radioactive materials and waste.

[1] Directorate of the Ministry for the Ecological and Inclusive Transition.

A CONSISTENT AND PROPORTIONATE RADIOACTIVE WASTE MANAGEMENT STRATEGY

Andra must ensure a range of issues are taken into account in its long-term management of radioactive waste. These challenges include the great variety of low-level long-lived waste (LLW-LL), the large volume of waste generated by future decommissioning projects and the proper consideration of environmental issues. In late 2016, Andra made a presentation of its thoughts concerning a consistent and proportionate management strategy to the French National Assessment Board (CNE) [1].

In developing a consistent safety and environmental-protection strategy, Andra's launched a wide-ranging reflection exercise which identified a number of challenges. The first issue is to ensure that there is an appropriate management strategy for each waste category. Although disposal solutions exist for most waste categories, either surface-level facilities (at the Andra CSA and CSM facilities in the Aube and Manche areas respectively) or the planned deep geological repository (Cigeo), questions remain for LLW-LL. This waste cannot be disposed of in surface-level facilities because of its long radioactive half-life but it is not dangerous enough to require deep geological disposal. Moreover, although its radiological properties are similar, there are more significant differences in terms of chemical content or the toxicity of its radionuclides. Examples include radium-bearing and graphite waste. Further reflection is therefore required as to the most appropriate management solution (see p. 17). There is an existing disposal solution for very low-level waste (VLLW) at the Cires waste collection, storage and disposal facility, but the volume and diversity of this waste also raises challenges. Some of it is safe from a radiation protection standpoint, and a lot more of this type of waste is going to be generated by future decommissioning projects (see p. 17).

A PROPORTIONATE APPROACH.

A long-term management strategy requires a proportionate approach based on how dangerous each waste type really is, while maintaining optimal safety levels at all times. A variety of confinement barriers are provided when waste is disposed of: the packages, disposal structures and the geological environment. A proportionate strategy is a comprehensive strategy, which incorporates other potential management solutions before disposal is considered. For example, sorting enables some of it to be recycled and treatment can reduce the volume and level of danger of waste to be disposed of. The dangers posed by waste go beyond mere radiological hazards. Andra has therefore started to study both radiological risks (e.g. activity level, type of radiation) and non-radiological risks (e.g. explosion risks, toxicity).

ENVIRONMENTAL BEST PRACTICE

Demands from law-makers and society at large have placed environmental protection and sustainable development at the heart of radioactive waste management challenges. Andra has therefore strengthened the way these aspects are taken into account in defining its waste management strategy. All types of radiological and non-radiological risks must be considered, and environmental impacts must be assessed for the entire waste life cycle. In addition, territorial aspects must be weighed up. The overall impact of waste will be reduced nationwide with the construction of a disposal facility, but there will be increased local impacts in the area where it is built.

[1] The National Assessment Board (CNE) is responsible for an annual assessment on progress in research and studies relating to the management of radioactive materials and waste. An annual report is produced for the French Parliament and sent to the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST).

COLLECTIVE REFLECTION ON DECOMMISSIONING WASTE

As French nuclear facilities are gradually withdrawn from service, they will require decommissioning, and this will generate large volumes of very low-level radioactive waste. In 2016, Andra worked with all the players in the nuclear industry to look ahead and find appropriate collective responses to the waste management challenges this poses.

By 2030, according to the National Inventory of Radioactive Materials and Waste, more than 60% of radioactive waste will be generated by the decommissioning of nuclear facilities (approximately 700,000 m³). Three-quarters of this waste will be very low-level waste (VLLW). The current plan is to send this all to the Cires waste collection, storage and disposal facility, but forecasts suggests that Cires will reach maximum capacity between 2025 and 2030. Andra and other players in the nuclear industry have started to think about the technical and societal issues around an appropriate and proportionate VLLW management policy.

OPTIMISING CIRES

The first solution, for which work has already been under way for several years, is to optimise Cires disposal capacities, while maintaining safety levels. Andra has started to build longer disposal cells (176 m), which prevents the wastage of space between the shorter cells (80 m) and the access ramps. Cell depth and package stacking heights have also been increased. These various optimisation strategies have raised disposal capacity by 56% compared to the initial design. For the same surface area, the site capacity could therefore increase from 650,000 m³ to 900,000 m³ [1].

INNOVATIVE SOLUTIONS

One fundamental question remains, with respect to the high volumes of VLLW: is disposal within Cires really the most appropriate management solution in all cases? 30 to 50% of VLLW are safe from a radiation protection standpoint and could be re-classified as very very low-level waste (VVLLW). Andra is therefore looking at alternative solutions in parallel to Cires, for instance simplified, tailored disposal facilities that could be located at or near the sites undergoing decommissioning. For VLLW and VVLLW, further studies are currently under way to determine whether metals and concrete rubble could be reused and/or recycled. In parallel, Andra has launched calls for projects to promote the emergence of innovative solutions (see p. 40).
Finally, even with the optimisation of Cires and the studies into alternative, complementary management solutions, a new disposal facility will be necessary.

[1] Extending the capacity of Cires will require official authorisation.

NEW ROADMAP FOR LLW-LL MANAGEMENT

In 2015, Andra submitted a status report to the government on the management of low-level long-lived waste (LLW-LL). The document included results from geological surveys in the Soulaines area of the Aube department, which had identified an area of 10 km² which is favourable for continuation of the near-surface disposal project. In 2016, after discussions with the French Nuclear Safety Authority (ASN), updates to the LLW-LL inventory [2], publication of the new decommissioning calendar for French first-generation (gas-cooled graphite moderated) reactors and the policy directions set forth in the 2016-2018 PNGMDR, Andra has defined a new roadmap. This will involve working on the new radiological inventory in order to define the waste to be disposed of in the project, consolidate disposal safety requirements and better define its gradual, incremental development.

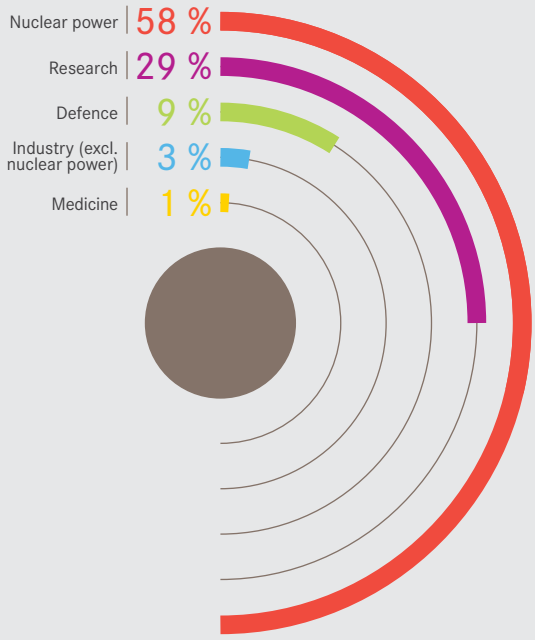
[2] ASN added new types of waste to the inventory, such as waste from the Malvési uranium conversion plant (Areva).

PUBLICATION OF THE ANNUAL UPDATE TO THE NATIONAL INVENTORY

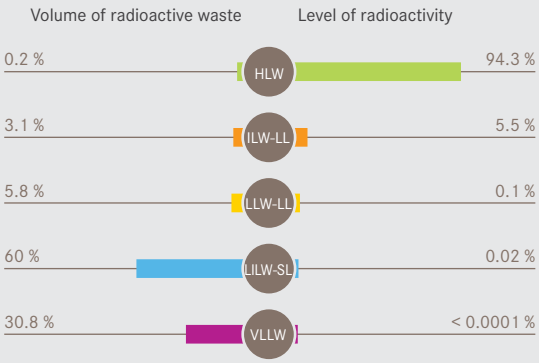
In December 2016, Andra published the annual report on stocks of radioactive materials and waste as at end 2015.

This report is now made available to the public every year, and complements the National Inventory, which comes out once every three years, detailing information on stocks and forecasts relating to radioactive materials and waste on French soil. The data is available on the National Inventory website (www.inventaire.andra.fr) and the French government open data platform (www.data.gouv.fr).

RADIOACTIVE WASTE BY ECONOMIC SECTOR AS AT END 2016



VOLUME AND RADIOACTIVITY LEVEL OF RADIOACTIVE WASTE STOCKS AS AT END 2016



HLW: High-level waste, ILW-LL: Intermediate-level long-lived waste, LLW-LL: Low-level long-lived waste, LILW-SL: Low- and intermediate-level short-lived waste, VLLW: Very low level waste

ANDRA PUBLISHES NATIONAL INVENTORY AS OPEN DATA

Since October 2016, Andra has made the raw data from the National Inventory of radioactive materials and waste on French soil available to the public.

A 2006 Act of the French Parliament requires Andra to report every year on stocks of radioactive materials and waste present on French soil, based on declarations by the waste producers. Andra gathers, verifies, validates and compiles this information into a single, homogeneous datafile that is used to produce the National Inventory. This source file is now available to all, every year.

TRANSPARENCY AND PEDAGOGY

Andra's aim with this open data initiative is to go further in promoting transparency and an educational approach to the issue of radioactive waste. This approach fits with the new provisions stipulated in the Lemaire Act promoting a Digital Republic, which was promulgated in October 2016.

COMPREHENSIVE INFORMATION

Prior to this publication of open data, the National Inventory already published large amounts of information in the form of graphs and explanations, giving maximum detail on the nature and location of radioactive waste and materials present on French soil. The National Inventory also offered thematic focus features, for instance on waste treatment and conditioning or on nuclear decommissioning and clean-up. With the publication of the source file used by Andra teams to compile the National Inventory, the Agency is further supplementing its initiatives to provide full information to the public at large.

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All data from the National Inventory of Radioactive Materials and Waste is available at:
www.inventaire.andra.fr

AWARDS FOR THREE MEMORY-RELATED ART PROJECTS

In 2016, Andra repeated the 2015 call for art projects, encouraging artists to imagine how to ensure the memory of radioactive waste disposal sites is preserved for future generations. Three "Art and Memory" prizes were awarded by Andra in November 2016.

Andra invited artists in all disciplines to think of ways to pass on memory. The "Art and Memory" committee of art professionals and Andra employees selected two proposals out of the 24 submitted. A third award, the "public prize", was awarded for this second edition by members of three focus groups of local people from near the Andra sites in the Aube, Manche and Meuse/Haute-Marne areas who work on issues of memory at radioactive waste disposal sites.

LANDMARK, MEMORIAL, MONUMENT

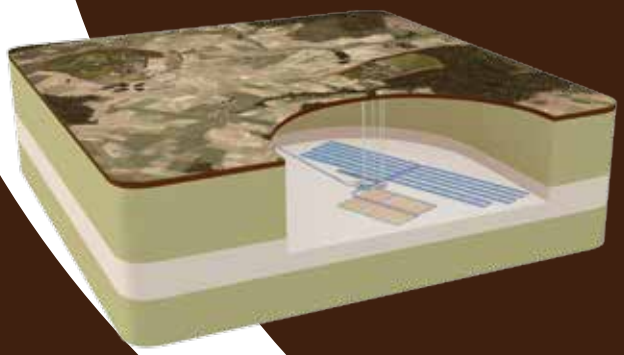
First prize was awarded to *Forest,* a project by architects Pierre Laurent and Nicolas Grun. It aims to create a landmark work to indicate the presence of disposal sites over a very long period of time. Their proposal involves creating a platform over a radioactive waste repository hosting an artificial forest of 80 concrete pillars, each 30 metres high, with an oak tree at their crown. A drip-feed irrigation system would water the trees, and the columns would slowly sink into the ground over time, as the radioactive waste decayed. The project proposed by Bruno Grasser, second prizewinner, *Bonne chance,* is a form of memorial object - an clay rock cylinder formed of 2500 small sculpted, textured cubes that each represent a unit of time, and which can be scraped off whenever the object is passed on from generation to generation. The project *Cloud in/Cloud out* by Alice and David Bertizzolo, which won the public prize, is based on the idea of a monumental installation to be placed at the disposal sites, comprising thousands of hemispheres made of artificial rock (geopolymer). Half of the work would be on ground-level, mounted on a stainless-steel mast, and the other half buried deep underground. Each half-sphere would be engraved on its underside with a warning message about the presence of radioactive waste.

PRESERVING AND PASSING ON THE MEMORY OF RADIOACTIVE WASTE

As part of its responsible, long-term radioactive waste management policy, Andra preserves the memory of each of its disposal facilities. It archives all documents pertaining to the life of its sites using durable media (permanent paper, see photo), provides information to the public to preserve memory and ensures all administrative limitations are recorded on the land register. Waste inside the Cigeo project will remain dangerous for a very long period of time and Andra has decided to go further by working on memory on a multi-millennial scale, looking beyond the lifetime of our current organisations, communication methods or languages. In 2010, it launched the "Memory for future generations" programme, a research initiative to enhance the way memory is compiled for existing facilities, and to imagine ways in which memory can be conserved for extremely long periods. Studies began on a range of themes, and some were still going in 2016 on topics such as semiotics[1], landscape archaeology or materials as memory storage media and markers.

[1] The study of signs and symbols and their use or interpretation.

Cigeo



IN 2016, THE CIGEO PROJECT TOOK ANOTHER MAJOR STEP FORWARD. ANDRA AND ITS STAKEHOLDERS ARE TOGETHER MOVING FORWARD TOWARDS THE REPOSITORY CONSTRUCTION LICENCE APPLICATION.

The project entered detailed design phase, the final step before licensing, and Andra filed the Safety Options Report with the French Nuclear Safety Authority for assessment. The French Parliament also passed an Act on reversibility and Cigeo creation procedures, as planned in the 2006 Act. This law defines long-term project governance and demonstrates the ongoing support of France's lawmakers. The executive branch of government also highlighted its support, organising a high-level committee meeting, chaired by the Minister of State for Industry, and starting work, at the Prime Minister's initiative, on the local development contract, coordinated by the prefecture. Andra had supported this initiative by specifying Cigeo needs in a document entitled: *Input data for local stakeholders preparing for integration of the Cigeo project*, which has been presented widely to a range of key players in the local area.

CIGEO: MOVING FORWARDS

The Cigeo project moved into its next stage of engineering in 2016 - detailed design phase. Andra is starting new studies in order to further clarify the design of the project and to prepare for the construction licence application.

Following the conceptual design phase and the basic engineering design phase, completed in late 2015, which determined disposal design choices, the project has now reached detailed design phase. This started in early 2016 and seeks to provide greater detail in the project engineering, drawing on technical progress achieved and further knowledge acquired. The target is the construction licence application which will be filed with the French Nuclear Safety Authority (ASN) in 2019. Detailed design phase will also involve surface-level site survey operations and initial work to prepare for Cigeo construction, if it is authorised.

PROJECT SUPERVISION

Supervision and assessment of the Cigeo project by various bodies and institutions continued in 2016. In the springtime, Andra submitted several pieces of technical documentation to ASN: a Safety Options Report for the repository operating period and post-closure period; a Report on Technical Retrievability Options, presenting Andra's strategy and the systems that could potentially be used to enable retrieval of packages disposed of in Cigeo; and a proposed operations masterplan. This latter document, which presents the Cigeo operating process and decision-making milestones, is already starting to be circulated for large-scale consultation in order to define project governance. In April and May 2016, experts appointed by the French Ministry for Energy examined Andra's progress in taking into account the recommendations issued as part of the third Cigeo project review (where 31 specialists had analysed the Cigeo project at the end of basic engineering design phase, in 2015).

PROVISIONAL SCHEDULE FOR CIGEO

2019 Submission of construction licence application

2022 Construction licence issued by decree and Phase 1 construction

Around 2025 Industrial pilot phase for approximately ten years, in which tests will be started and first tunnels dug The first radioactive waste disposal tests are planned for around 2030.

Around 2035 Start of routine operation, after authorisation

COSTING ESTABLISHED FOR THE PROJECT

In January 2016, the Minister of Ecology, Sustainable Development and Energy issued an Order determining a €25 billion total cost for the Cigeo project. This costing is based on Andra estimates and the opinions of the French Nuclear Safety Authority (ASN) and the waste producers. The project cost shall be fully covered by France's nuclear operators (EDF, CEA and Areva), and is included as provisions in their accounts. The costing will be regularly revised. Andra is working together with the waste producers to optimise and control costs, while ensuring safety remains the priority.

.fr All relevant documents are available at: **https://www.ecologique-solidaire.gouv.fr/demantelement-et-gestion-des-dechets-radioactifs**

ENHANCED COOPERATION BETWEEN ANDRA AND EDF FOR CIGEO SUCESSS

In January 2016, Pierre-Marie Abadie, Andra CEO, met Jean-Bernard Lévy, EDF Chairman at Andra's Meuse/Haute-Marne Centre. After visiting Andra's Underground Laboratory, the two executives went out to meet local politicians and businesspeople. The visit provided an opportunity to reaffirm their shared commitment to the Cigeo project, emphasising safety issues, the desire to develop synergies with local stakeholders and an enhanced technical collaboration in order to optimise the design of the repository.

A NEW LAW FOR THE CIGEO PROJECT

In summer 2016, the French Parliament passed a third Act relating to the Cigeo project. Following on from previous laws in 1991 and 2006, this supplementary legislation, focusing on reversibility and Cigeo creation procedures, is a major step forward for the project.

In 2006, Parliament selected deep geological disposal as the safest way of protecting people and the environment from the most radioactive long-lived waste. The law adopted at the time required the disposal solution to be reversible, and stated that further legislation would be required to specify the reversibility conditions. Ten years on, the Act dated 25 July 2016 on reversibility and creation procedures has fulfilled this requirement and incorporated the conclusions from the 2013 public debate.

This significant advance for the Cigeo project does not mean it is authorised to operate. Licensing will still be a long process.

REVERSIBILITY CLARIFIED

The Act of 25 July 2016 defines reversibility as *"the capability of future generations either to continue building and operating successive phases of a disposal facility or to review the decisions made in the past and modify the management solutions"*.

Implementation of this principle for the Cigeo project will require technical strategies that Andra has envisaged such as gradual facility deployment, adaptability or package retrievability, as well as governance tools such as civil society participation and project phasing.

The law also provides for an industrial pilot phase during which commissioning tests will take place, and a gradual, step-by-step process to lead up to full facility commissioning. Further parliamentary scrutiny is planned after the industrial pilot phase, and every five years, a stakeholder consultation will be organised, based around the Cigeo operations masterplan, alongside a review of reversibility implementation.

GOVERNMENT COMMITMENT TO CIGEO REAFFIRMED

A high-level committee on Andra's Cigeo project met in December 2016 at the Prefecture in Bar-le-Duc. The meeting was chaired by the Minister of State for Industry, Christophe Sirugue, and reviewed the project and the local support and economic development actions implemented.

This committee, whose previous meeting had been held in February 2013, brings together local and national politicians, top executives from Andra and the radioactive waste producers (EDF, Areva and CEA) along with local prefects, government departments and any relevant public bodies. The committee, whose 2016 meeting was chaired by a government minister - Christophe Sirugue, Minister of State for Industry - monitors Andra's work and mobilises the nuclear operators to engage in local economic development in the area planned for the Cigeo, on the boundary between the Meuse and Haute-Marne departments.

CONTINUED SUPPORT FOR THE PROJECT

At the event, Christophe Sirugue reaffirmed the French government's support for Cigeo, *"a strategic project of the State in the public interest"*. He also took note of proposals by the nuclear operators to support economic development in the local area. One example of this is the CEA's Cicéron project, which will use cutting-edge technology to produce metal parts for the aviation, defence and health industries. The Minister of State also urged Andra to continue its efforts to file the Cigeo construction licence application within the statutory time frame.

FRENCH AND INTERNATIONAL EXPERTS ANALYSE CIGEO SAFETY

The Cigeo Safety Options Report, produced by Andra, was filed with the French Nuclear Safety Authority (ASN) in the Spring of 2016. ASN will lead assessment of the report, with supporting analysis from a variety of organisations and bodies, including a team of experts from foreign safety authorities, which published its report in late 2016.

The Safety Options Report is a document that presents the broad safety choices that steer Cigeo project design. These choices are based on more than 20 years of scientific and technical research, which is regularly evaluated. The Safety Options Report, which is produced in advance of the construction licence application, firmly establishes the principles, methods and main design choices necessary for the forthcoming safety demonstration, which will be examined before the construction licence is granted. ASN is responsible for examining and assessing the report, which was submitted by Andra in spring 2016. It draws on a variety of different analyses by French and international bodies. International experts will be consulted for their opinion, coordinated by the International Atomic Energy Authority (IAEA). In addition, experts from the French Institute for Radiological Protection and Nuclear Safety (IRSN) and standing committees that ASN consults for its most important decisions on nuclear safety or radiation protection will also be invited to have their say.

REVIEW BY INTERNATIONAL EXPERTS

In late 2016, a panel of world-renowned experts from safety authorities around the world published their report, following a one-week review in November 2016, during which they met Andra to discuss the project and ask questions on key topics such as the safety scenarios defined by Andra during operations and post-closure, or the research and development strategy.

In their findings, they stated, in particular, that *"the content of the Report and the discussions undertaken during the mission gave the review team reasonable assurance of the robustness of the repository design".* The review also highlighted several strengths of the project, such as the industrial pilot phase at the start of facility operation, the operations masterplan and its use as a governance tool, or the overall management process implemented by Andra for systematic definition and identification of safety scenarios.

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Documents related to the review are available at:
www.asn.fr/Informer/Actualites/CIGEO-revue-internationale-du-dossier-d-options-de-surete

CIGEO SAFETY REVIEWED BY CNE

In December 2016, the French National Assessment Board for research and studies on the management of radioactive materials and waste (CNE) published its analysis of the Cigeo Safety Options Report. This is part of its preparation to issue an opinion on the forthcoming Cigeo construction licence application, as provided in the 2006 Act on sustainable management of radioactive materials and waste.

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The CNE analysis is available at:
www.cne2.fr

IN-DEPTH STUDY OF FUTURE CIGEO LOCATION

In 2016, Andra conducted a geotechnical investigation campaign on the site of Cigeo's future surface facilities. At the same time, the French National Institute for Preventive Archaeological Research (INRAP) was carrying out an archaeological assessment. The results of these two surveys will be used for Cigeo's construction licence application, which should be filed with the French Nuclear Safety Authority (ASN) in 2019.

From Autumn 2015 to March 2016, more than 600 hectares of land were surveyed by Andra around the Meuse/Haute-Marne Centre (MHM), for data-gathering purposes. The study area, referred to as the "Ramp Zone", is where one of the two surface installations will be built, for receiving, inspecting and preparing radioactive waste packages for disposal 500 m below ground.

ARCHAELOGICAL, GEOTECHNICAL AND TOPOGRAPHIC SURVEYS

A range of survey techniques were used, looking at archaeological, geotechnical and topographical issues. INRAP used ten mechanical diggers to identify areas that might hold archaeological remains. Its report was sent to the Regional Directorate of Cultural Affairs (DRAC), which will be responsible for commissioning subsequent digs. Alongside this, more than 200 survey interventions were made across an area of around 320 hectares, using piezometers, boreholes to carry out water testing, mechanical diggers, core drilling and so on. Once all the measurements had been taken, all the holes were refilled. The only items left in place permanently are the piezometers.

ENVIRONMENTAL CONCERNS AT THE HEART OF CIGEO

In 2016, Andra took environmental samples and observations on and around the future site of Cigeo. The data gathered will be used in the Cigeo impact assessment, which will aim to assess all the consequences of the project and determine measures to prevent, reduce and, whenever no other approach is possible, mitigate these impacts.

Studies have been conducted on the future repository site, in order to gather information for the Cigeo construction licence application. The environmental data acquired will be used for an impact assessment, a statutory document that is described and defined by Law. The impact assessment must be comprehensive, covering the whole project, to ensure it complies with all environmental issues relating to its host site. It will be an important tool for various parties involved in the project, helping Andra design an environmentally-friendly project, providing information for citizens and stakeholders and enabling the authorities to make licensing and supervision-related decisions.

ASSESSING AND MANAGING IMPACTS

The impact assessment will be a three-stage process. The first aspect is to acquire knowledge about the current state of the environment - characteristics of the forests and rivers, animal and plant species present, types of human activity and so on. This information is then used to identify all the impacts the project may have on its environment. Finally, the assessment examines what management measures can be put in place. With respect to impacts on biodiversity, for instance, each subject is analysed with the aim of finding ways to avoid disrupting the natural environment. When impacts cannot be avoided, they need to be reduced. If neither of these two options proves possible, the final solution is mitigation, where measures are taken, on a case-by-case basis, to provide favourable conditions on other sites for species and habitats that will be impacted.

EXPERTSE AND DIALOGUE

Andra wants to ensure biodiversity issues are properly taken into account at all stages of the project and has therefore sought the support of CDC Biodiversité, a subsidiary of Caisse des dépôts that has expertise in this field. Mechanisms for dialogue are also being planned, to feed into Andra's analysis of the issues and the way in which Cigeo impacts can be managed, taking into consideration the concerns, expectations and proposals of local stakeholders (see p. 26).

NEW FORMS OF OPPOSITION TO CIGEO PROJECT

In the summer of 2016, when Andra was carrying out surveys in the Lejuc woodlands (Meuse), opponents of the Cigeo project blocked the work and committed acts of vandalism. These events marked the start of a more radical form of opposition, the sign that a small minority of people want to stop the project.

In May 2016, in the Lejuc woodland owned by Andra, a geotechnical survey campaign began, with the aim of gathering the data required for the Cigeo construction licence application. If the project is licensed, this zone directly above the repository, will host one of the two surface installations used to access the areas where underground construction work will be performed.

PHYSICAL DAMAGE

A number of acts of vandalism led Andra to decide, in agreement with the local authorities, to fence off the site in order to protect from intrusion and ensure the security of people and property. In June, a number of opponents of the project broke down the fence and set up camp in the woods. They were moved on by the police because their occupation was judged to be illegal, but they used physical force in trying to access the the site again in July. Andra was forced to boost the protection of the site with a concrete perimeter wall. In early August, opponents petitioned the Court of Bar-le-Duc to have the work on the concrete structure halted. The Court deemed that Andra had carried out unauthorised land clearance work and ordered that any new land clearance be stopped and the plots of land cleared be returned to their original state within six months, unless the necessary permit was obtained. Andra noted the decision and performed the required formalities. In mid-August, the protective wall was broken down amid further physical attacks on Andra facilities and a temporary construction site cabin was set on fire. Andra responded by reporting the vandalism to the police.

LEGAL AND PHYSICAL CHALLENGES

The events in the summer of 2016 highlighted the emergence of a systematic campaign of opposition by a minority who wish to stop the project. From a legal perspective, multiple cases have been brought against Andra, using procedural arguments and technical debates that have already been settled by experts. All incidents are used as an opportunity for legal action. Andra has responded legally, by putting forward its arguments in each case. In the Meuse/Haute-Marne area, a small group of people has moved permanently into the Lejuc woodlands owned by Andra, and have regularly been taking action to oppose what Andra is doing. They have blocked clean-up and restoration work in the woods, by putting up barricades and climbing onto the equipment used. More physical attacks have also been seen, as in February 2017 when certain individuals damaged Andra's Environmental Specimen Bank.

SEEKING CALM

Opposition to the Cigeo project is linked to a general opposition to the "system", which has targeted all major public interest projects in France. Andra's response has not been to go to war, but instead to seek to calm the situation, without backing down, because deep geological disposal is the benchmark solution chosen throughout the world for dealing with the most hazardous radioactive waste. Andra is committed to making a success of the Cigeo project, in a spirit of constructive and democratic dialogue with all stakeholders that are prepared to engage with it.

JOINT DECISION-MAKING TO MANAGE THE IMPACTS OF CIGEO

Since late 2016, Andra has been consulting with other stakeholders on Cigeo-related subjects (see p. 50), including how to manage the impacts of the project. The aim of this consultative approach is to jointly identify the most appropriate measures for protecting the environment, local activities and quality of life.

When Andra files the Cigeo project construction licence application with the French Nuclear Safety Authority (ASN) in 2019, it will also submit an impact assessment. This document will list the impacts of the project on the environment and the planned impact management measures (see p. 24). Andra has been keen to involve local stakeholders in the impact assessment and incorporate their expectations regarding priority impacts or the prevention, reduction or mitigation measures required. In order to consult on these topics, Andra invited a wide range of relevant stakeholders to a meeting, including local politicians and residents, healthcare professionals, farmers' representatives, environmental associations, hunting bodies, forestry managers and representatives of the tourism sector.

INITIAL DISCUSSIONS BEFORE THEMATIC MEETINGS

In November 2016, Andra organised an impact assessment consultation launch meeting. 25 local stakeholders attended and engaged in discussions with Andra on progress with the assessment and the impacts of land clearance in the future "Shaft Zone", one of Cigeo's two surface installations. A second meeting was held in December 2016, and Andra has planned various thematic discussion sessions in 2017 on how to manage the impacts of Cigeo, covering topics such as biodiversity, business activities, landscape, forestry and agriculture.

INTERSITE CONNECTION ROUTE: A COLLECTIVE, SHARED CHOICE

Andra started a consultation process in 2016 to determine the route and technical solution that will connect up Cigeo's two surface installations. The aim is to involve local stakeholders in defining the most appropriate solution.

The Cigeo project will have surface installations in two different areas. The "Ramp Zone" will be used for receiving, inspecting and preparing radioactive waste packages for disposal and the "Shaft Zone", directly above the repository, will be the starting point for underground construction work. Andra will need to establish a connection route between these two locations, because the rock excavated from the "Ramp Zone" needs to be transported to the "Shaft Zone" where this excavation rubble will be stored. This route will also be used to bring construction equipment from the rail terminal at the first installation across to the second.

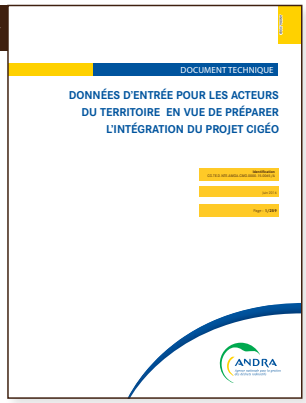
PARTICIPATORY WORKSHOPS

Andra has identified three potential technical solutions for this 5 km route that will cross agricultural land between the two surface installations. It could be a private road with trucks to provide transport, a ground-level conveyor belt, with a partially buried conveyor system, or an overhead cable-based conveyor system. Andra wanted to ensure local stakeholders were consulted, in order to incorporate their expectations in determining the most appropriate solution. The first round of meetings was held in late 2016, when Andra invited mayors of local municipalities to assess the options, according to various criteria, and help Andra select the solution that would be best suited to the area. This initiative was an opportunity to trial the consultation method that will be used in examining other local issues such as environmental compensation and the management of rainwater run-off.

TERRITORIAL INTEGRATION OF THE CIGEO PROJECT

In preparation for the Cigeo project, the Prime Minister commissioned work, which started in 2016, to draw up a local development contract. This preparatory work is coordinated by the Prefect of Meuse, working in consultation with local stakeholders, and draws on the technical project needs assessment document produced by Andra.

If construction work on Cigeo is to start as soon as the project is licensed, preparations need to be made now. In 2016, Andra went further in its territorial cooperation, by providing local stakeholders with new information. It used the Cigeo basic engineering design studies as a basis for producing a technical document in June 2016 – *Input data for local stakeholders preparing for integration of the Cigeo project*. This document specifies the industrial needs of the project. These include direct needs, such as water and electricity utilities connections and transport links, and also indirect needs such as relocation and welcome services for new employees. The document also suggests some ideas for the continuation of exchanges with local partners.



MEETING PROJECT NEEDS

Using Andra's document as a basis, and as a follow-up to the SIDT plan[1], France's Prime Minister commissioned the Prefect of Meuse (who is coordinating the project for the Meuse and Haute-Marne departments) to draw up up a local development contract in consultation with local stakeholders. The idea of the contract is to provide tangible solutions to help the Meuse and Haute-Marne areas to meet Cigeo's needs and benefit from the project being located there. The challenge is partly to ensure local equilibriums are taken into account and that the local economic benefits are optimised. Work on this local development contract was launched in July 2016, involving a large number of local stakeholders alongside the French government, Andra and nuclear operators – local mayors, inter-municipal authorities, both departments, the regional council, etc. These parties worked together on fourteen thematic topics including roads, community services, energy, housing, economic development, employment and skills, and training. A draft contract containing around sixty proposed actions was submitted to the Prime Minister in April 2017.

[1] stands for Inter-departmental territorial development plan. This plan was produced in 2013 under the supervision of the Meuse prefecture.

LOCAL WORKSHOPS: FIRST EVENT ON THE SUD EUROPE ATLANTIQUE HIGH-SPEED RAIL LINE PROJECT

In September 2016, sixty or so local politicians and stakeholders attended the Agency's first Local Workshop at Andra's Meuse/Haute-Marne Centre, which focused on the project to build the Sud Europe Atlantique high-speed rail link between Tours and Bordeaux. Various topics were discussed, such as how to mobilise local skills and boost employability in the way human resources are managed. Workshop attendees got the chance to hear feedback from the project owner on the way a major national infrastructure project like this is managed, and to pick up interesting ideas and innovative approaches that might help in the preparation for Cigeo.

Further Local Workshops are planned by Andra over the next few years.

Industrial Operations

A NEW DIRECTORATE WAS CREATED IN 2016 TO MANAGE ANDRA'S INDUSTRIAL OPERATIONS. THE GOAL IS TO REFOCUS ON OPERATIONAL MISSIONS FOR GREATER CONISTENCY AND EFFICIENCY.

At Andra's industrial facilities in the Aube department, operations are managed with a drive for continuing progress. The goal is to look ahead to future needs and develop safe and relevant industrial solutions. In 2016, a new sorting and treatment installation was inaugurated at the Cires waste collection, storage and disposal facility and final tests were performed on the future package inspection system at the CSA waste disposal facility.

At the CSM waste disposal facility in the Manche department, which is currently in closure phase, studies are under way to make the final cover permanent and to preserve memory of the site, for the purposes of long-term monitoring.

In 2016, Andra was also involved in clean-up at sites with radioactive contamination in Bordeaux, Pargny-sur-Saulx, Ganagobie or the Yonne area.

A NEW INDUSTRIAL OPERATIONS DIRECTORATE

In June 2016, Andra continued the reorganisation moves it had initiated in 2015, by creating a new department: the Directorate of Industrial Operations, headed up by Patrice Torres, Director of Andra's Industrial Facilities in the Aube department. The aim is to refocus activities around operational missions and boost efficiency, but also provide better support to waste producers.

The Directorate of Industrial Operations has 140 staff whose activities include operating the CSA waste disposal facility (Aube) and the Cires waste collection, storage and disposal facility, monitoring the CSM waste disposal facility (Manche), cleaning up radioactive contamination sites and dealing with radioactive waste owned by private individuals.

BOOSTING SYNERGIES

The goal of this new organisational structure is to reduce the number of interfaces and increase the efficiency of radioactive waste management. A single department is now centrally responsible for all processes related to waste package specifications, exemptions and approval/acceptance procedures. The targeted outcome is better relations with waste producers and increased consistency in the responses they receive. Likewise, a single unit will now be responsible for nuclear clean-up operations at contaminated sites and for managing radioactive waste from activities other than nuclear power generation. This choice is driven by the close relations between both roles and the common skills required to carry them out.

IMPROVING CUSTOMER SATISFACTION

Another key issue for the Directorate of Industrial Operations is relations with the waste producers. Andra works with them to improve the quality of their packages, contributing to ensuring safety at our facilities and developing innovative packing and management solutions. It also wants to listen and respond better to the specific needs of certain producers.

WASTE PRODUCERS SATISFIED WITH ANDRA'S SUPPORT

As it does every year, Andra carried out a satisfaction survey with the producers of radioactive waste, both from nuclear power generation and otherwise, in order to understand their needs and expectations.
The results are generally positive, especially regarding customer support, because Andra received 95% of positive comments regarding waste management. 98% of waste producers from nuclear power generation are satisfied with the information communicated by Andra on required procedures.86% of waste producers from activities other than nuclear power generation are satisfied with the information about how their radioactive waste can be managed. All respondents emphasised the efforts made by Andra to reduce application assessment times. A number of areas for improvement remain, however. Two key issues are providing advance information ahead of waste management applications and improving the advice available to customers for finding appropriate and tailored solutions.

INAUGURATION OF THE CIRES SORTING AND TREATMENT FACILITY

In June 2016 at its Cires waste collection, storage and disposal facility in the Aube department, Andra inaugurated a new sorting and treatment installation for radioactive waste from activities other than nuclear power generation.

After two years of procedures and construction work at Cires, Andra now has a new system for sorting and treating radioactive waste produced by hospitals, universities, research laboratories and conventional industries. In total, there are more than 1000 waste producers outside of the nuclear power generation industry.

CENTRALISED MANAGEMENT

Now the new sorting and treatment installation is up and running, Cires can perform various operations that were previously outsourced: X-ray examination of solid waste packages, grouping of liquid waste by category (solvents, oils, aqueous waste) and separation of solids and liquids when treating scintillation vials. In the future, the building will also get an installation for disassembling lightning conductor heads. Cires already collected, consolidated and disposed of waste from activities other than nuclear power generation, and is now able to handle almost complete management[1] with a more robust, optimised, long-term management system that simplifies processes and reduces waste package transport requirements.

[1] Some waste is sent for incineration at the Centraco site in Southern France.

SORTING & TREATMENT INSTALLATION

- **A Treatment of scintillation vials**
  - A1 *Grinding*
  - A2 *Separation of solids and liquids*
  - A3 *Cementation of solids*
- **B Liquid waste treatment**
  - B1 *Physical & chemical tests on liquid mixtures*
  - B2 *Grouping of liquid waste by family (solvents, oils, aqueous waste)*
- **C Solid waste treatment**
  - C1 *X-ray examination of solid waste packages*
  - C2 *Reconditioning of non-compliant packages*
- **D Disassembly of lightning conductor heads (planned)**

DEDICATED CELL FOR LARGE WASTE ITEMS

In 2016, Cires commissioned construction work on a dedicated cell (23 m wide and 265 m long) for the disposal of extremely large items of very low-level waste (VLLW). Such items are likely to come, in particular, from the decommissioning of French nuclear facilities. The cell is fitted with a mobile gantry for handling large parts. After initial work on internal fittings and gantry installation and following successful testing, excavation work started on the cell in late 2016, continuing into 2017. It is expected to be operational in summer 2017.

CSA SUBMITS ITS TEN-YEAR SAFETY REVIEW FILE

In August 2016, the CSA waste disposal facility submitted its safety review file to the French Nuclear Safety Authority (ASN).

As for every regulated nuclear facility, CSA has to undergo a statutory safety review once every ten years. This rigorous procedure seeks to assess compliance of the facility with the applicable rules and review facility safety via a comprehensive safety analysis. Many departments within Andra worked from 2014 to mid-2016 to complete this important piece of work and a weighty review file of more than 1500 pages was submitted to ASN in August 2016. Along with the main document, a further safety evaluation had been requested by ASN, following the Fukushima accident, and this was appended to the review.

A PAINSTAKINGLY COMPREHENSIVE TASK

The compliance assessment requires every activity at CSA to be reviewed in detail, to verify that the facility and its operation continue to comply with regulations, even when they have been updated, and despite any ageing affecting structures or modifications to the facility. The safety review required analysis of all risks identified by Andra (earthquake, flood, explosion, intrusion, etc.) and the barriers implemented to prevent and neutralise them (waste packages, disposal structures and the geological environment). Site operating experience feedback and any new knowledge available must be taken into account in the review.

NEW PACKAGE INSPECTION UNIT AT CSA

Construction was completed at the new CSA package inspection unit in 2016. This new installation will enable advanced investigations to be carried out on radioactive waste packages. Until now, these tests were outsourced to external laboratories. CSA already performed non-destructive testing, but will now also be able to add X-ray imaging, tritium degassing tests and destructive testing processes such as package inventories and core-drilling. In late 2016, while ASN authorisation to operate the installation was pending, Andra performed tests to ensure that systems such as the high-expansion foam fire-fighting system were operating correctly.

PHASE 9: NEW DISPOSAL STRUCTURES IN OPERATION

A new series of disposal structures called Phase 9, whose construction started in July 2014, was completed in late 2016. CSA now has 25 additional structures, in five rows: two rows of gravel-backfilled structures, designed to receive concrete-encapsulated waste packages, and three concrete-lined structures for the disposal of metal packages. With this construction campaign barely complete, Andra is already preparing for the next section, Phase 10, where work is due to start in 2018.

HIGHLIGHTS OF 2016 AT CSA

In April 2016 a very unusual operation was carried out at CSA, which hadn't been done since 1998. A 235-tonne mobile canopy that is used to protect disposal structures against the rain was rotated horizontally through 180°. This operation will enable the first disposal structures in the new Phase 9 to be put into service.

In late October, CSA received, inspected and disposed of ten large packages (4 m long, 420 kg) containing lateral neutron shielding (LNS) from the Superphénix facility that is being decommissioned near Grenoble. This was the final shipment of this particular type of package. In total, 59 LNS packages have been disposed of at CSA.

MEMORY AT CSM, A LONG-TERM CHALLENGE

To protect future generations against potential intrusion risks, the CSM disposal facility (Manche) implemented several concrete actions in 2016 in order to preserve and pass on its memory.

Like its sister facilities, CSA and MHM, the CSM facility has a citizen group who are responsible for thinking through issues of memory at radioactive disposal facilities. In July 2016, the groups from the Aube and Manche areas met up to discuss the progress of each group's work. Despite differences in context (operating facilities in the Aube area and a facility in closure phase in the Manche area), it was a useful meeting. Each group presented the work they have been carrying out on topics such as societal memory, with press cuttings about the establishment of the facilities and oral memory, with interviews and audio recordings of people like former facility employees, politicians and local residents. They also talked about how to engage local communities and work that they could plan to do together.

A DEVELOPING HERBARIUM

In order to preserve the memory of CSM, botanists from the National Society of Natural Sciences and Mathematics in Cherbourg started to work on establishing a site-specific herbarium. In 2016, five plant specimen collection campaigns were carried out on the CSM cover. Nearly 200 species have already been added to the collection. All the specimens gathered are kept frozen at the Natural History Museum in Paris in order to avoid any parasite infestation.

PREPARING FOR THE CSM SAFETY REVIEW

Andra is due to submit the CSM safety review fie to the French Nuclear Safety Authority (ASN) in January 2019, and a preparatory document was sent to ASN - the Safety Review Preparation File. This document acts as a roadmap for the forthcoming review, establishing a broad outline and initiating dialogue with ASN before the start of the review, by defining objectives and subjects for more in-depth study. It specifies what will need to be included in the safety review:

- improving the level of knowledge since the previous safety review in 2009, taking into account behaviour of the cover, the disposal facility, risk identification and an assessment of the radiological and chemical impact of the disposal facility on people and the environment;
- facility modifications implemented since the last safety review in 2009 and any modifications planned for the next ten-year period that will be covered by the 2019 safety review;
- identification of potential changes to the facility over longer periods in the future.

CLARIFICATION OF CSM STATUS

A decree was published in June 2016, pertaining to the modification, withdrawal from service and decommissioning of regulated nuclear facilities, and to subcontracting, with the aim of harmonising French regulations with a Euratom Directive (European directive on nuclear issues). The decree specifies different phases in the life of a radioactive waste disposal facility, and defines what closure means for such a facility. Although this decree does not alter anything in terms of what has been done at CSM, it does clarify its status. The site is now in closure phase. This closure phase will only conclude once all long-term passive safety provisions are in place for the facility. Once the relevant operations have been completed, the site will enter monitoring phase. The decree also requires that some form of memorial tool should be developed. CSM has been working on this tool for several years.

ANDRA EXPERTISE USED IN CLEANING UP CONTAMINATED SITES

In 2016, Andra continued clean-up operations at sites that had been contaminated by radioactivity, and continued to collect radioactive items from private individuals. Andra expertise was required in several situations - in Bordeaux for early preparatory stages of a clean-up operation on a recently discovered contamination site, in the Yonne area to remove radioactive objects from the cellar of a private home and in the Alpes-de-Haute-Provence, to remove contaminated products from a laboratory whose owner had gone bankrupt.

In mid-2015, radium pollution was discovered on a school construction site in a neighbourhood that is under development. Bordeaux City Council suspended construction, secured the site and demarcated the contaminated areas, before selecting Andra to offer expertise and manage the initial stages prior to decontamination. In March 2016, Andra prepared and removed the 360 m³ of contaminated earth already piled up on site. In the autumn, this was followed by a precise contamination survey, based on site mapping, to establish the volume of radioactive waste and how to condition and manage it.

BURIED RADIOACTIVE OBJECTS

At a private property in the Yonne department, land subsidence revealed the existence of a cellar containing suitcases with an abnormal level of radioactivity. In 2014, an initial clean-up campaign run by Andra from the ground level discovered the existence of numerous small radioactive objects in underground areas. The project was under review up until 2016, in order to ensure that all items could be safely removed and the location properly decontaminated. Andra then selected the specialist contractor Daher NT to perform this complex operation in late 2016. The earth, classified as very low-level waste (VLLW) and the items, which were low-level long-lived waste (LLW-LL) were conditioned separately and secured on site until the clean-up operation was completed.

CONTAMINATED CHEMICALS

In Ganagobie in the Alpes-de-Haute-Provence area, Andra has been working for 15 years on remediation of the former Isotopchim laboratory, which contains radioactive-contaminated chemicals, both solid and liquid. After several clean-ups, around 0.5 m³ of solids and 2.5 m³ of liquids were still on site at the end of 2015. To enable the laboratory to be demolished, Andra identified removal and disposal solutions for the chemicals. A contract was signed with the CEA in 2016 under which it will be responsible for characterising, sorting and incinerating the solid chemicals. Some of the liquid chemicals have been handled by Centraco [1], and solutions are being sought by Andra and CEA for the remainder.

[1] Facility operated by Socodéi, an EDF subsidiary.

HANDOVER OF ORFLAM-PLAST SITE IN PARGNY-SUR-SAULX

An official ceremony was held in 2016, where the French government handed over the land at the former Orflam-Plast cigarette lighter flint-making plant to the town council of Pargny-sur-Saulx (Marne). This followed 18 years of clean-up operations run by Andra in order to remediate the site following radioactive contamination. The green spaces along the banks of the River Saulx are now safe, and memory of the site is communicated by a variety of means (brochure, video, tours).

.fr

The history of Orlam is told in a video on Dailymotion. **www.dailymotion.com/video/x3bmou5_histoire-d-orflam_tech**

Science and Technology

THE MANAGEMENT OF RADIOACTIVE WASTE DRAWS ON ROBUST SCIENTIFIC AND TECHNOLOGICAL KNOWLEDGE IN ORDER TO PROVIDE RIGOROUS AND APPROPRIATE SOLUTIONS TO DESIGN, OPERATIONS, MONITORING AND SAFETY NEEDS FOR ANDRA'S EXISTING OR FUTURE DISPOSAL FACILITIES.

It is natural, therefore, that scientific and technological activities continued apace in 2016, with a particular focus on the Cigeo project. At Andra's Meuse/Haute-Marne Centre (MHM), a range of experiments continued in the Underground Laboratory, and other new ones commenced, looking at subjects such as fibre optic sensors, corrosion or seals for Cigeo's tunnels. Further environmental data for the project was gathered, notably by the Perennial Observatory of the Environment (OPE).

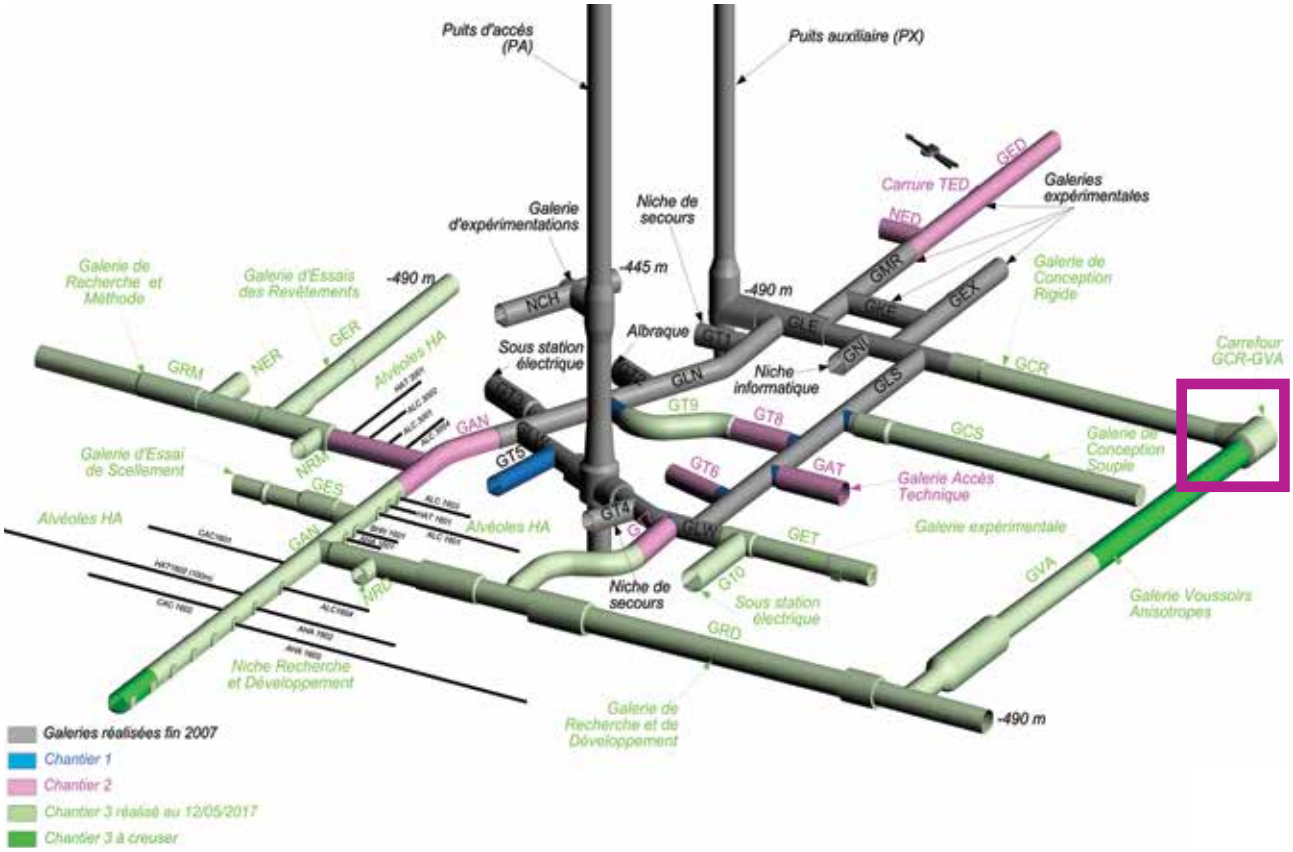
The engineering design and technology testing work performed in 2016 included trials of technical solutions that could help deal with unforeseen or degraded operating conditions in the future Cigeo repository.

ACCIDENT AT ANDRA'S UNDERGROUND LABORATORY

In January 2016, a worksite accident at Andra's Underground Laboratory led to the death of a subcontractor employee.

For over 15 years, Andra has been carrying out research on deep geological disposal in its Underground Laboratory 500 m underground. It has been digging tunnels in order to study the technologies required to build underground structures, with a view to the future construction of Cigeo. In January 2016, an accident occurred at the end of an experimental tunnel (GCR Tunnel - highlighted with a box on the diagram below). Three workers were fitting radial bolts during a support installation operation, an interim stage in the procedure that ensures the tunnel being excavated is held firmly in place.

One of the workers lost his life as a result. The two other employees required medical care: one had a slight hand injury and the other was in a state of shock. Andra has drawn up an action plan, to understand the causes of the accident and learn lessons in order to further improve safety at the Underground Laboratory. Analysis so far has not shown any new phenomena relating to the behaviour of the rock. Work has since resumed at the intersection affected and excavation has been completed there.



ONGOING WORK AT THE UNDERGROUND LABORATORY

A variety of maintenance and upgrading work was carried out at Andra's Meuse/Haute-Marne Underground Laboratory in 2016, on the shaft sinking zone and the elevators that provide access to the underground tunnels, 500 m underground.

After more than 15 years of work, the Underground Laboratory, which is licensed for operation until 2030, has been preparing for the future. The shaft sinking zone, a central area on ground level where the shafts that lead down to the underground tunnels are located, has been undergoing a comprehensive upgrade. After 2½ years of work, the temporary workshops and offices used by Andra contractors will make way for permanent buildings. 50 people will be working on this €10 million project, which has been split down into 27 small work packages, that are manageable for local contractors.

ELEVATOR MAINTENANCE

Site safety work also focused on the elevators, which had their first ten-year maintenance operation in 2016. This overhaul of the elevator components supplements the quarterly inspections carried out by Andra. Key parts were gradually removed for visual inspection, as well as an inspection of all the load-bearing structures, in order to check their structural integrity. All safety-important mechanical components were also replaced.

FIBRE OPTIC SENSORS FOR OBSERVING AND MONITORING CIGEO

Since 2016, Andra has been testing innovative systems such as fibre optic sensors in its Underground Laboratory. These instruments may be used to observe and monitor the future Cigeo repository during operating phase.

Andra needs to measure any changes in the disposal structures that will receive high-level and intermediate-level long-lived waste in the Cigeo repository, if it is licensed. Fibre optic sensors have been developed by Andra and set into the concrete lining along the walls of the lining test tunnel since the start of 2016 to test them at the Underground Laboratory.

RELIABLE AND ROBUST

A wave of light runs through the optical fibres installed in 20 m loops along the tunnel. Any temperature changes and strain in the tunnel will influence the fibres, modifying the amplitude of the light wave.
A measurement unit, which is outside the tunnel, both generates and receives the wave of light as it returns. This gives accurate information on the location of any deformation. The optical fibres, whose service life is expected to be several dozen years long, will provide remote monitoring measurements from inside Cigeo, at any time during operating phase, without any exposure to radiation.

TESTS ON MUCK PILES

If Cigeo is licensed, the clay-like matter excavated from the Callovo-Oxfordian layer where the repository is being constructed, will be brought to the surface and stored in muck piles. In late 2015 and through 2016, Andra carried out tests at the Meuse/Haute-Marne Centre to generate an accurate estimate of the final muck volume, and to define how best to form the piles. Andra measured the compactness of the excavated material obtained using the conventional excavation methods used at the Underground Laboratory, before wetting a test pile in order to determine a limit water concentration value up to which site vehicles can still drive and dump material.

CORROSION LIMITATION STUDIES FOR CIGEO

Since March 2016, in the main experiment tunnel at Andra's Underground Laboratory, scientists have been testing a system for limiting steel corrosion in the Cigeo high-level waste (HLW) package disposal cells. A cement-based grout is injected between the rock and the steel sleeve.

In the Cigeo repository, HLW packages will be disposed of in cells excavated from the clay rock and lined with a steel sleeve. This design means that the packages remain retrievable throughout the repository operating period. When the disposal cells are being excavated, air from the ventilation system can cause oxidation of the clay rock around the cells. The resulting acidity could accelerate corrosion of the steel in the cell sleeves [1].

A CORROSION-LIMITATION MATERIAL

Andra scientists have therefore come up with the idea of inserting a cement-based material between the rock and the steel sleeve. The high pH of the grout should neutralise acidity and slow corrosion. This concept has been tested in the Underground Laboratory since 2016. An experimental set up forming an *in situ* reproduction of the physico-chemical conditions in an HLW disposal cell was installed in the main experiment tunnel. Samples of steel grouted with a cement-bentonite mixture were placed in contact with the rock in order to measure the speed of corrosion in real conditions over a period of several years.

[1] Once the cells and repository have been closed, the lack of oxygen will naturally limit corrosion speed.

A NEW HLW CELL EXCAVATION CONCEPT

In order to ensure that the high-level waste (HLW) packages remain retrievable throughout Cigeo's operating phase, the steel sleeve around the HLW cells must withstand the pressure from the rock, which requires corrosion to be limited. Since July 2016, Andra engineers have been testing a new construction technique for this type of cell.

Over the last few years, various HLW cell excavation techniques have been successfully tested at Andra's Meuse/Haute-Marne Centre. From 2009, the steel sleeve was gradually inserted as excavation progressed, and a void was left between the sleeve and the rock.

NEW MICRO-TUNNELLING MACHINE FOR A NEW EXPERIMENT

The most recent research on adding a cement-based grout between rock and sleeve to limit sleeve corrosion has led to a new set of HLW cell construction experiments. In 2016, a 40 m hole was drilled with a new micro-tunnelling machine developed for Andra by the French specialist contractor Bessac. The new technique involves excavating the rock to its final depth, withdrawing the micro-tunnelling machine, then sliding in the steel sleeve, before using an innovative system to inject the grout into the space between the clay rock and the sleeve in one go.

TESTING CIGEO CLOSURE

Once Cigeo operation has been completed, the repository will be completely sealed to ensure maximum safety over an extremely long period of time (with no further human action required). Andra engineers are planning to use bentonite, a clay that swells in contact with water to become almost impermeable, to seal up the repository shafts and ramps. Bentonite was tested on a small scale within Andra's Underground Laboratory in 2016.

ANDRA MOBILISES THE SCIENTIFIC COMMUNITY AROUND CIGEO

Throughout 2016, Andra organised a series of events to promote discussion with other researchers on topics around radioactive waste management. The Cigeo project benefited from this enriching dialogue about topics such as decision-making, managing long-term uncertainties or observing and monitoring disposal facilities.

Andra hosted an international conference in Paris in December 2016 on decision-making and dealing with uncertainty in scientific and technological projects whose time-scale is longer than the time required for experimental validation. This issue is extremely relevant to the Cigeo project, which has repercussions affecting an extremely long time-scale. Delegates including climatologists, sociologists, historians of science, IT experts or specialists in public policy came together to discuss the different approaches in their research projects. Andra was also able to present the work it has done in this field over the last 25 years.

NATIONAL AND INTERNATIONAL EXCHANGES

Another topic shared by Andra in 2016 was the observation and monitoring of deep geological repositories. On an international level, the European research project Modern2020 brought together 28 partners. In late 2016, a workshop was held at Andra's offices, and one output was a generic method to identify and justify the parameters that need to monitored in disposal facilities (temperature, pressure, radiation), considering the technological maturity and varying contexts in different countries. Within France, Andra partnered with the French Optics Society and the Hubert-Curien Laboratory in organising the seventh edition of the Conference on fibre-optics in a radioactive environment.

SCIENTIFIC CONFERENCE ON THE CIGEO PROJECT

105 R&D partners from scientific bodies that work with Andra came together for a day-long conference aiming to provide information and discussion on Cigeo's development. Topics covered included repository safety, major progress in R&D for design and safety and the major scientific and technological questions that remain to be studied in years to come.

PARTNERSHIPS FOR RESEARCH

Andra seeks to share its research and develop knowledge on topics related to its activities, and has therefore developed partnerships with renowned institutions. In February 2016, Andra and five other partners [1] renewed their contract supporting the industry-funded research group at the *Ecole des Mines* engineering school in Nantes. Its aim is to promote research and teaching in geological disposal and storage of radioactive waste. In November, Andra signed a new five-year R&D partnership with LNE (*Laboratoire national de métrologie and essais*). The aim of this partnership is to jointly develop high-performance and long-lasting instrumentation for radioactive waste disposal facilities, especially Cigeo.

[1] École des Mines de Nantes, the École des Mines de Nantes endowment fund, Areva NC, EDF and Fondation EDF.

AWARD FOR A YOUNG RESEARCHER

In 2016, PhD researcher Isabelle Planes was awarded a prize for the best oral presentation at the Asian-Pacific Optical Sensors (APOS) conference in China. Her PhD research is funded by Andra and carried out at the Hubert-Curien Laboratory (Jean-Monnet University in Saint-Étienne and CNRS). Her work focuses on optical fibre systems that could be used for Cigeo observation and monitoring.

OPE, A HIGH-QUALITY SCIENTIFIC RESOURCE

Andra's Perennial Observatory of the Environment (OPE) was established to determine the initial condition of the environment around the future Cigeo repository and monitor any changes during operating phase. Its SOERE accreditation was renewed in 2016. OPE also obtained new storage capacities and enhanced its participation in wider research networks.

The Observatory studies both the characteristics and any evolution in all environmental components - water, air, soils, flora, fauna and human activities - across a 900 km² area around the surface installations of the future Cigeo facility. In late 2015 / early 2016, OPE had its "Long-term observation and experimentation system for environmental research" (SOERE) accreditation renewed by the French National Alliance for Environmental Research (AllEnvi). This certification recognises the original nature of OPE's work, in terms of the diversity of environments studied, the observation period (minimum 100 years) and the scale of the study area. The renewal comes with a set of recommendations, with a particular focus on making the data collected available to other organisations.

GREENHOUSE GAS MONITORING

In early 2016, the Observatory also invested its technical, human and financial resources in bringing its three environmental monitoring stations up to ICOS [1] standards. The three stations are the Houdelaincourt atmospheric station and mast, the Montiers-sur-Saulx forest station with its flux tower, and the Osne-le-Val meadow station. Andra is participating in the European ICOS research infrastructure in order to harmonise greenhouse gas monitoring to improve understanding of climate change and its impacts on ecosystems.

SPECIMEN STORAGE

The OPE's field systems are being enhanced, with a new sampling truck. The vehicle has a liquid nitrogen tank, which immediately preserves samples at temperatures between -150°C and -196°C. This halts decay and preserves their chemical characteristics in as faithful and representative a manner possible. The samples can then be transported to Andra's Environmental Specimen Bank, where they will be stored for at least 100 years.

[1] Integrated Carbon Observation System.

OPE CONFERENCE

In October 2016, Andra organised a one-day scientific conference on the Perennial Observatory of the Environment (OPE), with 60 delegates from many of the key R&D partners in environmental sciences. The event saw discussions about the observation systems used within OPE, and issues around data collection, integration and use, particularly for national or international research projects. It also provided an opportunity to strengthen relationships between the various parties in attendance and envisage potential new collaborative projects.

INTERNATIONAL TRAINING

In June 2016, Andra and the European research infrastructure ICOS jointly organised a training course on soil and leaf sampling protocols for around 30 specialist environmental technicians from Germany, Belgium, Denmark, Italy, Finland, France, the Czech Republic and Sweden. The trainees were hosted at OPE, where they were able to learn to use common procedures, that were explained to them by trainers from the French National Institute for Agricultural Research (INRA).

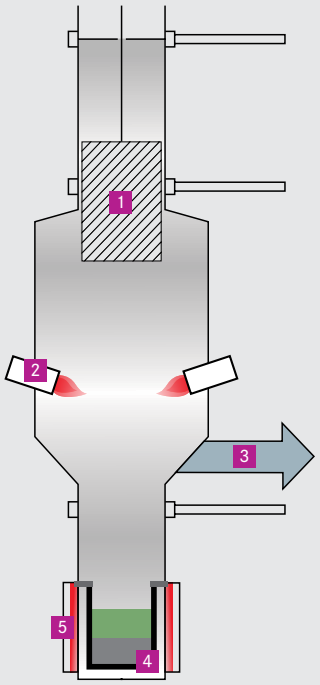
PIVIC – AN INNOVATIVE WASTE TREATMENT SOLUTION

The PIVIC project, a collaboration between Areva, CEA and Andra under the French government's Investment in the Future Programme, aims to develop an innovative treatment process for some types of intermediate-level long-lived waste. In 2016, breakthroughs were achieved, marking a significant step forward for project development.

Some intermediate-level long-lived waste (ILW-LL) from current nuclear facilities needs prior treatment in order to comply with the disposal safety conditions required for Cigeo. These types of waste include organic waste (e.g. plastics) from MOX manufacturing operations. MOX is a nuclear fuel, made from a mixture of uranium oxide and plutonium oxide from reprocessed spent fuel. Once it has been packed in the disposal containers, this waste poses two types of risk due to the organic material it contains: a hydrogen explosion risk and the risk of package corrosion.

INCINERATION, MELTING, VITRIFICATION

This is why Areva, CEA and Andra started the PIVIC project in 2011. PIVIC stands for 'process of incineration-vitrification in can'. The goal is to develop a process for removing organic material from waste using a multi-stage process of incineration, melting followed by vitrification and finally conditioning. The waste packages produced in this way can then be disposed of in Cigeo. Andra, with the support of the French government's Investment in the Future Programme, has provided €20 million in funding for the project. The partnership made another significant step forward in 2016, when Andra's engineers completed calculations to determine the maximum heat emission levels from the packages that would be compatible with disposal in Cigeo. Studies will continue over the next few years. System commissioning is planned for 2032, with an aim of treating approximately 3,400 m^3 of waste.



1 The radioactive waste containing organic material is inserted into the top of the process (furnace).

2 Plasma torches heat the waste to approximately 800°C. Organic matter burns and turns to gas and ash at this temperature.

3 The gas is removed and sent to a treatment system.

4 The lower part of the process (melting) comprises a metal can, which is induction-heated. Waste from the top part (ash from incineration of the organic matter) is introduced. Glass and metal frit is also present.

5 The metal is melted by the heat, which in turn causes the glass frit to melt and incorporate the ash in the molten glass frit. The final content of the can comprises two layers, a denser metal layer at the bottom, and a layer of glass, encapsulating the ash, above it. Most of the radioactivity is contained in this upper layer. The can is then removed and placed in a stainless steel container.

INNOVATIVE PROJECTS FOR DECOMMISSIONING WASTE MANAGEMENT

The second edition of Andra's call for projects, organised with ANR [1] and supported by the French government Investment in the Future programme, was held in 2016. The aim of this process is to encourage the emergence of innovative solutions for optimising the management of radioactive waste from nuclear facility decommissioning, prior to disposal. In total, 57 projects were submitted for the four proposed themes of waste characterisation, waste sorting and treating, new packaging materials and a social science topic on "innovation and society". Selection was carried out by an evaluation committee of independent experts, which met to classify the projects on the basis of their relevance, scientific and technical quality and methodology. In the end, 19 projects were chosen and will receive funding.

[1] French National Research Agency .

ANDRA VALUES INNOVATION

In June 2016, a new unit was established within Andra - the Directorate of Development, Innovation and International Affairs (D2I) Patrick Landais heads up the new unit, with a significant focus on innovation, including a dedicated department whose role will be to define and implement a strategy to promote, structure and value innovation within Andra. The Innovation Department coordinates innovation, in particular, in phases prior to disposal (waste characterisation, treatment, recycling and packaging). Some initiatives will be funded by the French government's Investment in the Future programme. It also has responsibility for intellectual property and knowledge management with the aim of preserving and maintaining Andra's knowledge and know-how over time.

A TECHNOLOGY PROGRAMME TO PREPARE FOR CIGEO

As part of its technology testing programme for the Cigeo project, Andra's work in 2016 focused particularly on technical solutions for managing unforeseen or degraded conditions in the future repository.

Reversibility means that future generations will still have a choice about the future of Cigeo - whether to continue as originally planned, modify the repository or reverse previous decisions. Andra is required to design the repository to ensure that high-level waste (HLW) and intermediate-level long-lived waste (ILW-LL) packages can be retrieved at any time during the Cigeo operating phase. Technology tests are being carried out to ensure that retrievability remains possible, even in difficult conditions (e.g. after several years, when materials are degraded).

For HLW packages, Andra has developed an HLW cell demonstrator with a highly-corroded environment (rusted materials) and a temperature of 90°C. During the initial tests in 2015, a special robot was used to retrieve the package using a steel cable. Andra engineers noticed that during the operation, corrosion products (rusted metal residue) could accumulate at the cell head, which could block the opening and radiation protection systems. A cleaning robot was designed and successfully tested in 2016, to clean extremely rusty cells before the second robot enters for package retrieval.

RETRIEVING DISPLACED ILW-LL PACKAGES

Andra is performing technology tests to find solutions to degraded conditions in the future repository. One example is the need to retrieve an ILW-LL package whose position has shifted inside an ILW-LL cell. Engineers have designed a robot with tilting, extendible forks that can automatically detect the position of the displaced package and transport it. After successful testing in 2015, the demonstrator was installed in Andra's Technological Exhibition Facility in 2016.

RISK MANAGEMENT

Andra has also been working to develop and qualify the concrete overpack containing the ILW-LL waste packages, testing their resistance in certain risky conditions in order to ensure facility safety. Drop tests and fire tests were performed in 2016. Results showed that the ILW-LL package containers maintained their structural integrity, could still be handled after a fall or fire, and still protected the waste package. In parallel, Andra is implementing technical solutions to directly reduce risks such as fire. Andra's water-based hydraulic systems were tested in 2016 (i.e. hydraulic systems that do not require inflammable oil). After successful testing, these systems could be used in Cigeo, for example, for opening and closing reinforced doors.

International

IN 2016, ANDRA SHARED ITS EXPERIENCE IN COLLECTIVE INITIATIVES AROUND THE WORLD, LED IN PARTICULAR BY THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) AND THE NUCLEAR ENERGY AGENCY (NEA). IT ALSO HOSTED FOREIGN DELEGATIONS AT ITS CENTRES, ENTERED INTO NEW COOPERATION AGREEMENTS, AND ORGANISED OR PARTICIPATED IN INTERNATIONAL CONFERENCES.

Two key events were a major feature of Andra's international relations in 2016. At the World Nuclear Exhibition (WNE), Andra had the opportunity to re-emphasise the importance of radioactive waste management when countries start out in the nuclear industry. It shared its expertise in the field.

At the International Conference on Geological Repositories (ICGR), which it co-organised with the Nuclear Energy Agency (NEA) in Paris, Andra presented progress on deep geological disposal solutions for radioactive waste, with other key international stakeholders.

SHARING KNOW-HOW AROUND THE WORLD

For nearly ten years, Andra has been developing international relationships in order to highlight the challenges of radioactive waste management, and to share its experience and expertise. In 2016, it attended major international events in the field, including the World Nuclear Exhibition (WNE) or the International Conference on Geological Repositories (ICGR).

Radioactive waste management is a crucial issue for countries that are just starting out with nuclear activities. Andra is responsible for this subject in France, and also has a role in presenting and sharing its experience and expertise. It was able to do this at the WNE event at Le Bourget, near Paris in June 2016. Examples presented including the support provided to Turkey in developing an institutional framework for radioactive waste management; assistance to South Africa in producing a national waste inventory; assessment of a scientific programme in China; or support in preparing for a surface disposal facility in South Korea, including training for engineers.

SHARING EXPERIENCE ON DEEP GEOLOGICAL DISPOSAL

In December 2016, international stakeholders in the field of deep geological disposal of radioactive waste came together in Paris for the fifth International Conference on Geological Repositories (ICGR). The event, which was organised by Andra and the Nuclear Energy Agency (NEA), presented progress in geological repositories, which are acknowledged to be the worldwide benchmark solution for the highest-level radioactive waste. In France, Andra is leader in this field, with the Cigeo project. The conference was an opportunity to present project history and progress to stakeholders from all around the world who are responsible for radioactive waste or representatives of safety authorities. Many participants were interested in questions around the dialogue and consultation process run by Andra with local stakeholders. This was considered to be essential for the success of any geological repository project.

ANDRA ENGAGES WITH IAEA

In 2016, Andra played an active role in International Atomic Energy Agency (IAEA) activities relating to radioactive waste management. It organised visits to its centres and performed expert analysis missions for different IAEA member countries. Andra also hosted a Chinese intern at its Underground Laboratory for two months, studying the geomechanics of clay for Chinese research into geological disposal.

In the context of IAEA actions, Andra presented its expertise on repository safety at an international conference. The Agency also hosted the annual meeting of the underground research laboratory network at its Meuse/Haute-Marne Centre, and organised a technical meeting in Troyes on options for radioactive waste management strategies for countries with nuclear activities.

With Andra's expertise, France is one of the most advanced countries in radioactive waste management. In 2016, Andra worked with various countries, at their request, sharing its experience and expertise.

SOUTH KOREA

A surface disposal facility for low- and intermediate-level short-lived waste (LILW-SL) is being designed in South Korea, and in 2016 Andra continued delivering training to engineers from Korad, its Korean counterpart. The two agencies also signed a contract for assistance in the disposal facility safety studies. South Korea also wants to develop a research facility with a view to designing a deep geological repository. In 2016, Korad therefore commissioned Andra to deliver a one-week training course to Korean engineers about its Underground Laboratory and the way it works.

UKRAINE

Since 2012, Andra has been working in two cooperative ventures in Ukraine: assistance in establishing a Ukrainian radioactive waste management agency, and support in developing disposal facility concepts that would be tailored to the country's needs and waste types. After four years of support, the two contracts came to an end in 2016, with submission of the planned deliverables.

IRAN

After various discussions between France and Iran, Andra signed a cooperation agreement with Iran Nuclear Waste Management Company (INWM Co.) in 2016. Iran has two nuclear power plants and a third is under construction. The country is now planning a surface disposal facility for very low-level waste (VLLW) and low- and intermediate-level short-lived waste (LILW-SL). Andra is providing support by training engineers, helping with facility design and defining acceptance criteria for the radioactive waste that will be disposed of.

TURKEY

Turkey has launched a programme to build a dozen nuclear power plants, and its Minister of Energy has selected Andra as a partner, as part of a twinning project between Turkey and the European Commission, aiming to support the country in its plans. In 2016, Andra provided support to the Turkish authorities in drafting a nuclear power bill, with a particular focus on articles covering the management of radioactive waste and spent fuel. It also contributed to work initiated in order to establish a waste and spent fuel management organisation.

BULGARIA

Since 2012, Andra has been assisting Nuvia Ltd., a UK-based nuclear engineering group, in optimising the way waste management is organised for decommissioning of the four reactors at the Kozloduy nuclear power plant. The contract between Andra and Nuvia was renewed for a three-year period in 2016.

SWITZERLAND

Andra has had a long-term partnership with its Swiss counterpart Nagra and the cooperation agreement was renewed in 2016. Switzerland is currently studying the possibility of deep geological disposal in clay, and has an underground laboratory at a depth of 300 m at the Mont Terri site. Having completing the second phase of studies, Nagra is now awaiting authorisation for final investigations in Opalinus clay formations at two sites.

LITHUANIA

After more than seven years work, Andra and its industrial partners have completed the main component of their mission to design and present the safety case for a low- and intermediate-level short-lived waste (LILW-SL) disposal facility from the Ignalina power plant which is currently being decommissioned. The safety case was filed with the Lithuanian nuclear power safety inspectorate, Vatesi, in 2015. Over the course of 2016, further technical details requested by the inspectorate were studied and prepared, and in April 2017, initial authorisation was granted by Vatesi, an essential step in the planning permission process for the disposal facility.

CHINA

The Chinese Ministry of the Environment has commissioned the East China Institute of Technology (ECIT) to carry out feasibility studies for an underground research laboratory in clay for high-level waste. Andra has been asked to provide assistance on various topics such as identifying a site or geological surveys, drawing on its know-how in deep geological disposal in clay. After various discussions, a five-year cooperation agreement was signed between ECIT and Andra in late 2016. The first phase of the agreement involves hosting five Chinese interns in France.
In parallel, Andra continued cooperation with the Beijing Research Institute of Uranium Geology (BRIUG), providing assistance in implementation of a scientific programme for the construction of an underground laboratory in granite in China.

Information, dialogue, consultation and local integration

ANDRA LEADS A PUBLIC INTEREST PROJECT THAT IS RELEVANT TO ALL CITIZENS NOW AND IN THE FUTURE, AND TAKES ITS ROLE SERIOUSLY IN DISSEMINATING SCIENTIFIC AND TECHNICAL CULTURE, AND ENGAGING WITH COMMUNITY LIFE IN THE AREAS AROUND ITS FACILITIES. IN 2016, THIS COMMUNICATION STRATEGY WAS FURTHER BOOSTED WITH A FOCUS ON INFORMATION, DIALOGUE, CONSULTATION AND LOCAL INTEGRATION.

Andra has worked to make access to information on radioactive waste available to as many people as possible. Members of the public can find out about the subject and ask questions, via various channels of information, public talks and events on various topics, visits to Andra facilities and open days.

A further step was taken in the societal engagement policy in 2016, with a dialogue initiative and the launch of a series of consultations on the Cigeo project.

Andra also pursued its ambitious sponsorship and charitable funding programme in 2016, showing its commitment to development in the local communities where its activities are hosted.

PUBLIC INFORMATION AND SCIENTIFIC CULTURE

NEW EXHIBITIONS

The "Forest Discoveries" exhibition at the Meuse/Haute-Marne Centre closed in June 2016, having been visited by around 15,000 people. It was replaced by an interesting new scientific exhibition about archaeology, which has been planned to tie in with the preventive archaeological surveys taking place in preparation for the Cigeo project. Visitors were invited to tour a mock-up archaeological dig site, with activities to find out about an archaeologist's day-to-day work. Andra's exhibition "Radioactivity: from Homer to Oppenheimer" moved into the Ludiver Planetarium in the Manche department, following spells in the Aube, Meuse/Haute-Marne areas and also Paris. More than 26,000 visitors enjoyed an educational introduction to radioactivity and its applications, between February and December 2016.

EVENTS AND ACTIVITIES FOR ALL AGES

Andra participated in a range of national initiatives by hosting various events at its sites in 2016. The facilities in the Aube area ran a schools workshop, and talks on nocturnal birds of prey and volcanoes for the Festival of Nature. Visitors to the Meuse/Haute-Marne Centre (MHM) enjoyed activities on the theme of insects. More than 600 people attended fun science-themed events at the Aube facilities and MHM Centre for the National Festival of Science. Andra also took part in Industry Week and offered construction and industry trainees and apprentices a tour of its CSA waste disposal facility.

SCIENCE TALKS THROUGHOUT THE YEAR

Throughout 2016, Andra organised presentations on scientific themes at the public information centre at its Aube facilities. The programme kicked off with the showing of a documentary entitled *Jungle d'eau douce* on the secret life of gravel pits, followed by a discussion with film-maker Serge Dumont. Astronomy featured in April, with a talk by Benjamin Poupard from the Planetarium in Reims. In the summer, Andra hosted a presentation on water, on and under the earth, with Claude Colleté of the Aube Geological Society. The final event of the year was on the subject of time, Roland Nespoulet, a Pre-historian from the National Museum of Natural History.

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Number of visits to Andra website in 2016: **400,336,** an increase of over **25 % on 2015**

Number of web discussions in 2016 (social networks and websites): **1,499,** a nearly **65 % increase on 2015**

Publication of **THREE** issues of *Andra's magazine:* four versions (national, Meuse/Haute-Marne, Aube and Manche) with more than **288,000 copies per issue**

PUBLIC DIALOGUE

POLITICIANS AND INSTITUTIONS

In October 2016, Andra took 50 mayors and municipal councillors from nearby their facilities in the Meuse/Haute-Marne, Aube and Manche areas on a visit to an EDF nuclear power plant at Bugey. They got to see two major projects related to radioactive waste management: decommissioning of the plant's first-generation Reactor 1 and the ICEDA activated waste packing and storage facility, a surface-level storage solution for intermediate-level long-lived waste (ILW-LL) from late 2017 until they can be disposed of in Cigeo. The study trip gave the local politicians an opportunity to understand the way an industrial site operates within its environment, and to share their experience as representatives of the communities around Andra sites.

Andra also received nine members of the National Assembly sustainable development and territorial planning committee at the Meuse/Haute-Marne Centre. The group found out about the activities at the Underground Laboratory and about Cigeo design and local integration, and this information will feed into the work of their committee.

HIGH-LEVEL COMMITTEE

When in the area for the Cigeo project high-level committee meeting at the Prefecture of Bar-le-Duc in December 2016, Christophe Sirugue, Minister of State for Industry, was taken on a guided tour of Andra's Underground Laboratory by Pierre-Marie Abadie, Andra CEO. The visit took in the programme of experiments in the laboratory's tunnels and the excavation techniques that Andra is testing ahead of construction of the Cigeo project.

REFLECTION AND DISCUSSION

In 2016, for the second time, Andra and the *Usbek & Rica*magazine organised a meeting of Les Arpenteurs, the digital media outlet for future generations [1]. The theme was the collapse of our industrial civilisation. This potential issue ties in with the topic of very long-term memory that is addressed as part of the Cigeo project.

A group of bloggers with an interest in science, the environment, energy and ethics came to visit Andra's facilities in the Manche, Aube and Meuse/Haute-Marne areas. The articles posted following these visits offered a new perspective on the subject and highlighted how universal the issue is.

[1] www.lesarpenteurs.fr.

STUDENTS

In 2016, many dozens of seminars were organised at Andra facilities, enabling students to find out about careers related to radioactive waste management, which their studies could lead to. A group of around 30 materials and mechanical engineering students from the University of Technology of Troyes visited the Meuse/Haute-Marne Centre. Students from Paris-Sud University also came and discovered hydro-geological aspects of the CSA waste disposal facility (Aube).

CULTURE AND CREATION

In June 2016, a short film entitled *La Solution Radiochats* won a Green Award (Gold) at the Deauville Green Awards. The documentary addresses the issue of memory at radioactive waste disposal facilities, and had already won first prize in the "*Regards sur les déchets radioactifs*" competition run by Andra. This annual event gives young film directors the chance to produce and present short films giving their perspectives on the subject.

LOCAL INFORMATION COMMISSIONS

Local commissions have been established in the areas around each of Andra's facilities (Aube, Manche and Meuse/Haute-Marne), to inform local people about the way the facilities are run. Andra maintained permanent dialogue with these bodies throughout 2016. In October, it invited the Underground Laboratory local information and monitoring committee to an information day on the Cigeo project, presenting the progress of the project, the way the facilities will work, safety issues, research and local integration initiatives.

All the local information commissions had the chance to meet up and share their perspectives in 2016 during study visits to different Andra facilities. 24 representatives of the three local information commissions in the Manche area (Andra, Areva La Hague and EDF Flamanville) visited Andra's Underground Laboratory to find out about the studies and experiments taking place on the subject of deep geological disposal. Members of the CSA waste disposal facility local information commission (Aube) also travelled to the Manche area to find about Andra's facility there that is now in closure phase, discovering issues relating to monitoring and the way information can be preserved and passed on to future generations.

Andra site visits were also held in 2016 for members of the Board of the National Association of Local Information Commissions (Anccli), enabling them to increase their knowledge of radioactive waste.

VISITS

In 2016,
14,708 visitors came to Andra sites

9,040 to the Meuse/Haute-Marne Centre, including **780** at Andra's open day and more than 500 at the Open Days for visiting Andra's Underground Facilities

4,538 to the Aube facilities, including **727** to the Cires waste collection, storage and disposal facility for Andra's open day there

1,130 to the CSM waste disposal facility

ENGAGING THE COMMUNITY WITH ANDRA PROJECTS AND ACTIVITIES

CO-CONSTRUCTION OF THE CIGEO PROJECT

The Cigeo project is moving forward towards the construction licence application, and Andra wants to engage local stakeholders to improve the quality of decision-making. Many choices have already been made, but other decisions remain for later stages - choices related to the local environmental impact, rainwater management, compensation, land clearance, landscaping and other issues. Such decisions will have consequences for the local area and its environment. Andra is looking to listen to the local community and incorporate concerns and expectations, but also proposals from all project stakeholders. There is no sense that Andra has all the answers to aspects of the project from detailed design to construction.

For the purposes of stakeholder engagement, Andra has identified various subjects requiring consultation, either locally or nationwide. The first meetings were organised in late 2016, to organise community discussion about the impacts of Cigeo, the choice of connection route between the two surface installations (see p. 26) or about the future of Cigeo's governance.

WORKING TOGETHER ON MEMORY ISSUES FOR DISPOSAL FACILITIES

At every Andra location, focus groups are formed, bringing together local politicians and residents, representatives of the non-profit sector and former Andra employees to reflect with Andra on how to pass on the memory of waste disposal sites over very long periods of time.

With one disposal facility in closure phase in the Manche area, two operating disposal facilities in the Aube area, and an Underground Laboratory and planned geological repository in the Meuse/Haute-Marne area, the various groups address different memory issues, and the work they carried out in 2016 varied. The group around the Manche site has continued developing an "ultrasynthesis" document summarising the essential information that is necessary for future generations to understand the nature of the site. Some of its members have continued sorting and collecting press cuttings on nuclear activities in the Nord-Cotentin area, including some articles directly addressing Andra and its activities. The group in the Aube area has been working on oral history, by interviewing local people who could retell the history of the two local Andra facilities. The focus of the Meuse/Haute-Marne group's work has been on preserving the history of the Underground Laboratory. They partnered with students in film studies at the high school in Joinville, who interviewed a range of local stakeholders. The videos will be stored in the Meuse and Haute-Marne council archives.

SUPPORTING LOCAL PROJECTS, CONTRIBUTING TO DEVELOPMENT

AUBE

Andra has provided funding for a local heritage project - the restoration of the Renoir family estate, aiming to protect the memory of the famous painter and ensure that the local tourist trail remains in operation for years to come. Other Andra sponsorship initiatives have supported a range of projects for different groups: Children and young people benefit from the B'attitude farm, which offers child-friendly events and workshops, with a focus on environmental awareness; Local businesspeople can enter the Initiative Aube competition, whose Starter prize was awarded to the founder of Altermaker, which publishes software focusing on sustainable development; People with disabilities were able to enjoy a concert from Prague Philharmonic Orchestra, organised by the local association "*Le mai des handicapés*". Any money generated by the association's events is ploughed back into funding individual and collective projects for disabled people.

MANCHE

In 2016, Andra renewed its sponsorship of the association "*Voiles écarlates de Cherbourg*", an employment promotion project that restores tall ships. This long-term partnership, which started in 2014, has been influential in the restoration of the ship *La Croix du Sud III*, an exciting project that promotes both solidarity and the preservation of local heritage. In Cherbourg, Andra's support was also key when a chest dating back to Napoleon III was found during the restoration of a statue of Napoleon I. Andra funding enabled the contents of the chest (parchments and an Imperial Decree from 1811) to be reproduced on the same type of permanent paper that is used at the CSM waste disposal facility to conserve site memory.

MEUSE AND HAUTE-MARNE

In 2016, Andra sponsored the Association for the Protection and Promotion of Metallurgy Heritage in Haute-Marne. The association plans to bring back a massive 200-tonne press into the area. It is the last remaining example of this technology from 1931, used for agricultural metalwork. Andra also provided funding for an artistic trail entitled "*Des pas qui résonnent*", involving 14 schools in commemorating the centenary of World War I. A "V"-shaped work of art entitled *Mémoire vive* was created for the event (see photo). Andra has also contributed to preserving local memory, through its support for local events such as the 19th edition of the *RenaissanceS* festival in Bar-le-Duc or the fourth edition of the *Generation De Gaulle* show in Colombey-les-Deux-Églises.

SPONSORSHIP

In 2016, Andra provided funding of more than **€340,000**

96 projects supported by the Meuse/ Haute-Marne Centre

49 projects supported by the industrial facilities in the Aube department

6 projects supported by the CSM waste disposal facility (Manche)

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