

THE CENTRE DE LA MANCHE DISPOSAL FACILITY: ENTERING INTO THE INSTITUTIONAL CONTROL PERIOD

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ABSTRACT

The Centre de la Manche is the first-opened near-surface disposal facility for Low and Intermediate Level Waste in France. The facility was authorised by a 1969 decree and remained in operation until June 1994. Some 500 000 m³ of radioactive waste packages have been disposed of there.

This paper describes the changes in the facility management rules since its inception and presents the technical alternatives selected to reinforce its safety. The statutory aspects of the transition to the institutional control period are reviewed, showing the important role played in this process by the Evaluation Commission named by the Government. The organization of the institutional control period as anticipated by ANDRA to abide by the guidelines of this Commission is explained at length, as well as the main findings of the safety analysis of the installation. Preventive measures taken during the operating phase and those that ANDRA will take during the institutional control phase show that the local populations are not exposed to any significant risk due to the presence of the disposal facility in their environment.

INTRODUCTION

Many decades ago, France decided to dispose of its low and intermediate level short lived radioactive waste (LILW) in near-surface facilities. Nine-tenths of this waste is generated by the nuclear power industry, and the remainder by research centers and by medical, industrial and agricultural production.

Since the government order of 7 November 1979, this waste has been managed by France's National Agency for Radioactive Waste Management (ANDRA). After the bill of 30 December 1991, ANDRA became a public establishment of an industrial and commercial nature independent of the waste generators and reporting to the three ministries of Industry, Research and the Environment. The law assigned ANDRA the following missions:

- participate in the definition and contribute to research and development programs concerning long-term radioactive waste management
- run the long-term disposal facilities
- design, locate and build the new disposal facilities

- investigate the possibility of disposing of high-level long-lived radioactive waste in geological repositories, through the construction of underground research laboratories
- in compliance with the safety requirements, draw up radioactive waste conditioning and disposal specifications
- identify the status and location of all the radioactive waste present on French territory.

ANDRA today manages two LILW waste disposal facilities: the Centre de la Manche and the Centre de l'Aube.

The Centre de la Manche disposal facility, created by decree in 1969, is the first French near-surface radioactive waste disposal facility. It lies at the north west end of the Cotentin peninsula, next to the COGEMA-La Hague fuel reprocessing plant (Figure 1). The Centre de la Manche facility occupies an area of about 15 hectares (36 acres). Its operation was terminated in late June 1994 with about 500 000 m³ of packages disposed of. Operating feedback from the Centre de la Manche was used to design the second French disposal facility, located in the Aube, which has been receiving LILW since 1992.

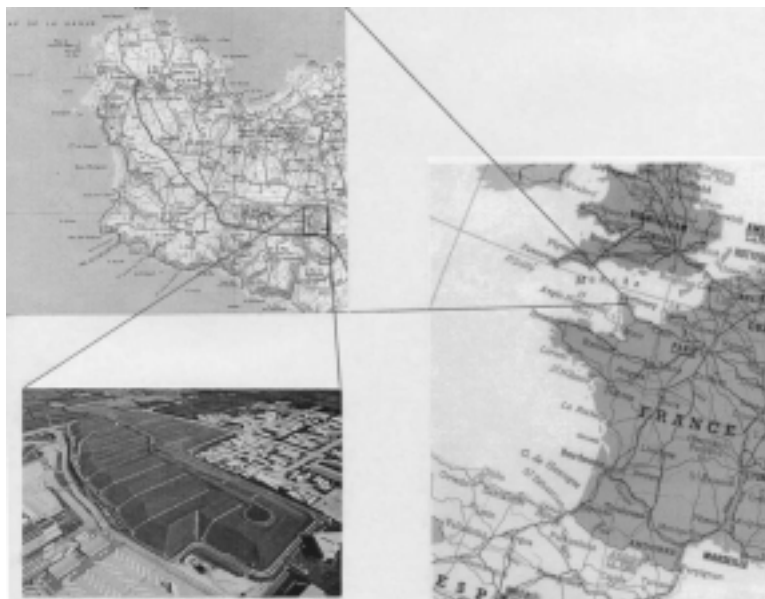


Fig. 1. Location of the Centre de la Manche

Since the end of the operating period, ANDRA has been preparing the statutory files to prepare the Centre de la Manche for its entry into the institutional control period. A new government decree, necessary since the 1991 bill, will set the framework in which the Centre will evolve in this period. The regulatory process includes the filing of an application with the ministries concerned, containing a file with the requisite statutory documents, including an impact study of the facility on its environment as well as a hazard study. The file will then be submitted to a public inquiry, an essential informative period of the project designed to make a compilation of criticisms and suggestions from the public. In support of the application, a safety report has been sent to the Nuclear Installation Safety Directorate (DSIN) for a decision on the admissibility of the application. Recently, the Group of experts appointed by the DSIN which examined it has come out in favor of the creation of a new

basic nuclear installation for the institutional control period. A draft decree will then be submitted to the approval of the Interministerial Commission for Basic Nuclear Installations.

This process, initiated in 1994, is nearing completion.

DEVELOPMENTS IN TECHNIQUES AND MANAGEMENT RULES OF THE CENTRE DE LA MANCHE

In 1969, the Centre de la Manche was run by a private company, INFRATOME, which assumed full responsibility for the transport, conditioning and disposal of all LIL waste. The safety and the radiation protection of the Centre was guaranteed by the French Atomic Energy Commission (CEA) through a technical liaison committee.

Management of the facility was based at the time on two principles, set out in the 1969 creation decree:

- Compliance with the irradiation and contamination limits set for the different categories of workers,
- Compliance with the irradiation and contamination limits set for members of the public, taking account of existing installations.

From the outset, all the technical arrangements were accordingly stipulated to fulfil these two principles. The construction rules then evolved through the years, in accordance with the feedback from the operation of the facility.

At the start, and according to the activity of the waste packages, the waste was either buried in ordinary trenches in solid earth or placed in trenches in concrete bins. Rainwater was collected in a pit which conveyed it by gravity to a retention tank. Depending on the activity, it was either sent to the Sainte-Hélène river or discharged into the sea via COGEMA's installations. After one year of operation, the ordinary earth trenches, which were deemed unsafe, were abandoned in favor of "platforms". The soil was leveled, covered with a layer of local materials and a bitumen emulsion. These "platforms" were equipped with a water drain. The packages were stacked on the platforms to form mounds. To guarantee overall mechanical strength and to facilitate disposal operations, the framework of the structures was built of concrete blocks containing the waste arranged stepwise on the edge of the structure, bounding internal compartments. Metallic drums were placed in these compartments, covered by a plastic sheet and a layer of soil. Starting in 1975, the voids between the packages were filled with gravel. The plastic sheet was eliminated in favor of a layer of gravel and soil. The concreted trenches consisted of concrete bins in which the packages were stabilized by sand. The presence of water was detected in one of these trenches in 1972. The sand was replaced by cement, to guarantee better sealing of the structure.

In 1975, the law decreed that the waste generator bore sole responsibility for the disposal of his waste. A specification was sent to INFRATOME, containing a stricter description of the type of activity of the waste packages, the production of the packages and the transport conditions. It became operational in 1977. In the same year, the CEA filed a first safety report to obtain confirmation of the provisional operating permit. It described the

installations, as well as the measures taken for monitoring and surveillance during the operating period. The safety analysis specifically addressed the operation of the site.

In 1976, the Sainte-Hélène river adjacent to the center was contaminated with tritium, at values that were high yet below the statutory limit. The structures responsible for the tritium leak were old concreted trenches in which the waste was immobilized by sand. These concreted trenches were opened, modified and rebuilt. The faulty packages were retrieved and reconditioned in special drums. Acceptance thresholds for tritiated waste were then reduced and inspections conducted at the generators. This incident nevertheless left a trace which persists today in the groundwater table and in the streams around the Centre.

In 1978, the CEA, which assumed sole management of the radioactive waste for one year, created the Waste Management Office (OGD - Office de Gestion des Déchets), which was charged with preparing the formation of ANDRA. In 1979, the Central Service for the Safety of Nuclear Installations, which examined the safety report, authorized the OGD to continue the operation of the disposal facility subject to compliance with technical requirements in addition to those of the 1969 decree. In particular, the waste had to be fully described and its characteristics had to meet the requirements and conditions set by the operator. For example, they could not contain any liquid phase, nor give rise to exothermic reactions. Disposal had to be maintained above water. The site and its environment had to be kept under permanent surveillance.

ANDRA was formed by a decree in 1979 within the CEA. The underlying principle of the disposal facility has since then been based on a "multibarrier" system: the first barrier is the package, and the second the structures placed around it. Through its retention properties, the site played the role of the third barrier. Concerning the packages, one of the first actions was to work alongside the waste generators to promote radioactive waste conditioning and disposal specifications. About 150 different types of package existed at the time, and they were standardized. At the same time, ANDRA established a policy of "super-controls", which consisted in sampling the produced packages at random and checking their conformity with the declaration of the waste generators.

The construction of the structures, which represented the second barrier, was improved. The solid earth trench, which had been built in 1969, was dismantled. The packages were retrieved, reconditioned and disposed of. Following the tritium leak, the seepage water collection system was separated in 1980 in order to collect separately rainwater and water which percolated around the waste packages. Starting in 1981, the "platforms" became host structures of reinforced concrete. These structures were built to withstand earthquakes and to collect rainwater efficiently. The concreted trenches, which were buried, were abandoned and replaced by monoliths, which were prefabricated reinforced concrete bins or concrete blocks. They were built on the host structures. One-storey structures were thus created. The lower level consisted of a raft on which the monoliths containing the waste drums were positioned. A second raft was placed on the monoliths, supporting the waste packages arranged in a mound. To prevent line breakages and to avoid the use of pumps liable to failure, a separate underground gravity water recovery system was built in 1982 (Figure 2).

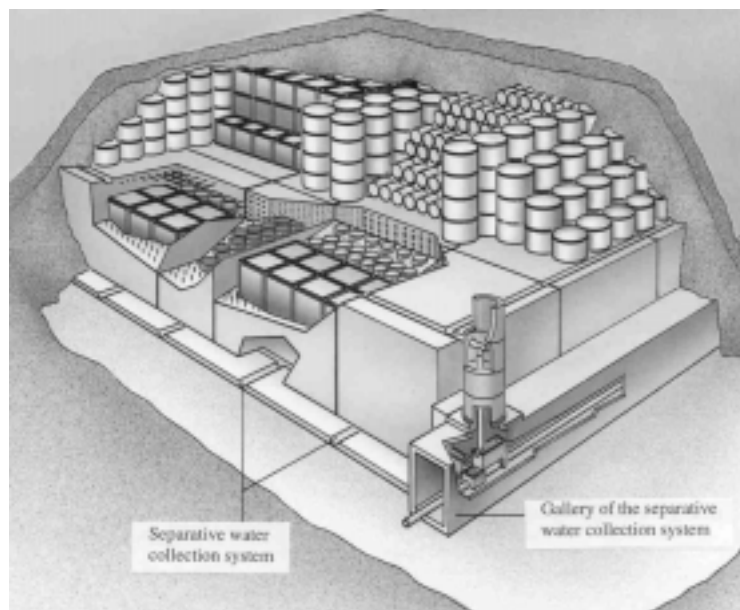


Fig. 2. Perspective view of disposal structures

The 1975 safety report was updated in 1982, incorporating the knowledge gained in the interim. A more comprehensive analysis of the safety of the facility was conducted, including an assessment of the potential radiological consequences connected with the activities likely to be stored since the Centre was created. The DSIN examined it in 1982, then in 1983 after ANDRA transmitted details of further studies concerning the safety scenarios, the impact results presented, the operation of the structures and equipment important for safety, and the hydrology of the site.

At the same time, the DSIN issued a major Fundamental Safety Rule, FSR No. I.2, in 1982 and again in 1984, stipulating the safety objectives and the design criteria for the near-surface facilities.

Two fundamental safety objectives were as follows :

- immediate and future protection of the public and the environment from the risks incurred by the dissemination of radioactive substances, to be guaranteed throughout the necessary period and in all situations deemed plausible.
- limitation of the institutional control period. Restoration of the site to unrestricted use must be possible no later than 300 years after the start of the institutional control period.

New technical requirements were issued in 1985, enabling continued operation of the Centre and replacing the earlier versions. In terms of disposal, they limited the quantity of radionuclides at the Centre de la Manche and stipulated the requirements for designing and building structures. In this respect, they observed the recommendations of FSR No. I.2. The waste had to be covered by an authorization procedure according to the specifications. The disposal areas had to be protected from rainwater by means of a suitable and effective cap.

The waste generators have declared the main characteristics of the packages to ANDRA since 1985. The management system has been computerized. Approved packages have since then been the subject of very detailed specifications (uniformity, leach resistance, load strength) and have been characterized by means of appropriate technical tests. A second major Fundamental Safety Rule, FSR No. III.2.e, was then published in 1986. It stipulated the approval of requirements for the waste packages and the specifications which they had to meet. Since then, approved packages have met the requirements of this rule. In 1988, ANDRA updated the safety report, which was examined in 1989 by the DSIN. In 1990, it advised ANDRA that the radiological consequences associated with the facility were acceptable and that the concept of a cap covering the facility as presented was admissible. The DSIN then issued a series of requests for studies in view of the future closure of the Centre de la Manche.

Construction of the structures continued up to 1994. Starting in 1991, and up to 1997, ANDRA covered the disposal areas with a cap, designed to isolate the waste from external aggression of natural, human, plant and animal origin. This cap plays an important role for the safety of the public and the environment (Figure 3).

From the bottom upward, it consisted of:

- a shaping layer of compacted coarse-grained materials (based on shale and sandstone) designed to impart a slope profile to the cap and to enhance the tightness of the system by its low permeability,
- a drainage layer of fine-grained sand designed to serve as a support for the bituminous membrane and to collect any seepage water in case of membrane failure,
- a bituminous membrane sealing the multilayer complex. The target is to obtain a cap penetrating flow in the range of a few $1.m^{-2}.yr^{-1}$.
- a fine sand drainage layer designed to prevent permanent head pressure of the membrane and to collect seepage water transiting through the biological barrier,
- a layer of compacted coarse-grained materials, designed to regulate the arrival of seepage water on the membrane and, above all, to protect the membrane from attack by roots and burrowing animals,
- a layer of plant soil.

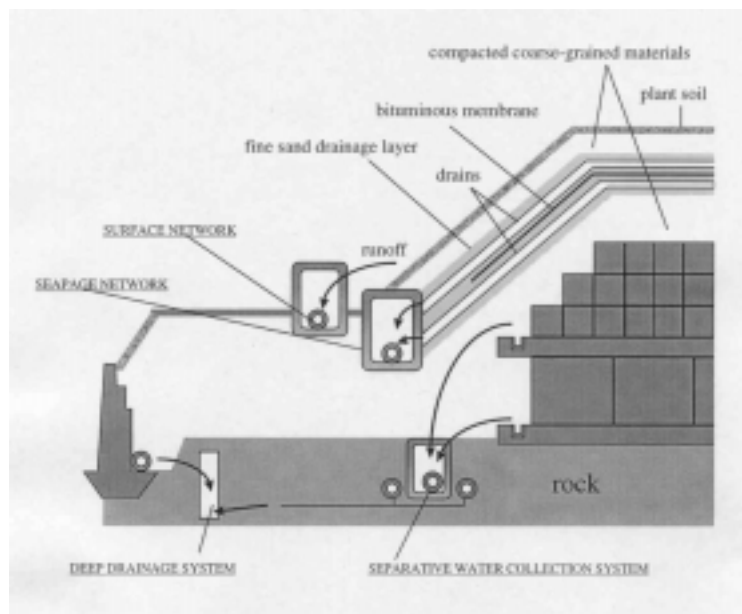


Fig. 3. Cross-section of the cap covering the Centre de la Manche

The outer appearance of the "factory roof" type cap planes which promotes the runoff is a succession of sloping from east to west, with a 6 to 14% inclination. On the edge of the facility, a system of panels stops at the upper limit of the structures. Beyond this, the cap is placed in a slope with a grade of 2.3/1 (horizontal/vertical) up to a peripheral road surrounding the covered area and terminating towards the facility boundary in a 3/2 slope. The same limits imposed the construction of support walls in the north and east.

Its design allows effective rain and seepage water management today through four separated networks:

- a surface network collecting runoff from the cap. Owing to their sources, these waters incur no risk of radioactive labelling in a normal situation ;
- another network collects the seepage water flowing to the biological barrier of the cap and on and possibly under the bituminous membrane. Examination of the feedback indicates that the water collected by this system incurs a risk of slight tritium labelling (connected with gas transfers from the disposal structures) ;
- the separative water collection system (SWCS) gathers the water drained and collected at the base of the disposal structures, after infiltration through the waste packages. This system incurs a risk of radioactive contamination ;
- a complex deep drainage system is positioned at the base of the buried installations of the Centre de la Manche. This network is not in direct contact with the waste packages. Nonetheless, since it is at a lower altitude than the waste disposal level, it incurs a risk of radioactive contamination ;

Depending on their radiological properties, these waters are sent to two outlets in a building, called the "basin building". ANDRA then transfers these waters to the adjacent COGEMA

plant which processes them. Waters incurring no risk of radioactive contamination in normal operation are dumped into the Sainte-Hélène river after control. Water liable to be radiologically contaminated is intended for direct discharge into the sea.

REGULATORY ASPECTS OF THE TRANSITION TO THE INSTITUTIONAL CONTROL PERIOD

Pursuant to the decree of 11 December 1963, ANDRA filed an application in September 1994 for authorization to inaugurate the institutional control period. This application included an impact study and a hazard study of the installation. To support this application, ANDRA sent a Preliminary File for Transition to the Institutional Control Period to the DSIN in 1993. This file was amended in 1994 to account for the DSIN requests concerning the modelling and its validation with respect to the measurements taken in the environment. The DSIN felt that the application for authorization to inaugurate the institutional control period could be submitted to a public inquiry. The administrative court of Caen conducted the inquiry proceedings. The inquiry took place from 2 October to 30 November 1995 on the communes located within a radius of 5 km around the Centre. From the operational standpoint, the cap of the Centre was installed to 2/3 of its area when the inquiry took place. Complaints were filed against ANDRA by ecological associations, for water pollution and violation of the regulations. These complaints led to suspension of the work on the cap in November 1995. The inquiry commission gathered the opinion of the population and, on February 1996, issued a favorable opinion on the transition of the Centre de la Manche to the institutional control period. This favorable opinion was nonetheless accompanied by recommendations, particularly addressing the control program and further work aimed to improve the inventory of the facility.

In this context, and in addition to the investigations conducted by the Inquiry Commission, the Government decided to set up a second Evaluation Commission in February 1996. This commission was asked to evaluate the situation of the Centre de la Manche disposal facility and to express its opinion on the impact of the Centre on the environment.

The Government made the Commission's conclusions public in July 1996. These conclusions were chiefly as follows:

- if the « ad hoc » measures are taken, the Centre incurs no significant health risk for the local population. The Commission also found the absence of a local and department-wide "cancer register" abnormal from the health standpoint.
- it judged that the cap added a vital safety factor to the installation,
- the waste inventory compiled by ANDRA, which was subjected to a thorough analysis, was deemed satisfactory.
- heterogeneities of long-lived alpha emitters exist in the facility and predate RFS No. I.2. The work necessary to eliminate these hot spots incurs greater risks for the public and the environment than its maintenance on the site,
- the site cannot be opened to unrestricted use in 300 years. The Commission found that the heterogeneity of the structures would subsist and that the areas containing long-lived radioelements would incur dangers in case of intrusion and destruction of the packages.

The emanation of radon, due to the presence of radium-bearing waste, would also subsist, and this element could accumulate in the subsoil of a dwelling built on the site. The Commission also noted the existence of a chemical risk due to the heavy metals present in the facility, particularly owing to the presence of lead.

- As to the duration of the institutional control period, the Commission judged it unwise to make any assumptions as to the evolution of our society and its structures by a horizon of a few centuries. In observance of the precautionary principle, the Commission discouraged the transfer to our descendants of the responsibilities which they could not or would not judge useful to assume. In consequence, it proposed a new organization of the institutional control period, including the preparation of the solution of a final cap to guarantee passive safety of the facility. The Centre will have to be placed in a state such as to incur no significant risk for the environment and the population, if it were to be suddenly abandoned.
- The Commission deemed it important to preserve the memory of the site and to take the necessary measures to limit the type of structures or equipment which could be installed. It also felt that the site should remain subject to requirements of public interest.
- The Commission emphasized the fact that the population expressed the feeling of having been disregarded in the decisions concerning the Centre. For example, the installation of the cap was carried out without consulting the population, at the risk of appearing to be a cover-up measure. The Commission proposed the formation of a Centre Surveillance Commission, composed of ANDRA and the representatives of the local populations and the ministries concerned, which would be informed and would express its opinion on the decisions to be taken.

The Government asked ANDRA to compile a new file accounting for these guidelines, to be subjected to a new public inquiry, and a renewal of the environmental release permits.

As requested by the government, a new application for a permit to release liquid and gases effluents was filed in December 1997. In June 1998, ANDRA sent the supervisory ministries a new preliminary report of transition to the institutional control period, which was taking into account of the Commission's conclusions. The inventory was completed and the impact of the facility reassessed from the radiological and chemical standpoint. In September 1998, a new application for a permit to inaugurate the institutional control period was filed, in which the hazard study of the installation was reinforced with a qualitative risk analysis.

NEW ORGANIZATION OF THE INSTITUTIONAL CONTROL PERIOD

Resuming the conclusions of the Commission, ANDRA proposed a phasing of institutional control in three periods:

The first period will be a period of highly active surveillance, to last about five years and designed to assess the satisfactory operation of the present cap in particular. The second period will be a period of active surveillance, to last between 50 and 100 years. ANDRA's presence on the Centre is necessary to ensure the monitoring and maintenance of the center, as well as environmental surveillance. Its task will be to confirm that any change in the cap

continues to meet the requirements and to investigate any further arrangements needed for its strengthening.

Many alternatives will thus be considered throughout this period:

- maintenance of the cap without change,
- repairs to the present cap,
- major reworking of the present cap (replacement of the membrane, repair of the slope grades, for example),
- installation of a new cap.

The third period will be a period of passive surveillance, during which ANDRA will conduct reduced surveillance of the Centre and its environment, but in which complete abandonment of the Centre will not incur unacceptable consequences for the environment. The transition to this period can only succeed after the verification of certain assumptions on the behavior of the Centre over the long term, and the possible implementation of technical improvements aimed to supplement the present containment systems with passive arrangements, which are simple and reliable over the very long term.

However, as noted by the Commission, the institutional control period will ultimately have to end. It is therefore important to take the necessary measures to restrict the nature of the structures or equipment to be installed there. This is why the memory of the site will be preserved as long as possible by the archival of major data in a lasting paper record. In this respect, an archive box containing the major documents is currently being prepared. It could contain a description of the packages and of the inventory, a description of the installations, a drawing of the structures and a qualitative analysis of the risks incurred by the facility, so that any dangerous uses made of it can be clearly identified. This box will be circulated among the local (town halls, land survey) regional (prefecture, general council) and national (ministries, national archives, ANDRA) administrations. Moreover, restrictions aimed to prevent intrusion on the site should be established during the active institutional control period.

FACILITY SAFETY ANALYSIS

Risk analysis

The safety of the facility was analyzed for the present installation during the institutional control period and in the longer term. The method used to analyze the safety of the facility first consisted in examining the risks of failure of the barriers inserted between the waste and man and his environment. The risks inherent in the installation, the risks associated with activities external to the installation, and the natural risks liable to generate failures of these barriers and hence to disturb normal operation, were examined.

Three distinct parts of the installation in which any failure is liable to cause the spread of radioactive or chemical substances in the more or less long term, were distinguished: all the disposal areas comprising the waste packages and the structures in which the packages have been placed, the cap covering the above and the system for collecting risk-incurring waters.

The risks identified on the installation, but which do not lead to the dissemination of radioactive or chemical substances, are mechanical accidents, fire, explosion, flooding of the galleries or the basin building, electric mains failure, and the loss of stability of a cover slope. The risk-initiating events take account of feedback accumulated since 1969. Activities examined external to the installation are connected with the proximity of the nearby transportation systems (aircraft, etc), of adjacent collection networks (industrial installations, etc), nearby industrial operations and malicious acts. The natural risks analyzed are associated with earthquakes, adverse weather, meteorites, animal and plant penetration into the cap and the facility, and water erosion of the cap.

For each type of risk, it was checked that suitable preventive arrangements had been set up during the operating period to reduce their likelihood of occurrence. Measures for the detection of abnormal situations were reviewed. They were registered in the surveillance plan of the installation. Despite the preventive measures set up and in pursuit of the principle of in-depth defense, the means for limiting the consequences associated with their occurrence were analyzed.

Quantitative assessment of risks

In a second step, the scenario technique was used to make a quantitative study of accidents liable to occur. The consequences of the normal and altered development scenarios were calculated. Analysis of the consequences allowed a more quantitative judgment of the safety of the installation and further measures were drawn up to reinforce the prevention of these risks.

- present impact of the installation

The theoretical consequences of an offshore release were calculated on a group of fishermen feeding on fish and seafood throughout the year and subject to external exposure due to radioactivity in marine sediments. The impact reaches about 10^{-3} $\mu\text{Sv}/\text{year}$. This impact is the result of a pessimistic calculation. For example, in 1995, releases from the Centre caused a smaller dose of about 10^{-5} $\mu\text{Sv}/\text{year}$.

The impact due to the presence of tritium in the river on a farming group using the water from the Sainte-Hélène for its household and agricultural needs (drinking, watering of animals and irrigation of a garden) was estimated at 2 $\mu\text{Sv}/\text{year}$. A more realistic scenario concerning the use of the water (not used for drinking) causes an impact of 0.5 $\mu\text{Sv}/\text{year}$.

Due to the presence of artificial radioelements in the sediments, a person fishing in the river would absorb a dose of 0.2 $\mu\text{Sv}/\text{year}$.

These figures are lower than the limit recommended by EURATOM Directive 96/29, which recommends 1000 $\mu\text{Sv}/\text{year}$. For comparison, the natural radioactivity represents 2.7 mSv/year in the Manche district.

- long-term impact

A scenario of normal development of the facility in the long term was constructed to estimate the impact of the Centre for 10^6 years, assuming it remained in its present configuration. The

calculations, which were conservative, on the farming group living near the Sainte-Hélène, a river supplied by the groundwater table, led to an impact not exceeding 90 $\mu\text{Sv}/\text{year}$, for a 300-year duration of the institutional control period. The impact of chemical toxics in the river is always lower than the maximum permissible concentration standards.

Altered scenarios were constructed from the judgments of experts and risk analysis. Despite the preventive measures drawn up, it was assumed that failures could occur, and their consequences were quantitatively estimated. The scenarios used consider failures such as raft fracture, collapse of a part of the cap or a rise in the groundwater. The impact of these scenarios does not exceed 110 $\mu\text{Sv}/\text{year}$ in the institutional control period.

ANDRA has estimated the consequences incurred by human intrusion 300 years after the start of the institutional control period. Scenarios including road construction, construction of a residential zone, intrusion of an archeologist in the facility or the handling of stripped packages following a landslide were also investigated. The dosimetric impact due to a road building site or the construction of a residential zone is about 1 mSv. By contrast, an archeologist handling waste packages with an alpha specific activity above average would absorb a dose of about 200 mSv. These serious radiological consequences must nonetheless be tempered by the fact that the probability of entering into contact with the contents of such packages remains extremely low.

Due to these consequences, the prevention of risks of human intrusion will be reinforced by restrictions and the preservation of the memory of the site.

SURVEILLANCE OF THE CENTRE AND ITS ENVIRONMENT

The surveillance of the Centre is an indispensable tool for managing the safety of the Centre de la Manche. It relies on a series of measures stretching into time and designed to:

- confirm the observance of the statutory requirements, particularly concerning releases ;
- detect any abnormal situation or development so as to locate and identify its causes. This means continued vigilance covering any abnormal development of the facility ;
- estimate the quantities of radioactive and chemical substances liable to exit the facility and identify the pathways ;
- contribute to the knowledge of the activity release mechanisms.

This plan was drawn up on the feedback accumulated since 1969 in terms of surveillance, operating procedures, incidents, technical events and the study of the various mechanisms involved, and also from the analysis of the risks of the installation. It accounts for the statutory provisions imposed in terms of release control.

It is based on three major guidelines:

- surveillance of the tightness of the cap. In practice, the tightness of the cap is monitored by visual and topographic inspection, by sampling the membrane, by hydraulic monitoring of the

different networks of the Centre, and by radiological and chemical surveillance of the groundwater and the waters of the SWCS ;

- surveillance of any releases from the disposal structures, into the networks and to the groundwater. Water in the networks is subjected to radiological and chemical measurements at the two outlets of the basin building. The groundwaters are monitored by radiological and chemical measurements via 60 piezometers. These measurements also serve to confirm the position of the groundwater table in relation to the disposal structures and to identify the groundwater flow paths. Piezometric high and low water maps are charted every year. Radiological and chemical measurements are also taken in the water of the three neighboring streams (Sainte-Hélène, Grand-Bel, Rotheures) and in the sediments ;

- radiological and chemical surveillance and monitoring the volumes of incurred waters transferred from the Centre to the COGEMA La Hague reprocessing plant.

Atmospheric radiological tests, measurements of ambient radiation, measurements on plants and rainfall measurements are also conducted.

More than 10 000 measurements are taken annually. They are checked by the Office for Protection against Ionizing Radiation (OPRI) which reports to the Health Ministry. Moreover, the main results of radiological and chemical surveillance of the Centre and its environment are presented quarterly in an information booklet aimed at the public.

The interpretation of the measurement results is not based on thresholds or alert levels, but on changes in the parameters measured, seen against a reference state of the installation and its environment. This interpretation relies on a number of simple criteria established in line with the main conceivable accident scenarios. For example, three criteria of the "absence, appearance or change in roof deformations" type are associated with the situation in which a large local leak of the membrane occurs.

CONCLUSIONS

The preliminary report of transition to the institutional control period, which takes account of the conclusions of the report of the Evaluation Commission named by the Government in response to the questions of the ecological associations, has been examined by the DSIN in December 1998. This report has earned the favorable opinion of the group of experts appointed by the DSIN, which examined it. The application for a permit to create a new Basic Nuclear Installation will then be submitted to public inquiry in 1999. The Centre could enter the highly active institutional control period in the year 2000. During this period, likely to last about five years, a program will be implemented to investigate the behavior of the facility and particularly of its cap.

The results of these studies will be communicated periodically to the Information and Surveillance Commission of the installation which was formed by an official decree in December 1996 and which includes 18 representatives of the administrations, the operator, elected representatives, ecological associations and the agricultural world. Armed with full knowledge of the facts, it can accordingly make a statement on the operation of the Centre, on its future, and will also be able to advise the local population in complete openness.