

Lessons Learnt from the 15 years Experience of the French Case in the field of HLLL Waste

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ABSTRACT

Year 2006 has been marked in France by the vote in the Parliament of the Planning Act of 28 June, 2006, concerning the sustainable management of radioactive materials and waste. This vote was the achievement of a 15 years research programme performed as required by the previous Research Law of 1991, also known as the Bataille Law, from the name of Christian Bataille, MP, who drafted it and monitored its enforcement as a member of the Parliamentary Office for Scientific and Technological Assessment (*Office Parlementaire d'Évaluation des Choix Scientifiques et Techniques* – OPECST). At that time a stepwise approach to siting was introduced in the process. It included the study of several alternatives to the geological disposal of long lived high level radioactive waste. Those alternatives have been thoroughly studied and assessed before the Government decided to submit the bill to the Parliament. Experience has been gained not only on the scientific and technical aspects, but also in the field of decision making process, also called now governance.

However, not only the results of the research programme were decisive in preparing the bill, but also of major importance were the industrial experience of Andra and the rigorous programme management along all those years. Main lessons learnt from the experience are given in this paper.

INTRODUCTION

Andra's history began in 1969 with the implementation of its first radioactive waste disposal facility, the Centre de Stockage de la Manche (CSM). More than 520,000 m³ of low-level and intermediate-level short-lived radioactive waste were disposed of at CSM between 1969 and 1994. A second facility took over from CSM soon in 1992; the Centre de stockage de l'Aube (CSA) was build and commissioned for the same waste categories at Soulaines, Aube. A large number of lessons were drawn from the first experiment in the field of site selection, implementation, design and operation. The new facility took advantage of the previous experience and initial weaknesses were corrected for the CSA's sake. The first point deals with the selection of a suitable site. All initial disposal operations at the CSM were essentially justified by the proximity of waste-generating facilities.

During the same period, the question for intermediate and high level long-lived radioactive waste was also of concern. It was raised in all nuclear power generating countries, and despite several attempts to install a geological disposal, no solution could be found. Same situation was evolving in France, with the attempt at the end of the 80s to survey 4 different rock types. From that time, a long work has been performed, overcoming successive stakes and bringing answers to all types of questions dealing with high level long lived radioactive waste disposal in a geological formation.

RESEARCH CONTEXT IN 1989

When new studies were launched in 1989 with the perspective to implement underground research laboratories prior to constructing a deep geological disposal, they were met with an opposition movement that was sometimes violent. Acceptance which was previously found for the low level activity surface land disposal was at that time not met. However, the conditions were quite different. A broad research programme had been initiated without any prior information in order to study disposal options for high-

level and long-lived radioactive waste. Doubts were raised and opposition developed due to the lack of information, thus leaving the field open to all sorts of interpretations and fears. Apart from the lack of information, the situation worsened due to the ignorance surrounding the issue. Until then, the only issue to be addressed had been low-level and intermediate-level waste, whose half-lives lie within the order of 30 years, a historical timescale that everybody is able to grasp. All of a sudden, though, citizens were requested to change their reference timescale and to jump to one million years, a timescale with which geologists may be familiar, but totally out of the boundaries of a layman's imagination. In addition, since people had just lived the Chernobyl catastrophe, it is easy to understand that they would associate it readily with the disposal of radioactive waste generated by nuclear power plants, which was now at stake, and increase their own anxiety.

Within such a context, the Prime Minister declared a moratorium that led to the adoption of the Law of 30 December 1991 in which the following innovating approaches were prescribed:

- a stepwise decision-making process; the first period of 15 years will be time for research, to improve the general knowledge, to gather all arguments for the respective solutions and to prepare a well documented decision for the future;
- the study of alternative solutions; whereas the geological disposal is shown by the engineers and technicians as the best and exclusive way to manage high-level long lived radioactive waste, the society, through its elected people, prefer to explore all possible ways of management before making a decision for the long and very long term. Along with geological studies for disposal, partitioning and transmutation has also to be studied in order to assess any possibility of reducing radioactivity and lifetime of the waste. Long term storage, as a waiting alternative for further research results has also to be investigated;
- in the framework of the stepwise approach, research for geological disposal would be conducted from underground laboratories which will be constructed on volunteer sites;
- as an alternative to the geological disposal, understood at that time as a "dump" to be forgotten as soon as it is closed, a reversible as well as non reversible design must be studied;
- independent assessment; previously under an exclusive control of technicians from the nuclear industry, again the society through its elected people want to understand the matter and to take part to any decision which concerns not only specialists but also the overall society. A National Assessment Commission is launched with scientists from different fields. Its role is to monitor and assess research programmes and results for high level and long lived radioactive waste. One of the interesting points to underline is the mission given to the Commission, and the way it reports to the Parliament and the Government. There is a clear demand from politicians to get clear and understandable information from the scientists and technicians. In fact one of the implicit role of the Commission has been to express results from research into operational decision arguments to be handled by the Parliament and the Government;
- information; the first lesson learnt from the failure in organizing field geological studies was that nothing would be possible without information of the local people. Thus, information will become not only one of the missions given to Andra, but is also organized. A Local Committee of Information and Follow-up is installed on each site where an underground research laboratory is to be built;
- the independence of the agency responsible for radioactive-waste management in relation to waste producers; previously Agency of the French Atomic Energy Commission, Andra becomes an Agency reporting to three ministries, those in charge of the industry, the environment and research.

MAIN STEPS AND ACHIEVEMENTS SINCE 1991

Soon after the adoption of the Law and the corresponding decree, the government entrusted upon Mr Christian Bataille, MP, to organise a public consultation with a view to seeking potential implementation sites for underground research laboratories (URL). In the meantime, however, the situation had changed drastically, since the information mission was now given to a Member of Parliament, detailed monitoring and control conditions were prescribed and financial-incentive modalities were clearly defined. In 1993, four candidate sites were selected among approximately 30 voluntary applications: a granite site under a sedimentary cover located in the Vienne; a deep marl site located in the Gard close to the Rhône River, as well as two sites located in Callovo-Oxfordian argillites, one in the Meuse and the other in the Haute-Marne. Those two last sites were rapidly combined to form the Meuse/Haute-Marne Site.

Detailed investigations were launched as early as 1994. At this stage they were limited to the form of surface boreholes and in geophysical-measurement campaigns. Concurrently, local information and oversight committees (*Commission Locale d'Information et de Suivi – CLIS*) and incentive funds were set in place. Based on the conclusions of its studies, Andra submitted three applications to license the implementation of URLs on the Vienne, Gard and Meuse/Haute-Marne Sites. In 1997, the applications were the subject of public inquiries. Relevant territorial communities were called upon to express their views and confirmed their willingness and, consequently, their agreement to host such URLs (figure 1).

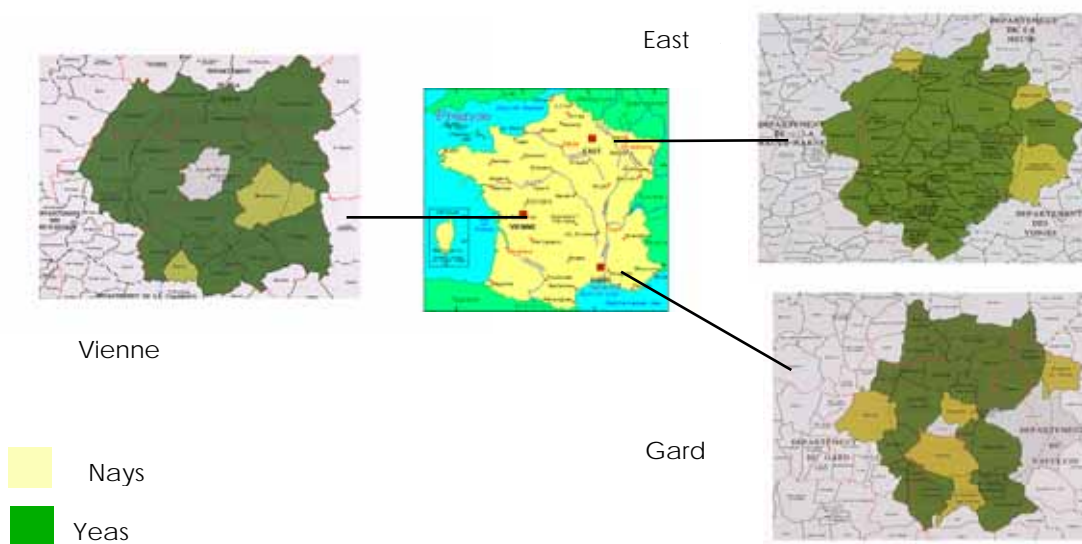


Fig. 1. Vote results of the territorial communities in 1997 concerning three sites: Vienne, East (Meuse/Haute-Marne) and Gard Sites.

The government's decision following the review of the applications by the competent services confirmed the continuation of operations in the Meuse/Haute-Marne with the creation of a URL in Bure. On the other hand, both the Gard and Vienne Sites were abandoned. The first one because a site was already decided in a clay formation which was well known, in East of France, on the Meuse/Haute-Marne, the second because of its limited size which would never be enough for a disposal. The last one was also considered more difficult to study and to demonstrate the safety of a disposal facility due to the sedimentary cover. In parallel, the government set in place a research mission in order to find a new granite site with a better configuration. However, the project was not met with any local support despite

the efforts devoted, with 3 high level state representatives especially committed for that purpose. Finally the project was terminated in 1999 following numerous opposition movements.

In the meantime, the preliminary work started for the construction of the Meuse/Haute-Marne URL. The construction phase and the first experiments took place from 2001. The research programme clearly indicated that all it would begin from the first stages of the shaft sinking. All the geological information was recorded and soon in 2004 the first experiments were performed from a drift at -445m in the argillite formation. Shaft sinking was then followed in the said formation, with a thorough monitoring from a series of boreholes drilled in the drift. Final target was reached at -490m and connection between the main shaft and the auxiliary shaft was achieved by mid December 2005. During all this time a very intensive experimental work was performed, and the accumulated information served as the basis for the *Dossier 2005 Argile*. It was submitted to the government in mid-2005, with additional information from experiments in December.

The scientific and regulatory assessments of the *Dossier* were entrusted to the National Review Board (*Commission Nationale d'Évaluation – CNE*) and the Nuclear Safety Authority, respectively. In spite of the many reviews performed during preparation of Dossier 2005, and especially of the review by Andra's Scientific Board, it also appeared at that time useful to have another external view by experts. The French government requested that an international peer review be carried out under the aegis of the OECD Nuclear Energy Agency (NEA). The resulting opinions were quite remarkable and very encouraging for Andra and for its scientific and technical partners, thus emphasising the quality of the work undertaken according to the best international standards and concluding to the feasibility of a deep geological repository.

The government also wished that a national debate be organised concerning the long-term management of radioactive waste. Consequently, it called upon an independent entity, the National Commission on Public Debate (*Commission Nationale du Débat Public – CNDP*). After six months of preparation, the debate included 13 meetings that were held in different cities from September 2005 to January 2006. Scientific and technical themes, management strategies and governance were discussed at length. In its final report, the Commission stressed the existence of a general demand for:

- all waste categories to be taken into account by the legislation;
- the need to improve governance regarding radioactive-waste management;
- the advantages of a stepwise decision-making process;
- and the need for a true economic-incentive programme for the territories on which any deep geological repository would be implemented.

Lastly, the report of the OPECST, published in March 2005 by Messrs Birraux and Bataille, MPs, analysed the results of investigations from the standpoint of management strategies. It concluded to the complementarity of the three research areas prescribed by the Law of 30 December 1991: partitioning and transmutation, deep geological disposal and long-term storage. The first way can be developed for future power generation, in order to reduce the amount of the resulting radioactive waste. The second way is confirmed as giving the best guaranty for safety, especially on the long term. Finally, the third one also needs to be further developed for those wastes pending either for further treatment or for geological disposal.

THE 28 JUNE 2006 PLANNING ACT

Finally, the 15 years research completes with the submission to the Parliament of a new bill. It takes account of the results from research as well as from the different bodies involved in the assessment and from the Public Debate. The new act was definitely voted by the Parliament on June 15th and published on the June 28th, 2006. The Planning Act n° 2006-739, labeled a planning act concerning the sustainable management of radioactive materials and waste, defines a number of principles and strategic orientations for the implementation of a repository. It also sets guidelines for the procedure leading to a license

application. It delegates specific research and development responsibilities to Andra, and ensures adequate funding will be available for Andra to act upon its responsibilities.

According to the Planning Act, a national management plan for radioactive materials and waste must be updated every three years and presented before Parliament. Its purpose is to have a periodic clear review about the types, amounts and locations of radioactive wastes and to settle the ways which are under consideration for their management. Guiding principles of this plan are that:

- the quantity and toxicity of waste must be reduced, notably by processing or conditioning spent fuel and radioactive waste;
- radioactive materials and waste pending reprocessing or disposal must be stored in dedicated facilities;
- after storage, any ultimate radioactive waste that is unsuitable for disposal in surface or near surface facilities must be disposed of in a deep geological repository.

Investigations and studies pertaining to partitioning/transmutation are to be pursued within the framework of the Generation-IV Program. The former two orientations are to be further developed by Andra. The main decision in the Act is that a reversible repository in a deep geologic formation must be further studied, with the objective of a site selection and a license application for construction in 2015. Operation of the deep geological disposal is targeted for 2025. Application of a license will be preceded by a Public Debate, based on the submission by Andra of a dedicated report, including sufficiently detailed repository design elements and describing the overall safety approach and underlying study results. Only a license application adequately demonstrating reversibility of at least one century will be accepted.

In the field of the scientific control, the role and the independence of the CNE have been reaffirmed, and its scope extended to social sciences.

The Local Information Commission (*Commission Locale d'Information – CLI*) is now entrusted with an expanded mission and is allocated with secure funds. It will be headed by a member designated by the President of the General Council of the department where the main access to the underground laboratory is located.

A detailed process of decision making to implement any final repository has been defined, including all regulatory reviews, a public debate and inquiry to be organised, and consultations with the various communities involved.

Funding for research and local development is covered by two new taxes. Lastly, waste producers are called upon to anticipate special funds for the future dismantling of their facilities and for the management of their radioactive waste through secured assets. Industrialists have to assess the relevant charges, constitute provisions and allocate assets with the corresponding security and liquidity level. Assets are controlled and locked by public authorities in order to finance the charges, and nobody can be allowed to use them for any other purpose.

LESSONS LEARNT

The first lesson learnt from the recent 15 years experience is that as far as decisions are not understood, any implementation remains impossible. In 1989, and again at a less extent in 1999, it was felt that the best science and knowledge could be enough to make a decision. In the field of radioactive waste management as well as in many other fields related to the environment, there is a legitimate social demand. The public is anxious of its environment and the quality of life it can offer. One of the ways to see and to ease is to participate to any decision process, and to feel involved in it. It is not reasonable to ask everybody becoming a scientist or a civil engineer, specialized in the radioactive waste disposal design and operation. However it is important to give the public clear and understandable information, as well as means to verify and assess studies and projects. In a democracy, each one has a position to satisfy and a type of responsibility to assume.

The Planning Act of 2006, as well as the 1991 Law, has defined places for the stakeholders to meet and to participate to the development of a geological repository.

The Local Commission Information gathers representatives of the local bodies. It fulfils a general follow-up, information and consultation mission with regard to research on the management of radioactive waste and, in particular, on the deep geological disposal of that waste. The Commission includes State representatives, two members of Parliament and two senators appointed by their respective assemblies, elected officials from the territorial communities consulted during the public inquiry or concerned by the preparatory research work for the deep geological repository, as well as representatives from environmental-protection associations, farmers' unions, professional organisations, representative labour unions of workers and medical professions, and qualified personalities, together with the holder of the authorisation for the creation of the deep geological repository.

On the aspect of the local development, stakeholders have also a place where they can participate to the local life linked to the implementation of the repository. In any department where the perimeter of a deep geological repository is located, a public interest group is constituted. Its missions are to manage any equipment designed to favour or facilitate the implementation and operation of the underground laboratory or repository, to perform regional or economic development actions, to support training initiatives. Also among its missions are the support to actions relating to the development, processing and diffusion of scientific and technological knowledge, notably in the fields investigated within the underground laboratory and in the framework of new energy technologies. All relevant regions, departments, communes or groups located within the proximity zone of the main access shaft of the repository shall bear the right to adhere to the public interest group. The public-interest group benefits from part of the income resulting from one of the 2 new taxes, known as the "support tax".

The expectation of information is fulfilled by the action of the local groups and committees. It is mainly fed by the reports and editions from Andra. As performed during the 15 years research period, information is also one of the missions of the Agency which is responsible for conducting operations relating to the long-term management of radioactive waste, such as:

- to establish, to update every three years and to publish the inventory and location of all radioactive materials and waste present in France;
- to make available to the public relevant information concerning the management of radioactive waste and to participate in the dissemination of scientific and technological culture in that field;
- to disseminate its know-how in foreign countries.

During those past 15 years, the major stake has been to gain confidence. Communication and information has played an important role in supporting the research programme of Andra. However communication only makes sense if related to a high quality work and to a strict project management, complying with stable rules, defined and agreed from the beginning of the process. If those basic rules are not satisfied, doubt is introduced, mistrust is increased, and as a result there is a total loss of confidence for the project. Information and communication is a daily effort, with all the people involved in the development of the deep geological repository. Based on reliable and verified information, it uses all types of media. One of the basic principles of the policy of communication with the media and all stakeholders is to give answer to all requests: "*No question can remain without answer*". The consequence of such a policy is the need of a rigorous management of the answers, because when it is not possible to directly answer to the question, it must be notified that it has been considered, it is handled, and that the answer will be forwarded at a given deadline. Then, the deadline must be satisfied.

A second rule of the policy of communication is that it must be understood. Especially in the complicated scientific area of the geological disposal, a sustained effort is asked to the scientific and technical teams to express their results in a clear and simple way for the different categories of the public. Scientific and technical specialists will always say that it is difficult because things are always more complicated than

expressed. However it is the role of communicating people helping them to express complicated ideas in a way which can be understood by the various publics.

The targets of the information can be different types of publics. The local public is the first concerned group as they are or will be faced to new installations, with all the discomfort which can accompany the building and operation phase, and all the risk associated with the radioactive waste. Efforts from the operator must be organized in order to avoid those discomforts and to decrease the risk at a level which cannot be differentiated from the natural background. At the national level, the interest of the decision makers is connected with other stakes, mainly on the safe management of the waste produced by the backend of the radioactive fuel cycle and the perspective of demonstrating that nuclear energy is well controlled from cradle to grave, thus allowing for the implementation of new nuclear power plants. Modes of communication used are classical:

- Availability of free documents and reports, which can also be ordered on the website www.andra.fr;
- Real time access to the information on the website;
- Information of all stakeholders, including the general public, at both the local level and the national levels;
- Visits of the LLW disposal facilities and at the Meuse/Haute-Marne URL. Visits of the sites give an illustration of the quality of work and conditions on how safety is achieved.

CONCLUSION

Lessons learnt from the experience have led to build a full set of rules and approaches to build confidence, taking care to never compromise it through non wished events.

Certainly the national waste inventory has played an important role in confidence building. An open and updated radioactive waste inventory, with their location, has been published for the first time in 1995. It also includes waste from defence activities, which improves confidence for Andra as well as for the National Policy of radioactive waste management.

Critical independent and published reviews, the last one having been performed under the aegis of the OECD Nuclear Energy Agency, give credit to the scientific findings. About this question, the role of the National Review Board has been very important. It could behave as the caution for the Government and for all the politicians that high level science was developed and used in the framework of the deep geological disposal projects. Andra put all its results on the table, in a very clear manner, each time identifying and managing remaining uncertainties and explaining how those uncertainties could be handled, either through modelling and additional R&D programmes.

Clear and understandable 'scientific and technical information' is delivered to local as well as national politicians and to all types of publics. Free documents are made available and are also sent upon request. URL experiments and demonstrators: performing experiments with various well known laboratories and publishing results, showing models, mock-ups and demonstrators contribute to realize things and are not only part of the research programmes but also feed communication.

Confidence was also reinforced by a strict project management and on time deliveries all over the period. The quality of work attested by ISO 9000 and 14000 series certifications have also contributed to the success of the first 15 years step. Now Andra is faced to new challenges with a first a license application to be submitted before 2015.