THE TRANSPORT OF LOW AND INTERMEDIATE LEVEL RADIOACTIVE WASTES FROM NUCLEAR FACILITIES IN SPAIN

C. Enríquez Marchal

ENRESA, Emilio Vargas, 7, 2843-Madrid, España

INTRODUCTION

In accordance with the Nuclear Energy act of 1964, the Ministry of Industry is the body having the capacity to legislate on any subject relating to nuclear energy, the Nuclear Safety Council being the regulatory authority providing advisory services in relation to such matters, via the aforementioned Ministry.

Activities relating to the transport of radioactive materials, among them low and intermediate level wastes, are regulated by the Ministry of Industry and inspected by the Nuclear Safety Council in accordance with recommendations by the United Nations and with the applicable national and international regulations.

ENRESA was created by Royal Decree on 4th July 1984, its specific function being radioactive waste management.

This management function involves tracking of the wastes from generation up to disposal, including the interfaces of conditioning and transport, along with disposal facility site selection and construction.

The function may be sub-divided as regards courses of action into the following categories:

- Low and intermediate level wastes.
- High level wastes.
- Decommissioning and closure of facilities.

SITUATION OF THE FACILITIES

There are currently 11 facilities generating low and intermediate level radioactive wastes in Spain, distributed as follows:

- 9 operating nuclear power plants.
- 1 nuclear power plant in decommissionig.
- 1 nuclear fuel manufacturing facility.

Most of these facilities are located in the northern half of the Iberian Peninsula, while the "El Cabril" waste disposal facility is in the south. This means that the distances between the different nuclear facilities and the "El Cabril" centre range from 350 km, in the case of Almaraz NPP, and 950 km, in the case of Ascó NPP.

Although the existing rail infrastructure was insufficient for the transport of low and intermediate level radioactive wastes - only one of the nuclear installations has its own line and the nearest unloading point to the "El Cabril" centre is some 50 kilometres away - ENRESA initiated a feasibility study in conjunction with the Spanish national rail company RENFE in order to perform this transport by a bimodal system (road-rail-road).

The final conclusion of this study indicated that the system was not feasible for economic reasons, since the total investments in rail infrastructure increased the costs of transport by 100%.

ACCEPTANCE OF WASTE PACKAGES

In accordance with the design and requirements of the Disposal Facility, ENRESA has to study the waste packages produced, such that they be acceptable for storage at the site.

A distinction may be made in this acceptance process between two different courses of action to be taken prior to any delivery of waste packages, these depending on the type of package in question:

NON-TYPIFIED WASTE PACKAGES

This group includes waste packages produced prior to the entry into force of the stipulations of the technical annexes to the contract signed between ENRESA and each waste producer. In this case the acceptance process is made up of the following phases:

- Documentary study.
- Specific waste package checks.
- Tests for waste package compliance with the ADR requirements.
- Drawing up of an acceptance dossier including the following documentation.
- List or inventory of the waste packages affected.
- Information on the packages.
- Technical judgement justifying acceptance.

TYPIFIED WASTE PACKAGES

This groups includes waste packages produced after the entry into force of the stipulations of the technical annexes to the contract signed between ENRESA and each waste producer.

In this case the acceptance process includes three parts:

- **Document describing the package:** This document, sent by the waste producer, describes the package manufacturing process and must be approved by ENRESA.

- **Characterization protocol:** This document defines the waste packages and samples to be tested and the chemical and radiochemical variables to be determined, and includes the test results. It also includes the ADR tests to be performed on the final packages.
- **Interpretation of results and acceptance:**

CHARACTERISTICS OF THE DISPOSAL FACILITY

The "El Cabril" disposal facility is located in the province of Córdoba, in the municipal area of Hornachuelos. This facility is of the surface disposal type and has a capacity for 35,000 ^{m3}. The disposal system is based on the three habitual geological, engineered and physical-chemical barriers. The novelty of this facility, in comparison with others already existing, consists of the use of a concrete storage container with a capacity for 18 packages of 220 litres or 30 pellets arising from the process of supercompactation carried out at the "El Cabril" facilities themselves.

Once filled with wastes, these containers are backfilled with cement mortar, forming packages of ADR type A, which are subsequently stored in the corresponding structures.

The facility has three unloading sheds, which are used depending on the dose of the waste packages and the process to be applied to each.

- **Compactable wastes shed:** This shed is used to unload vehicles transporting packages containing compactable wastes with a contact dose rate of less than 2 mSv/h. This shed is annexed to the supercompacter, and unloading of the packages is accomplished using the feed conveyor of this component.

- **Low irradiating wastes shed:** This shed is used for the unloading of vehicles transporting packages of wastes having a contact dose rate of less than 2mSv/h. The waste packages unloaded in this shed are placed directly in containers, which are immobilized and sealed once full.

- **Irradiating wastes shed:** This shed is used for the unloading of vehicles carrying waste packages with a contact dose rate of more than 2 mSv/h. The process applied to these packages is the same as that used in the low irradiating wastes shed.

MANAGEMENT OF TRANSPORT

This process consists of three different stages: planning of the waste packages to be removed, physical and documentary inspection of these packages, which in fact constitutes their reception, and transport to the "El Cabril" facility itself.

Given that ENRESA is directly responsible for transport, contractual delivery of the wastes by the producer occurs when the loaded vehicle leaves the producer facilities.

PLANNING OF WASTE REMOVAL

The following variables are taken into account when performing this planning:

- **Waste package inventory and acceptance status:** This includes determination of the number of packages available for removal and storage.

- **Situation of producers' storage facilities:** Depending on the degree to which the producers' storage facilities are occupied, priority is given to removal from one plant or another.

- **EL CABRIL disposal facility work schedule:** EL CABRIL operates using a methodology similar to the "just in time" approach, as a result of which the arrival of wastes must be carefully scheduled, not only as regards the quantity of the wastes but also their type: compactable, irradiating, typified, etc., such that the different chains of production, compacting, production and sealing of containers and of filling and sealing of the storage cells are not affected, and such that incoming flows are homogeneous in quantity and suitable depending on the type of package to be stored.

The combination of all the above factors provides removal volumes of the order of 8,000 packages/year. Planning itself consists of three stages:

Medium term: Every year the removal objectives for the next five years are established, including for each producer the number and type of packages to be removed from one year to the next

Short term: Every six months the number of transport events to be performed during the next year are defined, distributed on a monthly basis.

Monthly: On the 15th of every month the authorities are informed of the transport schedule for the next month, this including an express indication of the dates, timetable and routes to be used.

INSPECTION OF WASTE PACKAGES

Given that ENRESA officially receives the waste packages at the producer's facilities, there must be a guarantee that these packages meet the acceptance and reception criteria prior to removal.

For this purpose there is an inspection group in charge of checking, prior to the date of loading, that each waste package meets the established criteria both physically and as regards documentation.

In this respect, the waste producer issues to ENRESA the documentation associated with the packages, with sufficient notice prior to the day of loading. This documentation is analyzed on the basis of the acceptance criteria, and possible errors are put right before the packages are physically inspected.

One week prior to the data of transport, an ENRESA inspector visits the producer's facilities, verifying compliance with the waste package reception criteria. On completion of this process, and if there are no discrepancies, the load is ready for transport.

Periodically, on the date of loading, ENRESA sends an inspector to the producer's facilities; this inspector checks for compliance by the subcontractor of the conditions established by ENRESA for transport.

TRANSPORT

Although directly responsible for the transport of low and intermediate level wastes, ENRESA does not itself possess a fleet of vehicles for this purpose. To this end it establishes contracts with companies specializing in this type of activity, which are subjected to periodic processes of evaluation and required to meet the quality assurance programs applied to personnel training, maintenance of the equipment and organization of the company.

In particular, and apart from the generic training on class 7 transport that the drivers possess according to ADR, ENRESA establishes specific training programs on the transport of wastes, which are periodically delivered to the personnel of the subcontracted companies.

The equipment used for the transport of wastes from nuclear facilities consists of a prime-mover truck and its corresponding trailer. The technical characteristics of the prime mover are as follows:

- Maximum age: 8 years.
- Minimum power: 380 HP.
- A.B.S.
- Tachometer (graphic record of travelling and stopping periods and of speeds reached).
- ADR class 7 certificate.

The vehicle is required also to have a mobile telephone, in order to be permanently accessible for contact throughout its journey. In order to guarantee the perfect conditions of these vehicles, which are not the property of ENRESA, the transport company has a quality system implemented in accordance with the ISO-9001 standard, this being open to audit at any time by ENRESA.

ENRESA is the owner of the trailers, and currently has eleven of six different types, depending on the dose rate of the packages to be transported and their situation as regards the transport regulations. All of these have the following standard equipment:

- Pneumatic suspension.
- Signalling and beacon equipment.
- Dose rate and contamination measuring equipment.

2 DRUM TRANSPORT EQUIPMENT

This equipment consists of a 20 foot-long platform with a stowage structure for two industrial packages type II, each for the transport of one 220-litre drum, with a 10 cm-thick cast iron shielding. This equipment is habitually used for the transport of drums of conditioned wastes destined for the EL CABRIL facility's characterization laboratory. The opening device is individual and manual. ENRESA has one unit of these characteristics.

45/60 DRUM TRANSPORT EQUIPMENT

This equipment is mounted on a 40 foot-long platform. The variation in the load capacity of this trailer depends on the weight of the drums to be transported and on whether they contain compactable solid wastes - with an average weight per package of 140 kg - or conditioned wastes - average weight 430 kg. In the first such case the towing capacity is for sixty 220 litre drums, and in the second forty-five drums of the same size. In either case the maximum contact dose rate will be 2 mSv/h and the maximum thickness of the shielding 3 cm of steel on the vertical surfaces. There is a hydraulic opening/closing system by two longitudinal covers allowing for vertical loading by cranes. Stowage of the packages is accomplished manually.

Optionally, loading of the trailer may be carried out from the rear by fork-lift truck, there being two doors providing access from this part of the vehicle. ENRESA has four units of this type.

27 DRUM TRANSPORT EQUIPMENT

This equipment, mounted on a 30 foot-long platform, is designed for the transport of 220-litre drums with a contact dose rate of between 2 and 5 mSv/h, for which it has shielding on all the surfaces, ranging in thickness from 3 cm of steel for the covers and 10 cm of steel for the vertical surface closest to the load compartment. Like the previous equipment, this has a hydraulic opening/closing system by two longitudinal covers allowing for loading/unloading vertically by cranes. It also has a system for the collection of rainwater, for checking and subsequent drainage, and a grid in the load compartment designed to prevent manual stowage. ENRESA currently has two units of this type.

18 DRUM TRANSPORT EQUIPMENT

This equipment is mounted on a 30 foot-long platform and is designed for the transport of 220-litre drums with a contact dose rate of between 5 and 9.99 mSv/h, for which it has shielding on all the surfaces, ranging in thickness from 4 cm of steel for the covers and 12 cm of steel for the transverse surface closest to the driver's compartment. Like the previous equipment, this has a hydraulic opening/closing system by two covers allowing for loading/unloading vertically by cranes, a system for the collection of rainwater and a loading grid. ENRESA has 1 trailer of this type.

9 DRUM TRANSPORT EQUIPMENT

This equipment, which is mounted on a 30 foot-long platform, incorporates the novelty of not only having shielding in accordance with the transport regulations, but of the load compartment itself being a industrial package type II, in which respect it has passed the corresponding tests. The equipment is designed for the transport of nine 220-litre drums with contact dose rates higher than 10 mSv/h, for which it has shielding on all the surfaces, ranging in thickness from 9 to 16 cm of steel. The opening/closing system is by means of a single sliding cover operated by an electric motor, and there is a loading grid inside the load compartment. ENRESA currently has 2 units of this type.

TRANSPORT EQUIPMENT FOR 45 DRUMS NOT SUBJECTED TO ADR TESTING

Most radioactive waste drums meet the specific requirements applicable to industrial packages type II and, unless the dose rate exceeds 10 mSv/h, do not need an overpackages making up the package itself. Nevertheless, there are some wastes which, because of their nature or of the condition of the drum, cannot be considered as a packages, for which reason ENRESA has designed a ISO container which, in accordance with the ADR, may be considered a industrial package type II, due to its meeting the requirements of standard ISO-1496. Consequently, the drums transported inside this container do not have to meet the testing requirements for this type of package.

The equipment measures 40 feet in length and is equipped with three manually operated upper opening/closing doors for loading and unloading; there is also a grid on the floor to prevent manual stowage. No specific shielding has been considered necessary since the drums to be transported do not exceed a contact dose rate of 2 mSv/h.. ENRESA currently has one equipment unit of this type.

EMERGENCY PLANS FOR ACCIDENT EVENTS

ENRESA has in operation a contingency plan for accident events with the DIRECTORATE GENERAL FOR CIVIL DEFENCE. This plan is divided into three parts:

- **Informative :** Specifying the characteristics of and the risks associated with radioactive wastes, and the different types and characteristics of waste transport.

- **Operative:** Typifying contingencies and emergencies, the response groups involved and responsibilities of each, the available resources and action procedures and the methodology used for maintenance of the action plan (drills, training, etc.).

- **Appendices:** The following aspects are included, among others: a) Telephone directory, b) Transport routes, c) Intervention dockets.