

Update on Cigeo, the French Geological Disposal Project - 15067

Alain Harman, Thibaud Labalette and Gérald Ouzounian
Andra – France, gerald.ouzounian@andra.fr

ABSTRACT

Cigeo, the French geological disposal project, is the result of 20 years of studies and research led by Andra. Following a nation-wide selection and siting process, research focused on an argillaceous formation near Bure, a village on the boundary of the Meuse and Haute-Marne departments in eastern France, for the construction of an underground research laboratory. Based on the results submitted to the French Government and Parliament in 2005, a planning act was passed in 2006, establishing geological disposal as the reference solution for managing high-level and intermediate-level long-lived waste. The act sets out guidelines for managing this waste and includes a roadmap leading up to the commissioning of the geological disposal facility in 2025.

A public debate was held in 2013 and the project team took note of the ensuing change requests. Meanwhile, studies and design work continue, with a particular focus on the need for optimisation and an assessment of the cost of disposal.

INTRODUCTION

The geological disposal programme for radioactive waste in France has been in progress for more than 20 years now. Following the failure of efforts to find study sites, the Prime Minister in office at the time declared a moratorium in 1990. The period that followed served to analyse and understand the reasons for this failure and to put forward a step-wise process to make further progress in finding solutions for radioactive waste disposal. The outcome of this effort was the Act of 30 December 1991 [1], a research law providing for a 15-year research programme which would include the study of alternative solutions. Within this context, detailed research work began on partitioning and transmutation and long-term storage, alongside research on geological disposal. Regarding the latter, license to build and operate an underground research laboratory in the Callovo-Oxfordian argillaceous formation at Bure was delivered in 1998, on the basis of studies and investigations carried out from the surface. By the end of 1999, enough progress had been made to start detailed investigations and the first experiments. The many results acquired were collated in a document entitled Dossier 2005 [2] and submitted to the French Government and Parliament, at the same time as the partitioning, transmutation and long-term storage reports. The same year, the Government organised a public debate on the issue of radioactive waste management. Based on all the information gathered - and after consulting the stakeholders - a new law was debated and passed by Parliament. This was the Planning Act of 28 June 2006 [3], which sets out the main spent fuel management options, together with a genuine roadmap for the disposal of high-level and intermediate-level long-lived waste. Field investigations were stepped up, leading in 2009 to a proposal to build underground disposal facilities some 5 km north of the underground research laboratory. After consulting the stakeholders at the local and national levels, the site of the underground facilities was chosen in 2010.

THE 2013 PUBLIC DEBATE

All major infrastructure projects in France are subject to a compulsory public debate procedure, organised and led by the National Public Debate Commission, an impartial body tasked with gathering and summarising the opinions and positions of the various parties. For the Commission, the preparation phase primarily involved taking on the issue of the Cigeo geological disposal project and consulting the various stakeholders. Meanwhile, Andra prepared the presentation of the Cigeo project in readiness for the public debate. A descriptive document of about a hundred pages, setting out the main options concerning the

overall architecture and operation [4] was prepared, with a constant concern for clarity. The Commission prepared a template for “Position Paper” in a standard 4-page format, in which the parties concerned could express their position, setting out their reasons or their questions. The Commission also opened a special website [5].

The public meetings had to be interrupted by the Commission Chair due to disruptions by protesters. Encouraged by opinion surveys and political stands, the Commission swiftly proposed new forms of debate including, in particular, interactive meetings on the Internet and the organisation of a “Citizens’ Panel”. A periodic question and answer forum also appeared in the regional press on Sundays for nearly three months. The debate was extended until 15 December 2013.

In its conclusions on the public debate, the Commission pointed out that the website recorded around 75,000 connections. Andra replied to nearly 1,600 questions and more than 150 Position Papers were published by a wide range of stakeholders including research centres and institutes, unions, politicians of every persuasion, waste producers, environmental protection associations and opponents.

THE OPINION OF THE CITIZENS’ PANEL AND OF THE PUBLIC DEBATE COMMISSION

The Panel was entrusted with the task of expressing its opinion on radioactive waste management and specifically on the Cigeo deep geological disposal project. The 17 members of the Panel were uninitiated citizens, almost half of them residing in the Meuse or Haute-Marne departments, the planned site of the Cigeo project. They received intensive training from experts in a range of disciplines and with different opinions, after which a public hearing was organised with guests of the Panel’s choice. In view of the novel character of the project and the exceptional lifetime of radioactive waste, the question of ethics was central to the choices the Panel made.

The opinion of the Citizens’ Panel was published by the Commission on 3 February 2014 [6]. Its main observations and recommendations concerned:

- The notion of waste as a legacy; the present generation is already impacted by decisions made and waste produced in the past. Geological disposal will provide greater security but efforts should be sustained to reduce the toxicity of waste;
- The extent to which the Cigeo project meets requirements: the Panel considered the possible changes in radioactive waste production and the flexibility that the project might offer in the future for handling this waste. Regarding the implementation timeline, the Panel emphasised that, for reasons of safety and the cooling period required for vitrified waste, there was no need to set such a tight schedule and that time could be profitably used to study alternative solutions or improvements;
- Technical hazards including, in particular, fire and personnel and transport safety, all topics which Andra is already studying in depth;
- Retrievability and reversibility, which justify the need for feasibility demonstrations before the Cigeo disposal facility is commissioned;
- The need to preserve records, knowledge and memory of the Cigeo project and site;
- The clarification of the geothermal potential of the site, especially regarding safety requirements that prohibit a disposal facility from being sited close to an exceptional resource;
- The importance of health and environmental monitoring around the site, with a reference state prior to the operation of the Cigeo facility and an alert system programme combined with health education in the area;
- The contribution of the Cigeo project to the development and appeal of the region through the high-level scientific and technical activities it entails;
- The cost and funding of the project.

In its report published on 12 February 2014 [7], the Public Debate Commission incorporated the Panel’s comments and recommendations, adding to them the positions and proposals gathered during the debate

between 15 May and 15 December 2013. Andra then had three months to decide on its next course of action and to submit proposals to the Government to meet the expectations that had emerged from the debate.

ACTION TAKEN BY ANDRA REGARDING THE CIGEO PROJECT FOLLOWING THE PUBLIC DEBATE

To guide development of the Cigeo project and submit proposals to the Government, Andra took into consideration the outcome of the public debate and the opinion of the Citizens' Panel, as well as the various opinions and recommendations received in 2013 from its French assessors, namely the Nuclear Safety Authority (ASN), the Institute for Radiological Protection and Nuclear Safety (IRSN), and the National Assessment Board (CNE), and from the French Environmental Authority and the High Committee for Transparency and Information on Nuclear Safety (HCTISN).

Four changes have been proposed:

1. Integration of a pilot industrial phase in the facility startup process: Conducted under real operating conditions, the pilot industrial phase sets out to test all disposal facility features: technical devices and systems deployed to control operating risks, the ability to remove waste packages from the facility, repository monitoring sensors and systems, techniques for sealing cells and drifts, etc.

The transition to normal operating conditions at Cigeo will take place once Andra has assessed the outcome of the pilot industrial phase.

2. Preparation of a regularly reviewed master plan for facility operation: Andra proposes to implement a master plan for facility operation, prepared in cooperation with stakeholders. Approved by the Government and reviewed regularly, the plan would serve as an operational guideline throughout the lifetime of the facility.

3. Schedule adjustment: Andra has decided to apply for the Cigeo construction licence in two steps.

- In 2015, it will submit the disposal facility operational master plan to the Government and send the safety options report and retrievability technical options report to the Nuclear Safety Authority (ASN).
- Andra will finalise the construction licence application at the end of 2017, based on the above items and the basic design package, with a view to obtaining the construction licence by 2020.

Subject to obtaining the necessary licences, disposal facility construction could begin in 2020, with startup of the pilot industrial phase scheduled for 2025.

4. Involvement of civil society in the project: To stimulate civil society's participation in the Cigeo project decision-making process, Andra has decided to take several measures: firstly, lead consensus-building action to prepare and review a Cigeo operational master plan; secondly, contribute to the development of multidisciplinary expertise on radioactive waste management; thirdly, study ways to launch the Perennial Observatory of the Environment; and lastly, create a multidisciplinary committee to advise Andra on how to encompass societal issues within its activities.

The French Parliament will be called on to define the conditions of waste disposal reversibility. To meet these requirements, Andra has chosen a staged approach that will allow future generations to act on the disposal process by making it possible to retrieve waste packages throughout the 100-year period of disposal facility operation, if they so choose.

Lastly, Andra has made three commitments that will shape future project development: guarantee disposal facility safety, which must remain an absolute priority; preserve and develop the host community in close cooperation with local actors; and control disposal costs without compromising safety and security.

Details of these further actions were published on 6 May 2014 in a descriptive document [8].

CHANGES IN MAIN TECHNICAL CHOICES

Meanwhile, the Cigeo industrial project has been making headway. After producing the first industrial sketches, Andra launched a scientific and technical review phase with the primary purpose of optimisation before beginning the detailed design phase.

The initial sketches of the industrial project were produced starting in 2012 and have served as the reference for all studies since. Figure 1 is a general sketch of the project at its current stage.

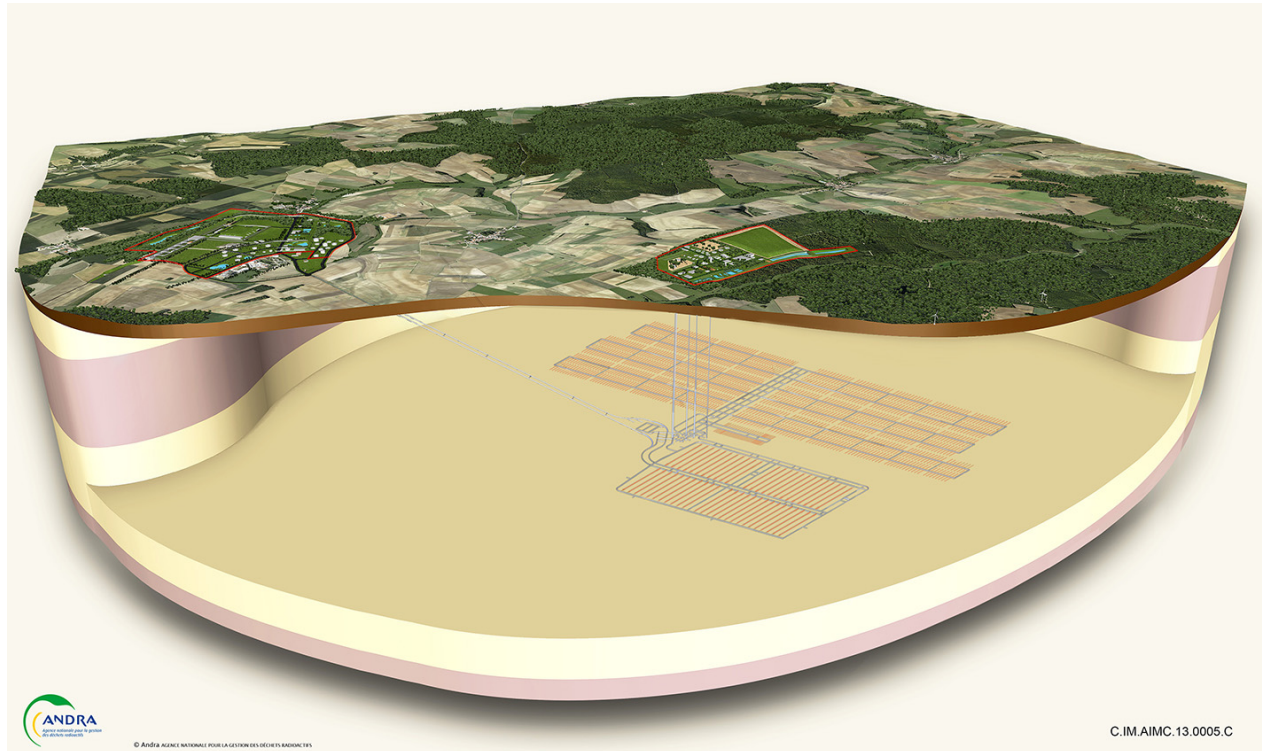


Fig. 1. General sketch of the Cigeo project

The Cigeo geological waste disposal facility will be located in the Callovo-Oxfordian argillaceous formation some 500 m below the surface and covers an area of about 15 km². The most compact area is designed to accommodate 100,000 m³ of non-exothermal waste packages. The most extensive area will house roughly 10,000 m³ of vitrified waste, which is not only highly radioactive but also gives off heat.

There will be two surface facilities. The first, located above the underground facilities, will be a non-nuclear site. It will be used to transfer personnel to and from the surface and for bringing up excavated rock. Transfers will be carried out via vertical shafts. The second surface facility will be designed to handle nuclear material. It will be used to receive, inspect and prepare waste packages before they are transferred to the disposal facility below ground. These operations will be largely automated, including the transfer of packages below ground and their emplacement inside the disposal facility. Transfer to and from the surface will be made via a 5 km long ramp.

The layout of the surface facilities was part of an interesting consensus-building process with local representatives and was decided upon at the end of the public debate.

After examining the documents available at the Cigeo preliminary design phase, Andra made its detailed choices regarding the next action to be taken, possible opportunities and sensitivity studies to be carried out prior to the basic design phase, which will serve in particular to prepare the facility construction licence application, now scheduled for completion in 2017.

The first goal of optimisation was achieved through detailed work with radioactive waste producers to define the timeline for waste deliveries and emplacement in the disposal facility. Spreading deliveries of

intermediate level waste over a period of 70 rather than 60 years reduces the maximum number of packages delivered per year from 5,500 to 3,000. The package receiving, inspection and disposal facilities will thus be smaller than shown in the initial sketches and, more importantly, the number of inspection and packaging lines can be reduced. This will lead to a gain of roughly 35% in civil engineering activities. In light of knowledge concerning the mechanical aspects of the argillaceous formation and a review of its thermal-hydraulic characteristics, the overall architecture of underground facilities has been reconsidered. Figure 2 shows the updated configuration.

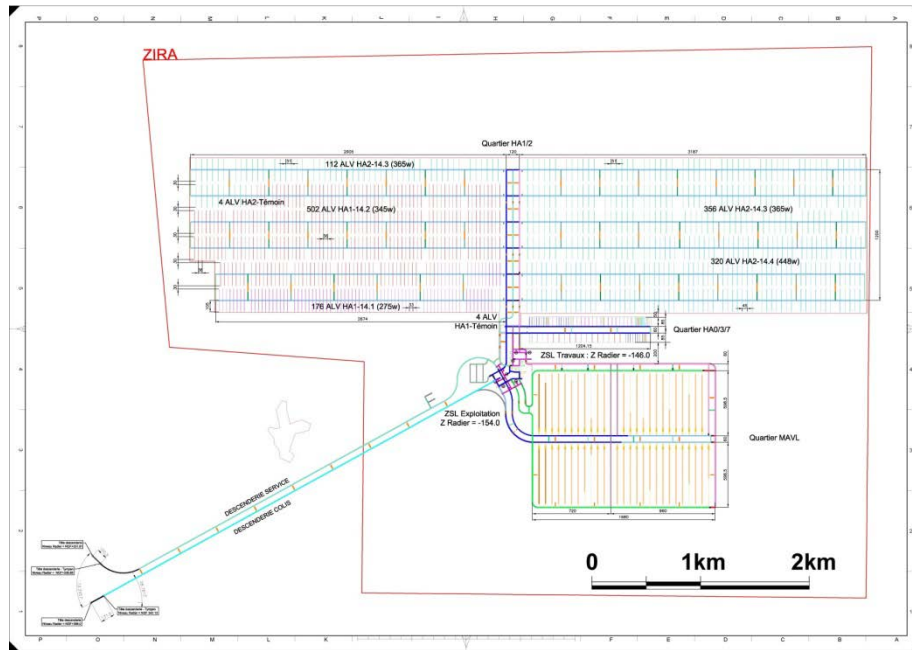


Fig. 2. Update of the overall architecture of underground facilities

The total area occupied has been optimised in spite of exothermal packages being spaced further apart. On completion, five shafts representing a total length of 2.6 km will be sunk. In all, there will be 114 km of drifts excavated and 154 km of disposal cells for exothermal packages. The drift support system has been improved through the use of compressible materials incorporated in (or attached to) the concrete lining, and by eliminating certain drift intersections through a better arrangement of air filtering units on the return circuits.

The standard disposal cells for intermediate-level long-lived waste will be 500 m in length, with a 65 m² cross-section. This provides enough flexibility to handle various package configurations. An alternative 110 m² cross-section is also being studied. Regarding the disposal of exothermal waste, technological developments in recent years now make it possible to consider disposal cells up to 100 m in length. New avenues of optimisation are being explored, aiming at a target of 150 m.

Waste packages will be transferred to and from the surface by a funicular railway. This means that drive machinery can be installed on the surface, thus reducing the risk of fire underground. Detailed studies are now underway for its detailed design.

The various technical choices made have a direct impact on the cost of disposal. Methods have been developed for costing purposes and information will be published by the Ministry of Energy following the necessary reviews.

CONCLUSION

The Cigéo project is rapidly moving towards industrialization. The opinions of the public and stakeholders have enriched the project, particularly in governance that will be needed during the 120 years of operation.

It is important that the proposed mechanisms may, at the outset, allow good collective ownership of issues and responsibilities.

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