

## **The Creation of a French Basic Nuclear Installation - Description of the Regulatory Process – 13293**

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### **ABSTRACT**

CEA is a French government-funded technological research organization. It has to build a medium-level waste interim storage facility because the geological repository will not be available until 2025. This interim storage facility, called DIADEM, has to be available in 2017.

These wastes are coming from the research facilities for spent fuel reprocessing and the dismantling of the most radioactive parts of nuclear facilities. The CEA handles the waste management by inventorying the needs and updating them regularly. The conception of the facility is mainly based on this inventory. It provides quantity and characteristics of wastes and it gives the production schedule until 2035. Beyond mass and volume, main characteristics of these radioactive wastes are chemical nature, radioisotopes, radioactivity, radiation dose, the heat emitted, corrosive or explosive gas production, etc. These characteristics provide information to study the repository safety.

DIADEM mainly consists of a concrete cell, isolated from the outside, wherein stainless steel welded containers are stored, stacked in a vertical position in the racks. DIADEM is scheduled to store three types of 8 mm-thick, stainless steel cylindrical containers with an outside diameter 498 mm and height from 620 to 2120 mm.

DIADEM will be a basic nuclear installation (INB in French) because of overall activity of radioactive substances stored. The creation of a French basic nuclear installation is subject to authorization according to the French law No. 2006-686 of 13 June 2006 on Transparency and Security in the Nuclear Field.

The authorization takes into account the technical and financial capacities of the licensee which must allow him to conduct his project in compliance with these interests, especially to cover the costs of decommissioning the installation and conduct remediation work, and to monitor and maintain its location site or, for radioactive waste disposal installations, to cover the definitive shut-down, maintenance and surveillance expenditure.

The authorization is issued by a decree adopted upon advice of the French Nuclear Safety Authority and after a public enquiry. In accordance with Decree No. 2007-1557 of November 2, 2007, the application is filed with the ministries responsible for nuclear safety and the Nuclear Safety Authority. It consists of twelve files and four records information. The favorable opinion of the Nuclear Safety Authority on the folder is required to start the public inquiry. Once the public inquiry is completed, the building permit is issued by the prefect.

## **INTRODUCTION**

The CEA has undertaken a vast dismantling programme for its shut-down nuclear facilities (research laboratories, experimental reactors, etc.). One of the major issues involved is to demonstrate its ability to manage the radioactive waste produced by these operations.

For the LL-IL and HL waste, long-term management solutions are being studied in the context of Law n°2006-739 dated 29 June 2006, concerning the sustainable management of radioactive material and waste. The recommendations will only be available a few years from now, and the Law gave the objective of 2025 for the commissioning of a deep geological repository.

Today, the CEA is organising its waste management in temporary storage units while awaiting the availability of a long-term solution. It was decided to study the possibility of storing SL-LIL and LL-IL waste in a new facility, known as the DIADEM project. The objective was to design and build a temporary storage unit for highly irradiating and/or highly  $\alpha$  contaminated waste, to be used until the commissioning of the planned deep geological repository. The facility will be built at the Marcoule Centre in the Rhône Valley, the site where much of the waste concerned is produced.

The DIADEM project began in 2006. First, the CEA carried out a feasibility study which formed the basis for launching a consultation and call for tenders. The prime contractor was appointed in 2008, and the design studies were completed early in 2012. It is planned to commission the facility at the end of 2016.

## **INTEGRATION OF THE BASIC NUCLEAR FACILITY CREATION REGULATORY PROCEDURE IN THE PROJECT SCHEDULE**

Given the type and the quantity of waste which must be stored, the DIADEM facility will be classified as a Basic Nuclear Facility, or “INB” in French. In conformity with the requirements of Decree n°2007-1557 dated 2 November 2007 and in application of Law n°2006-686 dated 13 June 2006 concerning nuclear industry transparency and safety, a public enquiry must be organized in the case of an INB creation.

To meet this requirement, the DIADEM project has written a Creation Authorisation Request file, or “DAC”, in French. This file has approximately 1500 pages, and is made up of 12 parts together with 4 notices:

### Introduction: Request Presentation

- Part 1 - Identification of the requesting party
- Part 2 - Description of the DIADEM project
- Part 3 - 1/25 000 map: location of the planned facility
- Part 4 – 1/10 000 location plan: perimeter proposed for the facility
- Part 5 – Detailed facility plan (scale: 1/2 500)
- Part 6 - Impact study: containing in particular the environmental characterisation, the presentation of the site and of the DIADEM project, the analysis of the direct and indirect effects of DIADEM, the justification of the project choices, the measures to prevent, limit and compensate for the impact of the project, the study methodology and a non-technical summary.
- Part 7 - Preliminary Safety Report: this includes the inventory of the risks of all origins which the planned facility may present, as well as the analysis of measures taken to prevent such risks and the description of measures proposed to limit the probability of accidents and their effects.

- Part 8 - Risk Mastery Study: this gives in particular the risk inventory, the analysis of the lessons learned from similar facilities, the presentation of the methods retained for risk analyses, the analysis of the consequences of any possible accidents, the presentation of monitoring systems, the means and measures foreseen for emergency services, and a non-technical summary.
- Part 9 – Public interest limitations: not applicable for the DIADEM project.
- Part 10 – Dismantling plan: this presents the steps foreseen for the dismantling of the facility, the site clean-up and the later monitoring of the site.
- Part 11 – Prior consulting: not applicable for the DIADEM project.

Notices:

- Notice, part 1: Presentation of the Operator's technical skills
- Notice, part 2: Presentation of the Operator's financial resources
- Notice, part 3: Information notice regarding the Owner (not applicable for this file)
- Notice, part 4: Operation conformity with the rules related to health, safety and radiation protection. This document presents the measures foreseen to ensure the respect of regulatory and legislative rules concerning the health and safety of the personnel, particularly the measures taken to apply the principles and the rules defined for radiation protection by the public health code, the labour code, and the additional texts in force for their application.

As the file can be consulted by the general public, two communication documents were created in order to simplify understanding of the project:

- « L'homme et la radioactivité » (Humans and radioactivity): An information booklet presenting general information about radioactivity, sodium, safety and radiation protection
- « Sigles et glossaire » (Abbreviations and glossary): A list of the main abbreviations and definitions used in the file

This file was sent to the MSNR (Mission de la Sûreté Nucléaire et de la Radioprotection – Nuclear and Radiation Protection Safety Mission) at the end of April 2012. The MSNR duly requested the ASN (Autorité de Sûreté Nucléaire, the French Nuclear Safety Authority) and the AE (Autorité Environnementale, the French Environmental Authority, which answers to the Ecology, Sustainable Development & Energy Ministry) to give its advice regarding the document's acceptability, in order to be able to launch the related public enquiry.

## **DESCRIPTION OF THE DIADEM PROJECT**

DIADEM's role is to safely store containers of highly irradiating and/or high  $\alpha$  content waste. The facility has been designed for a lifetime of at least fifty years.

During these fifty years of storage, the facility must ensure that the containers are kept in a state of preservation which will enable their retrieval at any time with the current means of operation. It must also keep records of each container's characteristics, including its origin, nature and radiological contents.

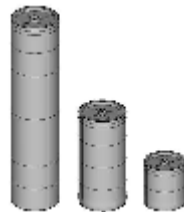


*Outside view of the future building*

From the functional point of view, the DIADEM storage facility must carry out the following operations:

- reception and checking of the shipping packaging loaded with waste containers;
- preparation of the containers for storage by checking, decontamination if necessary, and lid welding operations;
- container storage and monitoring;
- maintenance of the containers' integrity throughout their storage period;
- archiving of all the information available related to each container;
- retrieval and despatching of the containers at the end of their storage period.

The facility is planned to receive 3 types of cylindrical stainless steel containers, with identical diameters (external  $\text{\O} 498 \text{ mm}$ ) and with increasing heights (620mm, 1060mm and 2120mm).



*The three types of containers*

The containers have 8 mm thick steel hoops. This extra thickness enables the containers to resist falls, and means higher corrosion resistance.

The lids will be screwed onto the containers in the waste-producer's facilities, and then welded in DIADEM (or in another facility) before placement in storage. The lid welding will guarantee leaktightness for periods of several decades.

These lids will be fitted with gripping points. For waste involving radiolysis phenomena (gaseous releases caused by radiation), the lids will also be equipped with metal filters which will allow gases to escape. These special filters are designed to only give gaseous pressure release, while blocking all particles.

### **Dimensioning hypotheses**

The waste to be stored in the DIADEM facility will come from several CEA facilities:

- for the majority, from research facilities currently being cleaned up or dismantled (the Phénix reactor, for example),
- from waste storage facilities nearing the end of their lifetime, whose waste must be removed,
- for a very small amount, from currently-operated research facilities.

The wide variety of these facilities, the age of some waste and sometimes access difficulties have required a major effort, in collaboration with the producers, to determine the characteristics of the waste involved.

These discussions have enabled limit values to be set for different parameters concerning the waste, which have been used for the studies. These limits will also be used to define the acceptance specifications during the facility's operation phase.

In terms of quantity, DIADEM has been dimensioned to receive up to 460 m<sup>3</sup> of conditioned waste. The current estimation represents a little more than 90% of DIADEM's total capacity. More than 60% of the waste volume stored will come from Marcoule, which was a deciding criterion for the location of the project.

In terms of radioactivity, the main cut-off limits are given in the table below.

Parameter	Maximum value per container
Maximum $\alpha$ activity	21. 10 <sup>12</sup> Bq
Maximum $\beta\gamma$ activity	1200. 10 <sup>12</sup> Bq
Mass of fissile matter	200 g
Radiation	680 Gy/h

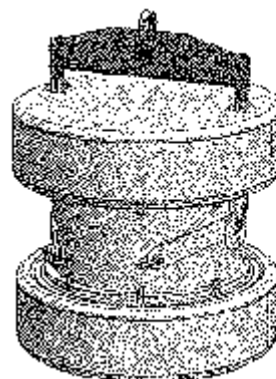
To date, the inventory of waste likely to be stored in DIADEM has shown that the waste characteristics can vary greatly from one container to another. The dimensioning therefore plans for a total radioactivity in the storage shaft, once filled, of up to 7,5. 10<sup>17</sup> Bq.

### Transport

Knowledge of shipping packaging has been necessary when designing DIADEM, as this impacts the dimensioning of part of the facility. The waste containers will be sent to the facility by road transport, in two types of shipping packaging: IR500 and TIRADE casks. This shipping packaging is designed and proven to prevent any spread of the radioactivity transported, be this under normal conditions or in the case of an accident.



*IR500 cask on its base, without the cover*



*TIRADE cask*

## MAIN RESULTS OF THE IMPACT STUDY

The impact study includes the environment characterisation, the site and the DIADEM project, the analysis of the project's direct and indirect effects (for which the main results are given below), the justification of the project's choices, the measures foreseen to prevent, limit and compensate for the project's effects, the methodology used for the studies, and a non-technical summary.

### Radiological impact

- The radiation to be released by the DIADEM facility on the site border has been assessed as 0,3mSv/year, assuming a presence of 24 hours per day for 365 days on the site border.
- The worker dose rate has been estimated to be 2 mSv per year per person.

### Impact of radiological releases

- The forecasts for radioactive gaseous effluent releases are given in the table below:

Type of radioactivity	Proposed annual limit in Bq/year
$\alpha$	$1 \cdot 10^5$
$\beta \gamma$	$2 \cdot 10^6$
Tritium	$8 \cdot 10^{12}$

- The radioactive liquid effluents will be managed by the Marcoule liquid effluent treatment station. The forecasts for annual production are given in the table below:

Type of radioactivity	Annual quantity in Bq/year
$\alpha$	$5 \cdot 10^6$
$\beta \gamma$	$9,5 \cdot 10^7$
Tritium	$2 \cdot 10^3$

- The radiological impact of the liquid and gaseous releases on health will be less than 0,0005mSv/year for an adult or a child.

### Impact on the fauna and flora

This study was entrusted to a specialist company, which set up a classic methodology with the identification of the stakes involved and analysis of the disturbance caused, along with suggestions for appropriate measures to be taken. The zone where DIADEM is to be located is an anthropised zone, and is of little interest overall from an ecological point of view.

### Impact on the human environment

The impacts will be low, as the worksite is far from the first households and the operation of the DIADEM facility will produce only a little waste.

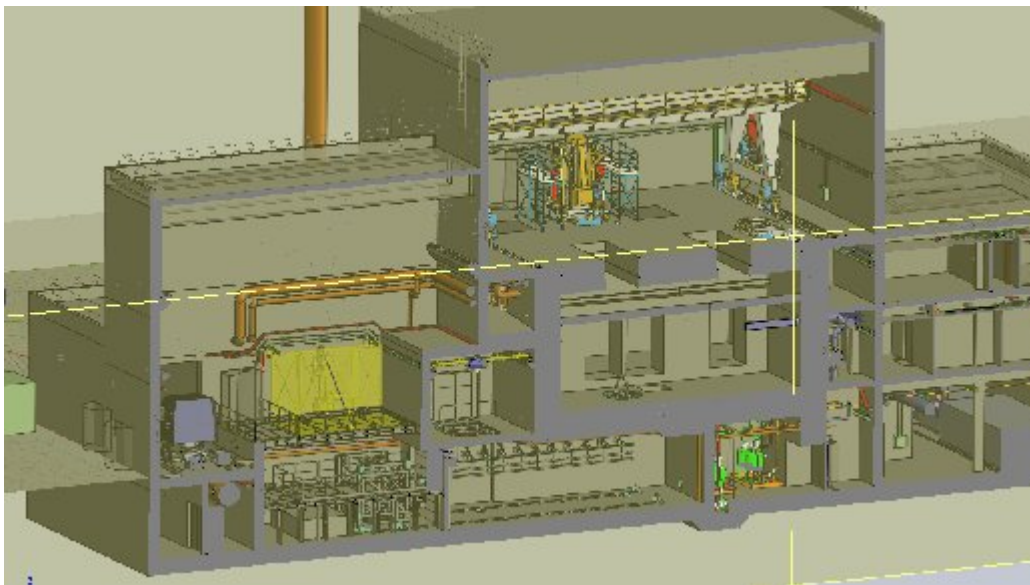
This study made it clear that the environmental and health impact of DIADEM is overall very low.

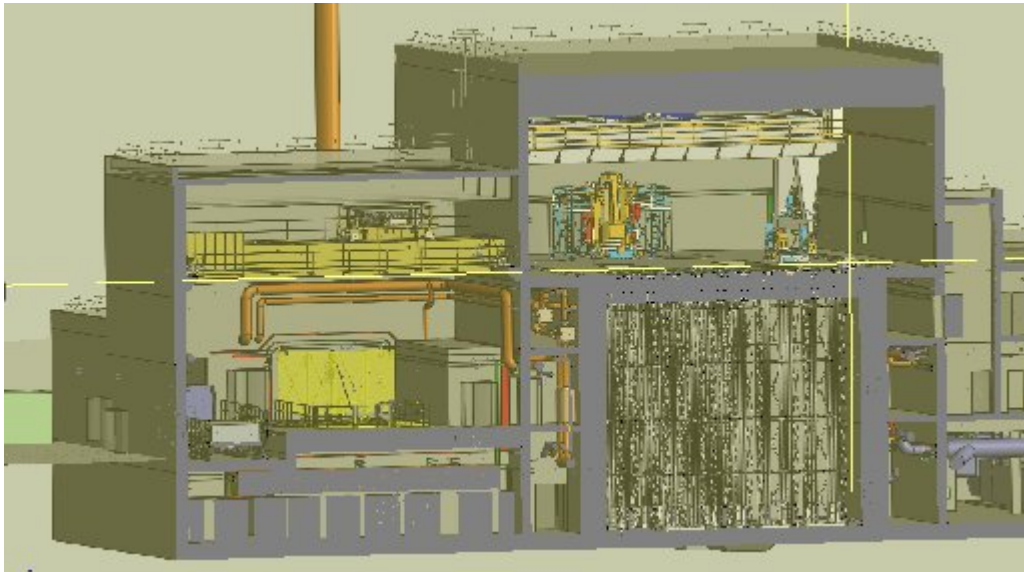
## PRELIMINARY SAFETY REPORT

The risk inventory and the analysis of the measures foreseen to prevent such risks, as well as the description of the appropriate measures for limiting the likelihood of accidents and their effects, led to the inclusion of the following main counter-measures:

- the radioactive dissemination risk ☞ physical barriers will be successively interposed, in order to prevent the workers and the public from coming into contact with radioactive matter:
  - the container
  - the transport packaging
  - the container preparation cell
  - the shielded carrier which will be used to move the container from the cell to the storage shaft
  - the storage shaft
  - the building's external shell
- the external exposure risk ☞ physical screens, such as concrete walls, will reduce the passage of radiation emitted by the waste;
- the criticality risk ☞ as the waste contains fissile matter, the storage geometry will be suitably adapted in order to prevent the triggering of a chain reaction;
- the radiolysis risk ☞ the gases produced by the decomposition phenomenon of the matter due to the action of radiation will be let out, in order to prevent the formation of an explosive atmosphere;
- the heat risk ☞ the containers will be cooled throughout their storage period, in order to avoid the phenomenon of gaseous releases caused by high temperatures and any damage to the barriers set up.

These constraints led to the design of a shaft-type storage, in which a steel guiding structure, called a rack, will enable the containers to be stacked. The thickness of the shaft walls will give sufficient radiation reduction to protect the personnel.





*Section views of the building*

The containers will have a high mechanical resistance. Those likely to be subject to radiolysis will be equipped with filters which will allow the release of the gases produced while retaining the particles.

Container handling throughout the facility will be carried out remotely, using semi-automatic equipment and from behind very thick biological protection barriers, thus limiting external radiation exposure for the workers. The shaft walls are up to 140 cm thick.

The shafts will be ventilated non-stop, in order to both remove radiolysis gas releases and cool the containers.

The facility has been dimensioned to resist the most extreme conditions, and an additional safety assessment (“stress test” analysis, following the Fukushima accident) was carried out and sent to the Safety Authority as a complement to the Preliminary Safety Report (part 7 of the file).

## **NEXT MAJOR STEPS FOR THE PROJECT**

### **Regulatory aspect**

The public enquiry will take place during the 1st semester of 2013. The process involves the following steps:

- The president of the Administrative Tribunal appoints one or several Commissioner-Investigators, chosen from a county list of those suitable for this function.
- A Prefectoral Order for the opening of a public enquiry is published, specifying its perimeter (in general approximately ten kilometres around the project site) and the places where the Authorisation Request file can be read.
- The enquiry is publicised via a legal notice in the local press at least 15 days before the opening of the enquiry, with posters displayed in the town halls within the perimeter and in the Prefecture.
- The public consultation takes place for one month. Stakeholders may go to the town halls within the enquiry perimeter, examine the file and note their comments in a register made available for



this purpose. The comments, proposals and counter-proposals may also be addressed by postal mail to the Commissioner-Investigator or given orally during sessions held by the latter.

- At the end of the enquiry, after having collected all the information from the authorities which seems to be necessary, the Commissioner-Investigator writes a report describing the holding of the enquiry and analyzing the comments received, followed by the conclusions reached including advice given.
- The Commissioner-Investigator usually has one month to file the report and the conclusions reached. Advice is given which may be "favourable", "favourable with condition(s)" or "unfavourable". The report and the conclusions are made public and may be consulted in the prefecture or town halls for one year.

The advice of the Commissioner-Investigator, as well as that of other official organisations consulted, particularly the Local Information Commission, are sent to the Ministries which are responsible for signing the authorization decree.

The building permit may be delivered after the Commissioner-Investigator's report has been received, following instruction by the Departmental Direction of Territories and Sea (the French "Direction départementale des territoires et de la mer", or DDTM).

The instruction of the Preliminary Safety Report can begin as soon as it has been judged receivable. To do this, the Nuclear Safety Authority (ASN) entrusts the examination of the file to a permanent expert group. After the advice of the permanent group is received and taking into account the results of the public enquiry, the ASN prepares a draft of the decree authorizing the facility's creation. This draft is sent to the Technological Risk Prevention High Council for its opinion. This group's role is to assist the ministries in charge of facilities classified for the protection of the environment, for nuclear safety and for industrial safety.

Decree n° 2007-1557 dated 1 November 2007 sets the maximum time for the examination of creation authorisation requests at 3 years, which should mean a creation authorisation decree for DIADEM in mid 2015.

In the frame of the Euratom treaty, in parallel with the French regulatory procedure, the CEA must send investment projects concerning new nuclear sector facilities to the European Commission, and provide the general data for any project involving the release of radioactive effluents whatever their form. This is to clarify whether implementing the project is likely to lead to a radioactive contamination of the water, the soils or the air space of another member State. The Commission, after consultation with an expert group, gives its opinion within a six month timeframe. The creation authorisation cannot be given until after the reception of the Commission's advice.

### **Technical aspect**

After sending the creation authorisation request, the project and owner teams have been preparing the calls for tenders for the 11 work packages. The current schedule foresees contracts being awarded during the summer of 2013. Although some work packages will only be implemented towards the end, the execution studies will be carried out as soon as the contracts are established, to ensure both an execution study synthesis and the spatial consistency of the building components among all the trades participating. The worksite is expected to begin during the last quarter of 2013.

## CONCLUSION

The very thorough nature of the French regulatory procedure enables the French Government to decide on the political and economic opportunity of the construction, but also to benefit from the advice of the competent authorities:

- The Nuclear Safety Authority, which examines the risks and any harm for public health, safety and sanitation, as well as the protection of nature and of the environment, before proposing to authorize or to refuse the creation of a BNF (INB)
- The Environmental Authority, which gives its advice on the environmental impact assessment
- The European Commission, which is consulted on the impact of the facility's radioactive releases
- The Departmental Direction of Territories and Sea, which instructs the building permit

These successive complementary checks enable the Government to take the safest decision possible and to guarantee facility operation conditions in conformity with requirements for safety and security.

There is a great deal at stake for the CEA in the commissioning of the DIADEM facility, as it is a key factor in satisfactorily carrying out several major clean-up and dismantling programmes on various nuclear sites (Marcoule, Fontenay-aux-Roses, Saclay, Cadarache). The facility is necessary to cover the waiting period until ANDRA's deep geological repository (the CIGEO project) can be opened, all the more so as once the latter is operational, producers must respect waste transfer schedules spread over many years. The interim storage to be located in DIADEM will be needed.