PRESENT ISSUES FOR CENTRE DE LA MANCHE DISPOSAL FACILITY

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ABSTRACT

Centre de la Manche disposal facility officially entered its institutional control period in January 2003. Andra performs monitoring of the environment and of the capping system in order to prepare further phases that should become more and more passive. A detailed "long term memory" has been established in order to provide future generations with the relevant information about the facility.

1. Introduction

Centre de la Manche disposal facility is the first French radioactive waste surface disposal facility. It was operated between 1969 and 1994. 527,000 m^3 of packages of low and intermediate level short lived waste have been disposed in the 12 ha of the facility. To prepare its closure capping works were performed between 1991 and 1996, water tightness being provided by a bituminous membrane. The facility officially entered its institutional control period in January 2003.

Figure 1: Centre de la Manche disposal facility

The way the facility will be monitored will evolve in a step by step approach. An update of the safety report is required in January 2009 in order to take into account collected data from the environmental monitoring. The report should also include proposals for modifications of the facility, in particular the capping system, in order to make the monitoring more and more passive.

2. 25 years of operation and improvement of Centre de la Manche

During 25 years of operation of Centre de la Manche, continuous efforts were made to improve operating conditions of the facility . The design of Soulaines-Dhuys (Aube Prefecture) disposal facility that superseded to Centre de la Manche in 1992 and the way this facility is operated are the result of these permanent efforts to improve, in particular the design of the disposal structures and waste package specifications.

2.1 The design of the disposal structures

When the facility started up the only requirements by the 1969 Order of Creation of the facility were the followings:

- Direct disposal in the ground is authorised for waste that is conditioned in such a way that leaching by water does not induce any hazard (waste that is grouted in concrete or metallic drums);
- Low level waste in drums may be disposed in the ground provided that it is covered by a plastic and bitumen protection and that a drainage system is implemented at the bottom of the disposal cell;
- Intermediate level waste and bulk waste must be grouted in concrete disposal cells.

Figure 2: concrete disposal cells

Figure 3: disposal vaults with a steel reinforced concrete bottom slab

From this initial simple design improvements were made and resulted in two major changes:

- The fact that water going inside the disposal vault has to be considered as an effluent and to be clearly separated from rain water. Therefore a specific collecting system was implemented between 1979 and 1982 in an underground monitoring gallery;
- The inclusion of a steel reinforced concrete bottom slab that provides resistance to the burden of the disposed waste packages and that provides water-tightness in order to prevent infiltration of effluents in the water table. Therefore direct disposal in the ground was quickly abandoned.

These principles have been used since 1984 for the design of vaults. Effluents are transferred to AREVA's reprocessing plant close to Centre de la Manche.

2.2 Waste packages specifications

The Order of 1969 creating the facility was referring to the maximum concentration in drinking water to define the disposal modes, water being the main contamination vector. When operations started at the facility, there was practically no activity limit for the waste, except to define the packaging and disposal modes.

In 1984 Fundamental Safety Rule RFS I.2 formalised the incorporation of the long-term safety objectives into acceptance criteria. It took into account that, in the post-institutional control phase after no more than 300 years, the intrinsic safety of the disposal facility relied partly on the initial activity limitation in long-lived emitters of the disposed waste.

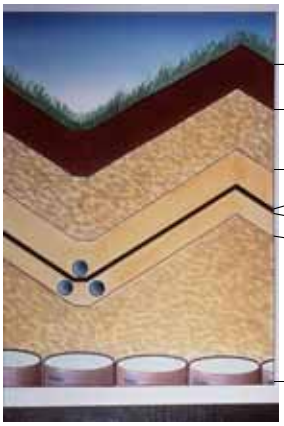
As a complement, Fundamental safety Rule RFS III.2e imposed systematic waste packaging and established minimal characteristics, particularly with regard to containment, with which packages must comply depending on the nature and activity of the waste. A minimum mechanical strength was required in order to integrate packages in the disposal architecture. Andra reflected all these requirements in its technical specifications in 1985.

2.3 The capping system of Centre de la Manche

Due to the changes in the design of vaults or in waste specifications, it was decided to implement a capping system that would be able to sustain strains that might be caused by settlement of waste packages in the eldest parts of the facility. Therefore a bituminous membrane was selected. Such a membrane, 5.6 mm thick, has good water tightness properties (significantly less than the target of a few litres per square meter and per year). Its maximum strain before failure under a tensile stress is 45 to 50%.

The "roof" of the capping system is made of successive tilted sectors of 25 meters with slopes between 6 and 14% above the repository. Because of the limited area of the facility, the slopes on the side are steeper (about 25°).

Different layers are implemented. In particular they include permeable levels under and above the membrane and coarse material (1.2 m) to protect the membrane against intrusion by animals or roots. Infiltrated water above and under the membrane is collected by drains and can be monitored.



MATERIAL	FUNCTION
Top soil	Evaporation
Coarse material (clayey sandstone)	Bio-intrusion barrier
Fine material (sand w/drains)	Drainage
Bituminous geomembrane	Watertightness
Fine material (Sand w/drains)	Drainage
Coarse material (clayey sandstone)	Support and slope

Figure 4: Typical cross section of the capping system

3. The institutional control period

3.1 Monitoring the capping system

Monitoring of the capping system is performed through 3 main undertakings:

- The surveillance of surface movements by periodic topographic measurements. These measurements actually show settlements on the "roof" in some places. A maximum displacement of 50 cm since 1996 is detected in one place.
  However other displacements are measured on the slopes of the capping system that correspond to the consolidation or slide of the covering material along the membrane. These movements are continuous with a velocity of 1 or 1.5 cm per year (3.5 cm per year in one sector).

- The monitoring of collected water in the different networks of the facility.
  Measurements since the beginning of capping works show that the collected volume of water from the vaults has been divided by 75 and its activity by 130 to 270. This volume should be reduced as some infiltrations that do not percolate through the vaults are detected in connecting pipes at the boundaries of the repository.
  The target value of infiltrated value is achieved: 0,08 l/m^2/year in drains under the membrane, 2 l/m^2/year from the vaults.

Effluents collected from vaults	1991	2005
Volume	21,000 m^3	280 m^3
Beta activity (but ^{3}H)	1.3 GBq	0.008 GBq
^{3}H activity	1,700 GBq	6.2 GBq
Alpha activity	0.4 GBq	0.003 GBq

Table 1: effluents collected from vaults

- Diagnostics of the membrane by periodical samplings every five to ten years. Two samples (2.5 m X 3 m) were taken in 1997 and two in 2005. Tests are performed on the membrane (thickness, mechanical strength, water tightness), on the bitumen (softening temperature, asphaltene content) and on welded areas (mechanical strength). No indication of ageing can be detected at present.

Figure 5: membrane sampling

Figure 6: replacement of the sample

3.2 Environmental monitoring

Chemical and radiological measurements are performed to verify that the facility complies with its applicable regulation, in particular in terms of discharge. These measurements enable to assess its impact. Measurements are made in the water networks, in rivers, in the ground water, in vegetation and in the air.

As a tritium contamination was detected in the river in 1976, groundwater is monitored by 73 boreholes drilled around the facility and its vicinity. Tritiated waste was retrieved in 1977 - 1978, however tritium diffused in the ground. The average tritium activity at the boundaries of the facility is now decaying (by a factor 2.35 between 1996 and 2005 – 6240 Bq/l in 2005), even if in some boreholes the level of activity remains significant (maximum: 190,000 Bq/l, the other values are between 100 and 24,000 Bq/l). The activity in the river is 100 Bq/l and 700 Bq/l in a contributory stream.

The present impact on a critical group living along the river is less than 0.8 µSv/year.

3.3 Keeping memory of the facility

The duty of memory constitutes a statutory requirement for Andra and the Agency pursues four major objectives:

- to inform future generations about the existence and the contents of the site, especially with regard to the risk of human intrusions, in case the facility was forgotten;
- to facilitate the understanding of the observed phenomena;
- to ensure that any relevant corrective actions be carried out under safe conditions, if necessary;
- and to allow for future generations to make any decision concerning the future of the site, especially in response to technical and societal developments.

In order to be sure that future generations will always have the proper means to keep abreast of all developments concerning information systems, Andra copied the documents on “permanent” paper. “Permanent” paper complies mainly with an international standard (ISO 97.06). Provided that it is handled with care and that it is kept in suitable premises, it is designed to remain stable over several centuries and therefore constitutes a sound solution in response to technical evolutions.

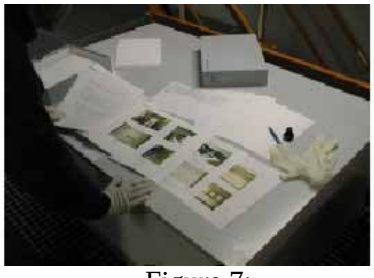


Figure 7:
copy of documents on permanent paper

Documents for a detailed long term memory are selected when relevant concerning potential risks. For Centre de la Manche, thirteen scenarios of potential incidents were developed in accordance with the safety report. Those scenarios are divided into three levels. For each of those scenarios, questions

are raised, and the required knowledge is explained for each answer in order to provide feedback elements allowing future generations to make their own decisions. The purpose is to provide information to the operator of the facility (or by any person who, in the far future, would be in charge of managing or transforming it).

The "detailed memory" of Centre de la Manche was compiled at the beginning of the monitoring phase of the facility in 2003, and includes 10,732 documents of a total of 442,938 pages, and spread over 60 linear metres. A copy was transferred in 2004 to French National Archives, another copy is kept by Andra.

A "synthesis memory" of about 400 pages will also be established for local and national decision makers. It will contain the most important information (historical and descriptive briefing notes, summaries of inventories and regulatory applications, etc…).

4. Conclusion

The update of the Centre de la Manche safety report in 2009 will include proposals for the transition from a very active monitoring to an active monitoring period. Proposals will concern possible improvements and modifications of the capping system in order to deal with the problem of steep slopes, of settlement of ancient waste. It will provide the results of research concerning the service life of the membrane and about other substituting materials. Some technical elements of the facility will be investigated with a goal of simplification and to have passive operating systems. A review of the environmental monitoring program will be performed. The active monitoring period will be followed by a passive monitoring system in a step by step licensing approach.

Centre de Soulaines-Dhuys disposal facility (in the Aube prefecture) that superseded to Centre de la Manche takes benefit of the experience gained since 1969. At the end of 2005 about 183,000 m^3 of waste packages have been disposed in Centre de Soulaines-Dhuys, which has a capacity of 1,000,000 m^3. In particular Andra has a very cautious approach with the acceptance of waste containing tritium.

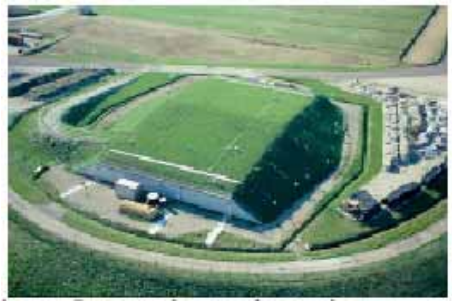


Figure 8: experimental capping system

As 110 disposal vaults have been constructed, a continuous area in the eastern part of the facility will be occupied by closed vaults in a few years. It will be then possible to begin partial capping work. The reference design uses clay as an impermeable material. An experimental capping system is being tested since 1995. Its results will also be used for Centre de la Manche studies in the same way that Centre de la Manche feed back will be used to prepare a report on the capping system of Centre de Soulaines-Dhuys to be submitted to the regulatory body in 2012.

The experience feedback from the implementation of the detailed memory of the Centre de la Manche was instrumental in highlighting the need to establish that memory as documents were produced. Hence, every document produced by Andra or received from its suppliers is input in the Agency's information system (document software for content management) and "ticked off" or not to indicate whether it will be part of the detailed memory or not. Those documents are printed on a regular basis on permanent paper (two copies). In 2005, the first shipment to the French National Archives was performed for documents concerning the first 10 years of operations at the Centre de Soulaines-Dhuys disposal facility.