Very Low Activity Waste Disposal Facility Recently Commissioned as an Extension of El Cabril LILW Disposal Facility in Spain - 9014

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ABSTRACT

This paper describes the Very Low Activity Radioactive Waste (VLLW) disposal facility, designed, built and operated by ENRESA as a part of El Cabril LILW disposal facility. El Cabril facility was commissioned in 1992 and has 28 concrete vaults with an internal volume of 100,000 m^3, as well as waste treatment systems and waste characterization laboratories. The total needs identified in Spain for LILW disposal are of some 176,000 m^3, of which around 120,000 m^3 might be classified as VLLW

This project was launched in 2003 and the major licensing steps have been town planning license (2003), construction authorization (after Environmental Impact Statement and report from Nuclear Safety Council-CSN, 2006), and Operations Authorization (after report from CSN, July 2008). The new VLLW disposal facility has a capacity for 130,000 meters cube in four disposal cells of approximately the same size. Only the first cell has been built. The design of the barriers is based on the European Directive for elimination of dangerous waste and consists of a clay layer 1 m, 3 cm geobentonite films, and 4 mm HDPE film. In order to minimize leachate volumes collected and help a good monitoring of the site, each cell is divided into different sections, which are protected during operation –before placing a provisional HDPE capping- by a light shelter and where leachate collection is segregated from other sections.

INTRODUCTION

The project of complementary installation for the storage of the very low radioactive activity waste (VLLW) in the Cabril, responds to the diverse resolutions of the Commissions of Industry and Energy and Economy and Property of the Congress of the Deputies.

In this sense, the Congress of the Deputies through its commissions and as a result of the appearance before the same ones of the Presidency of the Nuclear Security Council, has showed its interest by “it is imperative not to squander the important assets that for the Country represent the Cabril storage capacity. Therefore, the Government is urged from a technological perspective to implement in the Cabril less complicated complementary facilities to store the very low intensity radioactive waste.".

The El Cabril disposal facility, located in the province of Córdoba, is an essential part of the national LILW management system. The new very low level waste disposal is integrated at El Cabril in all aspect: site, organization, infrastructures, impact, etc. It is located in the south-east area of the actual site. With this complementary installation ENRESA is able to manage, mainly, the large quantities of waste generated especially by the dismantling of the nuclear power plants and waste resulting from a non nuclear industry incident. For the definitive storage of the VLLW a technical solution based on multiple barriers, establishment of a period of monitoring, implantation of a network of collection of the possible infiltrations, and using an agreed technology commensurate with the type and risk of the waste stream is the object of this project.

This project was launched in 2003 and the major licensing steps have been Municipal planning license in January of 2003, the approval of the Environmental Impact Statement in December 2005, the Construction Authorization in February 2006, Operations Authorization in July 2008, and the operation of the first disposal cell in October 2008.

This paper outlines the design principles of the disposal facility, objectives and criteria, and describes the disposal facility.

LILW DISPOSAL FACILITY

VLLW DISPOSAL FACILITY

Figure 1. El Cabril disposal facility

SAFETY OBJECTIVES AND CRITERIA

The disposal of very low level waste fulfils the same basic objectives and criteria of safety as the present facility in El Cabril. Nevertheless the design is based on the regulations governing disposal facilities for non-radioactive hazardous waste more in keeping with the type of waste and risk associated with its activity level. Two main fundamental objectives are considered in the design:

– Ensure the immediate and deferred protection of the public, the workers and the environment, during the operation and after closure.

– Ensure the control and surveillance of the site through exhaustive and traceable documentation regarding waste, facility, workers and environment.

The criteria applied that lead to the fulfilment of the objectives are:

– The use of isolation barriers to prevent the radionuclide migration

– The activity limitation by waste package and by cell

– The requirement of a surveillance period for a maximum of 60 years

Some other technical options have been adopted in the design as:

– A leachates control network system to control the water that can be in contact with the waste

– The exploitation of the cell will be performed under a light shelter in order to minimize the quantity of potentially contaminated leachates to be treated

– The piling up of waste will be stable under disposal conditions and will present load characteristic enough to support the final cover.

CHARACTERISTIC OF THE VLLW

Consider radioactive waste of very low activity (VLLW) those solid or solidified materials that is contaminated or activated, and whose radioactive content does not surpass the values limit. Those limits are indicated in the document Waste Acceptance Criteria.

From the total needs of Spanish of LILW of 176,000 m^3, around 120,000 m^3 might be classified as VLLW, the majority will come from: Dismantling of nuclear power plants (90%), Operation and maintenance of nuclear power plants, Incidents occurring in Spanish non nuclear facilities (not covered by the Regulation of Nuclear power plants and Radioactive). Additionally the small percentage of the radioactive waste of VLLW, that can present additional characteristics of danger will be stabilized previously to their disposed of.

REPOSITORY DESIGN

The more important technical aspects of the cells storage, follow the document “Basic Criteria of Facilities for Storage of Radioactive Waste of Very Low Activity”, appreciated favourably by the Nuclear Security Council. This document is based to the European Directive and Spanish Law

The components that integrate the Complementary Installation for VLLW, can be divided in two blocks:

1. Four cells of storage of VLLW, that will be located in new zone of storage within the Cabril Facility, numbered like cells 29 to 32, with an approximately total capacity of 130,000 m3. Currently the first cell, number 29, is built and has been operated since October 2008. The remaining three cells will be constructed throughout a period of about 30 years, commensurate with the radioactive waste management needs.
2. The treatment, conditioned and interim storage building, is located in a zone close to the disposal area. In this building is performed the stabilization or any other treatment which they require the waste.

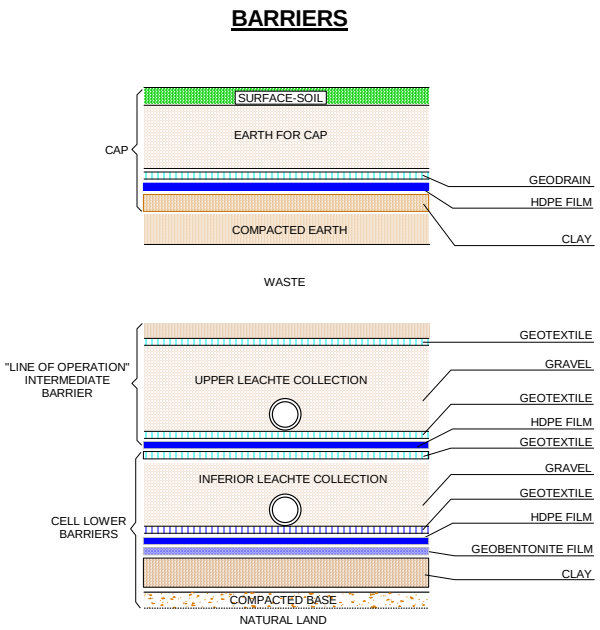
Disposal cell.

These cells are located near of LILW disposal facility and their design focuses on the durability and effectiveness of the isolation barriers for a period longer than 60 years with is the time required for the radioactivity to have decreased to a level sufficiently low for natural disintegration.

- The bottom barriers includes the following protection layers: a layer of gravel for subdrainage, a layer of clay one meter thick as a impermeable layer, a layer of geobentonite consisting of layers of polyethylene backfilled with sodium bentonite, a layer of high density polyethylene (HDPE), a layer of gravel traversed by leachates collection pipes. Over this another layer of redundant gravel is placed (with collection pipes inside), duplicating the safety of the individual system for each zone and hence facilitating monitoring of system performance. The last layer is a layer of soil on which the waste is placed.

- An intermediate protective layer is placed over this first waste section, consisting of a new layer of high density polyethylene (HDPE) and a drainage layer of gravel for leaching collection. Both form a part of the lower layers of the second section of waste.

- Final cap. Once the cell is full of waste, it will seal with a cap consisting in a layer of clay half meter thick, over which is placed a layer of high density polyethylene (HDPE) and a filing of soil and coarse gravel, finishing in a layer of vegetal soil and shrub planting.



The El Cabril site is a sloped area, it was necessary for building the disposal cell to build a rock dyke in the lower part of the disposal cell. This dyke and the cell have been calculated to withstand extreme loads, including the Site Safety Earthquake (SSE) with a ground acceleration of 0.24 g.

Geologic barrier itself or with the complementary materials will be have a permeability equivalent to a layer of 5 meters of clay with $K=1x10^{-9}$ m/s. In VLLW facility of El Cabril is placed one meter of clay with $3,5x10^{-10}$ m/s and 3 centimetres of geobentonite with $1x\ 10^{-11}$ m/s.

Waterproof layer. On the clay, is placed two layers of the high density polyethylene (HDPE).

Figure 2. Engineering barriers

Drainage layers. On each HDPE layer are placed a drainage layer, both formed by gravel with a collection pipe inside, the lower with 300 mm of thickness and the upper with 500 mm of thickness.

Control of leachates

The possible leachates seeped though the protective layers will be collected by a network of slotted pipes which crosses the drainage layers. These pipes remove the effluent through the dyke to collectors which they are connected to from the start of the exploitation phase, in a manner which allows the runoff from each exploitation line to be distinguished.

The effluent is then piped by gravity to a Final Control Tank with a capacity of 100 m3 situated downstream of the dyke. Its interior has a impermeable lining and equipped with valves for sampling of liquid collected, or transferred to a tank for recycling, or piped to natural channels once they have been proved harmless.

Protection from rainwater

Three different systems have been elaborated to minimise the impact from rainwater:

- The first consists in protecting the disposal area with perimeter gutters to collect all the external water and lead it to natural channels.
- The second consists in a light shelter that protect of waste from the rainfall.
- And finally the network of pipes extending from the exploitation line, the rainwater to flow directly to collectors and then to natural channels.

Phases of Construction and utilisation

The construction and utilisation of each cell will be carried out in two phases or sections as follows. Following a process which is standard for all cells, the ground is cleaned and conditioned, and the bottom barriers are placed. After preparing the bottom of the cell, the first section of the cell will be begin the operation of storage of waste.

When the available capacity of the first section reaches the upper level of the dyke, the intermediate protective layer is placed. Over this surface a new soil dyke is constructed and set back from the first phase. Once it is rendered impermeable inside, this will form the basin for the second phase or section, and the cell is then ready for utilisation again.

Once the cell will be full, it is covered with the final cap.

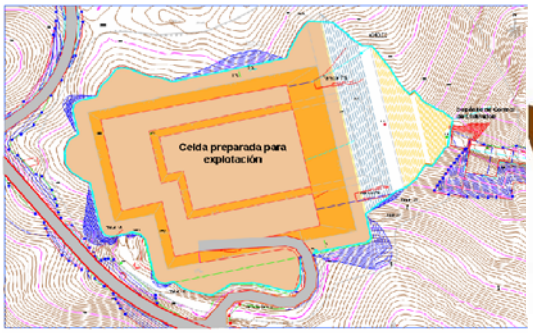


Figure 3. General view of the cell 29

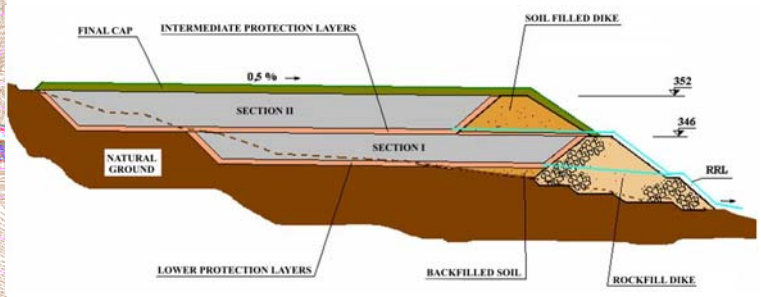


Figure 4. Longitudinal view of the cell 29

Treatment and conditioning building

The Technologic building, the functions associated to this building are: Reception and unloading of the vehicles of transport, Identification and control of the different waste, Temporary Storage of the waste, Classification of the waste for treatment and/or final storage, internal movements of the waste in the building, Stabilization of the waste that require it by means of the addition of a hydraulic mortar, Storage of the necessary elements for the manufacture of the hydraulic mortar, backfilling the gap into containers with metallic waste inside. The building will be 50.4m length; 12.40m wide; and 8.5m height.

Figure 5. Treatment and Conditioning building

OPERATION

Since October 2008 the first cell is under operation.
The waste which is delivered for storage is transported in handling units, drums, big-bags, metal containers, and can be send directly to the cell or stored temporary in the treatment and conditioning building to be classified and checked before conditioning, if required.

The exploitation of each section of the cell consists in the ordered accumulation of the waste according to the morphology of its handling units, always with the goal of maximising the use of space and achieving the greatest stability of the pile until the crown of the storage facility is reached.

Due to the extent of the surface in each section and in order to encourage good control, the waste is placed in longitudinal strips, called exploitation lines. The front of the exploitation line is approximately 20 metres wide and is advanced under light shelter which stretch over the whole line. This will minimize the quantity of the potentially contaminated leachates to be treated.

The waste is taken to the exploitation line in trucks suitable for its transport and is placed in position using a crane. This crane deposits the waste in a stable pile up to the capacity of the bottom and the height of the crown which was marked previously. During the storage operation a covering soil is spread over the surface of the waste to backfill the gaps between the disposal units. When the exploitation line is full, 300 mm of soil is compacted over the waste to form a secure base on which the truck can move to place the new batch of waste.

When a exploitation line is finished, the intermediate protection layer is placed, after that the light shelter will be dismantled and moved to the following line, beginning the process again and which will be repeated successively until the corresponding section is filled.

Due to the very low dose rate of this type of waste the storage techniques are simple and allow direct handling by the operators.

Figure 6. General view of a disposal cell

Figure 7. waste handling

Figure 8. General view of the Light Shelter

Figure 9. Internal view of the Light Shelter

CONCLUSION

The project of complementary installation for the storage of the very low radioactive activity waste (VLLW) in the Cabril, is the consequence of the Spanish requirements for waste management. In order to “not to squander the important assets that for the Country represent the Cabril storage capacity. Therefore, the Government is urged from a technological perspective to implement in the Cabril less complicated complementary facilities to store the very low intensity radioactive waste".

The new very low level waste disposal is integrated at El Cabril in all aspect: site, organization, infrastructures, impact, etc. For the definitive storage of the VLLW a technical solution based on multiple barriers, establishment of a period of monitoring, implantation of a network of collection of the possible infiltrations, and using an agreed technology commensurate with the type and risk of the waste stream is the object of this project.

REFERENCES

1. El Cabril LILW operation license of 5 de Octubre de 2001.
2. El Cabril VLLW design modification authorization in july 2008.
3. Basic criteria for low level waste disposal facilities approved by the Spanish safety authority, Consejo de Seguridad Nuclear (CSN).
4. Regulations governing disposal facilities for non-radioactive hazardous waste approved by Royal Decree in 2001.
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