

The First International Decennial Appraisal of the Detailed Memory of the Manche Disposal Facility – 14470

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ABSTRACT

In 2009, during the decennial review of the safety report of the Manche disposal facility (CSM), the Nuclear Safety Authority (ASN) wondered if the provisions for memory preservation would be sufficient for the needs of future generations over 3 centuries (which is the specified duration according to the regulation). As there is no available convincing feedback on this subject, Andra organized the first international decennial appraisal of the CSM in September 2012. Experts from European counterparts, retired persons as well as members of NGOs and local representatives proposed by the local oversight committee participated in this appraisal. The appraisal process was based on a role playing game simulating “future memory needs”. The scenarios placed the participants in a somewhat far future, in 2262, and they had access to a « numerical image » of the “Detailed Memory” archives (more than 60 meters of archive boxes, several thousands of plans related to the CSM site). They were helped by summary documents. Information available on the origin and nature of CSM varied according to the scenarios. They had to answer practical and plausible questions which had been envisioned when the first set of Detailed Memory had been constituted (1995-2000). This appraisal provided fruitful comments and suggestions, which are being taken into account for the upgrading of the memory and knowledge preservation provisions of the CSM. Experts emphasized the need for renewing such appraisal on a periodical basis. This could build a kind of local ritual contributing to memory preservation.

INTRODUCTION

In France, for every nuclear facility, a review of the safety assessment report has to be performed periodically, on a 10-year basis. During the surveillance period of a radioactive waste repository, this process continues. During the 2009 review of the safety report of the Manche disposal facility (CSM), the Nuclear Safety Authority (ASN) wondered if the provisions for memory and knowledge preservation would be sufficient for the needs of future generations over 3 centuries (which is the specified oversight duration according to the regulation).

Provisions for memory and knowledge preservation of the CSM include a set of documents (long-term archives), called “Detailed Memory”, referring to the repository.

As there is no available convincing feedback on this subject, Andra organized an international appraisal of the Detailed Memory of the CSM in September 2012.

BACKGROUND: DEVELOPING A SOLUTION FOR MEMORY AND KNOWLEDGE PRESERVATION FOR THE CSM

What is required by the Safety Authority?

The French Nuclear Safety Authority, ASN, requires that memory regarding the repository be preserved for at least 3 centuries, corresponding to the oversight period. This requirement relates to the existence of the repository and its content. A complementary objective is to provide knowledge in order to (i) understand how the repository was implemented and what is happening on the site, (ii) correct possible unwanted events or (iii) transform the site if desired.

Looking for a solution

To achieve these goals, when preparing the closure of the CSM, Andra performed during the 1990's an extensive search for a solution. The first track investigated, at the beginning of the 1990's, concerned digital archiving, which was thought to provide large possibilities, e.g. in terms of efficient access to relevant information. But demonstrating durability of digital information over 3 centuries, and obtaining a technical commitment from providers, turned out to be impossible. So after 5 years of efforts, Andra decided to go back to "classical archiving", with the help of "Archives de France", the French national archive institution, who provided fruitful advice. This initial misdirection resulted not only in a loss of time and money, it occurred at the time the repository was being closed and workers leaving, taking with them the non-written memory of the repository.

After this search for a technical solution, the documentary base had to be restructured. This was achieved in two phases.

First phase of implementation of the solution: «historical reconstruction »

The first phase of implementation of the solution dealt with the reconstruction of historical data on the first period of the repository operating phase.

During this period (1969/1984) the safety rules have been stabilized. At the very beginning of this period, waste packages were deposited in trenches directly in the ground. This rapidly showed to be not compatible with industrial operation (see Figure 1, left), and it was decided to retrieve the disposed waste. After retrieval, waste were sorted and repackaged. Some wastes were sent back to the waste producer, the CEA (Commissariat à l'Energie Atomique), the others were deposited in tumulus or in concrete trenches.

During part of this period, in the very first years, part of the waste was received without inventory. Knowledge on the waste content had thus to be built a posteriori. This was done through an investigation work and through modeling. Historical data were collected with operators of activities producing the waste, in the various nuclear workshops. Then, radioactive spectra of possible waste were inferred for each of these activities. Finally, waste inventory was reconstructed, residual uncertainties being covered by safety margins. Around 20 000 hours were spent in reconstructing these data.

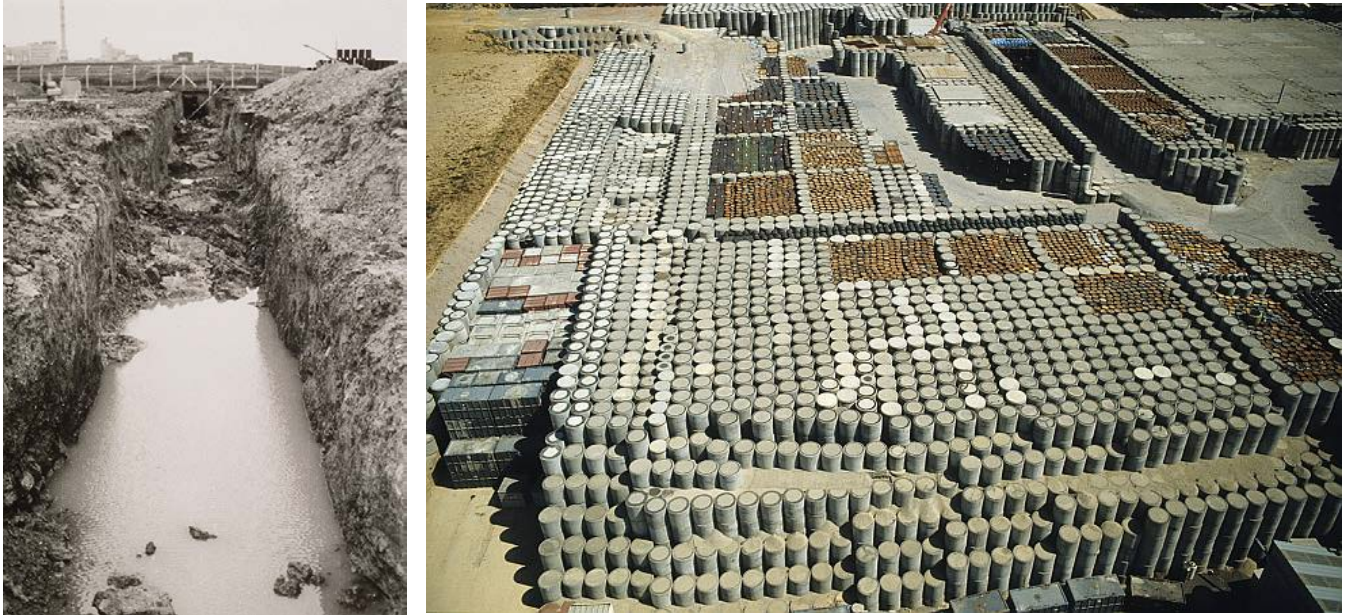


Fig.1: Initial trench (left), tumulus (right)

Second phase: selection / incorporation

The second phase of implementation of the solution dealt with identification of needs, through a risk approach, consistent with long term safety analysis. This was followed by the selection of relevant information and knowledge necessary for addressing the needs, which was performed with the help of retired people from Andra. Then collected information was hierarchized, according to a tree structure. Work was conducted to enhance legibility of information: a glossary was created, acronyms explained, an abstract was written for each archive box.

To allow durability of the physical support, all documents were duplicated on permanent paper, according to the international standards (ISO 9706 and 11108).

The memory and knowledge solution finally developed for the CSM

The complete solution is formed by two types of provisions: “passive” and “active” provisions. Passive provisions comprise three archives provisions: (i) the “Detailed Memory”, set of more than 10 000 documents, enriched with a complementary set every five years (surveillance data); (ii) the “Summary Memory”, one single volume describing in widely understandable terms the repository, its history, its inventory; (iii) public utility easements, reported in documents restricting future uses of the site. The Detailed Memory is copied in two sets; one is kept at Andra, the second is transferred to the national Archives. The Summary Memory is written for decision makers and for the public. When stabilized, it will be distributed in large number of copies, maybe thousands: one copy per decision maker (mayor, notary ...), one per audience (NGO...) and one per organization or state agency. The diffusion of the public utility easements will be instituted by a ministerial decree.

Active provisions consist in communication activities, vis-à-vis two types of audiences: (i) institutional partners, such as the Safety Authority (ASN), the local oversight committee (CLI), (ii) the public in general.

What is “permanent paper”?

Until the middle of the 19th century, paper was made out of rag. At the beginning of the industrial revolution, its composition was modified by the massive use of wood pulp and rosin during the sizing stage. Those components produced an acid that generated the self-destruction of paper within a few decades.

Consequently, the need to manufacture a special paper for long-preservation purposes became obvious. During the 1950s, papermakers in Great Britain, followed by their counterparts in the United States, started to produce such a paper, although no specific rules existed in the field. The very first standard defining the nature of “permanent” paper was issued in the United States in 1975 (ANSI Z39-48), before the publication of two international standards in 1994 (ISO 9706: Permanence Requirements¹, updated in 1998) and 1996 (ISO 11108: Durability Requirements¹), respectively. Those standards integrate more than a century’s experience feedback from the major international archive systems.

The main features of “permanent” paper include: no mechanical wood pulp, no recycled paper, no composite material and no wood pulp mix in the manufacturing process; minimum alkali reserve of 2 % in calcium carbonate generating a relatively basic pH² (from 7.5 to 8.5); Kappa number³ under 5; tearing strength above 350 MN for common gram (80 g/m²).

METHOD USED FOR THE INTERNATIONAL APPRAISAL

To address the issue raised by the Safety Authority, Andra organized in 2012 an international appraisal. The main appraisal, in September, involved in-company expertise as well as national and international experts or local stakeholders. It concentrated on the Detailed Memory. Experts from European counterparts, retired persons as well as members of NGOs and local representatives proposed by the local oversight committee participated in this assessment exercise.

The appraisal process was prepared by internal exercises in January 2012 with former CSM workers and new Andra employees. It was based on a role-playing game simulating “future memory needs”. The scenarios placed the participants in a somewhat far future, in 2262 (that is, 259 years after the beginning of the surveillance period), and they had access to records (the Detailed Memory) related to the CSM site. Information available on the origin and nature of CSM varied according to the scenarios. Participants were asked to imagine that they are facing a green hill (the closed repository) which could be similar to the hillock showed in Figure 2, and have to answer a set of questions. These questions were elaborated on the basis of the plausible evolution scenarios defined when the first set of Detailed Memory had been constituted (1995-2000).

¹ Permanence: Ability to remain chemically and physically stable over time.

Durability: Ability to withstand normal wear, especially due to manipulations.

² Measurements for pH range from 0 to 14, with 7 indicating a neutral ph. From 0 to 6, paper is acidic, and from 8 to 14, paper is basic or alkaline. In general, common white paper is rather acidic due to the bleaching process involved.

³ Assessment of oxidation resistance due to the presence of lignin: The lower the Kappa number, the clearer the paper remains naturally. Common paper made with wood pulp normally has a Kappa number varying between 25 and 50, before bleaching.



Fig. 2: Hillock shown to the participants of the appraisal (potential aspect of the Manche repository in 2262)

Questions Asked to the Participants

The questions had been established in connection with the safety assessment scenarios. They dealt with:

- General understanding of the site and knowledge on the components of the repository (disposal structures, waste packages, etc.)
- Environmental pollution issues, by radionuclides or toxic chemicals (e.g. how can the presence of ^{36}Cl or Hg in the neighborhood be explained?)
- Intervention modalities above or inside the site (e.g. cover repairs, archeological excavations).

Information provided to the participants

The experts had access to a « numerical image » of the Detailed Memory archives (more than 60 meters of archive boxes, several thousands of plans). This simulates a future situation where there is no computer and where the repository operator no longer exists, which requires searching information directly from paper documents (the Detailed Memory) found on the repository site, while facilitating the practical aspects and limiting the time required for searching information (the only search engine was xls files). The participants worked alone or in pairs, each group (single person or pair) had to answer a part of the set of questions, and was given 1 hour 1/2 to 2 hours per question. Each question was allocated to at least two different groups. The whole exercise lasted two days.

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Experts had a few guiding tools to get through these thousands of pdf documents:

- The Summary Memory, which in 2262 would have been distributed on a large scale (local, national and international);
- All the guides and search lists elaborated when constituting the successive complementary sets of the Detailed Memory (2004, 2005 and 2010).

Documenting the results

Searching operations have been traced in order to investigate the work of the experts (searching approach, problems encountered, etc.) and compare it to internal appraisal exercises. This was done by means of (i) reviewing each sequence including the answer found out, the list and the assessment of the consulted records, (ii) making a round at the end of the appraisal and (iii) reviewing the whole appraisal subsequently, by asking a written report to each external participant.

RESULTS

Lessons Learnt

During the appraisal, the Summary Memory showed to play a key role for getting into CSM history as well as into the Detailed Memory, as it is self-supporting and understandable by all public. This appraisal highlighted the importance and quality of the work performed over more than 15 years on memory preservation, which was quite a surprise for some of the participants, and the relevancy of such simulation exercise.

However, some difficulties were also encountered, and issues were raised, for example:

- Various search methodologies into the Detailed Memory have been established, corresponding to the various scenarios: lists, guides, etc. It was found out that instead of these methodologies, the Summary Memory was the most often used tool.
- It was also noted that the quality of answers depends on historical background: available information is very rich, and maybe oversized, when the question asked to the participants refers to a situation which occurred already several times during the operating phase. This may lead to the identification of different documents by different participants. In other cases, the available information is poorer, and was sometimes not found by the participants.
- For example, some first level documents, such as the Safety Report, were not used by people unfamiliar with nuclear activities, who were not aware of the importance of such documents.
- Similar procedures conducted by different persons, using the same keywords, led sometimes to different documents
- New needs were brought to light, for example the need for upgrading the environment evolution scenarios, namely on the toxic chemicals aspect.

First improvement suggestions

- Search methodology into the Detailed Memory

Updating and merging the various search methodologies is recommended. This work should be based on the simple and instinctive logic of the Summary Memory. This should lead to simplification and a better access to relevant information, providing in a single document the tools for guiding the search, according to various simple and instinctive logics: chronology, geography, context...This document would be updated every 5 years, corresponding to every complementary set of documents in the Detailed Memory.

- Detailed Memory structure and content

Concomitantly, work has to be performed to develop a new classification of the archives, consistent with this restructuring of the logic, in a comprehensive and sustainable perspective over the surveillance period (three centuries). First level documents will be emphasized. Various versions of the same document should be compared in order to select which is the most up-to-date.

Work will also be continued on checking the completeness of the archives, possibly leading to introducing records from external sources, and on assessing the relevance of the present selection of records. This will be performed not only in the framework of plausible events but also by considering the evolution of environmental protection issues, of societal expectations, or by anticipating events not considered during the initial safety assessment (where no existing archive is available). Work will also be devoted to introducing historical knowledge on the disposal process context.

- Ease of access for all types of audience

Access to the information provided in the Detailed Memory should be made easier, by adding pictures for example. To help solving understanding difficulties of non-experts, providing knowledge frameworks on specific subjects with a high scientific content (e.g. plutonium) is also envisioned.

CONCLUSIONS

This first international appraisal of the knowledge and memory provisions for the CSM proved to be very fruitful. Experts emphasized the need for renewing such appraisal on a periodical basis. Some experts expressed the wish to participate in a continuation of this exercise, even outside the periodical framework.

In the future, Andra propose that appraisals be organized regularly. This monitoring process, which will be associated to the decennial revisions of the safety case, will aim at periodically testing and upgrading the so-called “passive memory” provisions of the CSM. This could build a kind of local ritual contributing to memory preservation.

This process could be subject to validation reviews, outside of the decennial framework.

Suggested improvements are being implemented in the framework of the long-term memory preservation project of Andra [1].

REFERENCES

[1] The Long-Term Memory-Preservation Project of The French National Radioactive Waste Management Agency (Andra). F. Boissier, P. Charton, G. Martin

<http://www.andra.fr/international/download/andra-international-en/document/andra---long-term-memory-program.pdf>