

THE FRENCH INTEGRATED WASTE MANAGEMENT SYSTEM

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ABSTRACT

To optimize the long term disposal of wastes, both technologically and economically, ANDRA developed an integrated waste management system and established a quality assurance framework for each step of waste management from waste generation to its final disposal.

The system covers all phases of waste processing, transportation and disposal activities.

By integrating each step of waste management, public confidence can also be nurtured, which is an important component of the system.

This system has been in use for several years for Low Level Wastes and is being implemented progressively for High Level Wastes ; for this reason this paper is more concerned with LLW disposal.

ANDRA'S RESPONSIBILITY

ANDRA (Agence Nationale pour la gestion des Déchets RADioactifs) was created in 1979 by an interministerial decree within the French Atomic Energy Commission (CEA) but a recent waste act of December 30, 1991 and a more recent decree of December 30, 1992 turned ANDRA into a public service company controlled by the Ministries of the Environment and of Industry and Research.

ANDRA was given the responsibility for the management of waste and therefore was given the authority to establish waste acceptance criteria and disposal methods which will provide compliance with the applicable basic safety guidelines.

ANDRA was also given authority to verify compliance with specifications.

Specifications and waste acceptance criteria, the waste acceptance process and the quality assurance program are therefore key components that allow ANDRA to fulfill its mission.

WASTE ACCEPTANCE CRITERIA

The first step of the integrated waste management system is to define waste acceptance criteria for disposal and to verify that these are met.

In accordance with government regulation like fundamental safety rules for surface or near surface LLW disposal, which are law in France, and like technical requirements about disposal sites, technical specifications have been developed by ANDRA about three primary waste acceptance criteria : the waste packages must be within the limits of mass specific activity levels, must be in a stabilized waste form and the radioactivity must be contained or immobilized in the package.

Other LLW waste acceptance criteria must be met such as :

- no free-standing liquids,
- no organic liquids or oil even absorbed,
- no chemical exothermic reaction,
- no biological hazardous waste,
- no pyrophorics,
- amount of chelating agents as low as possible,
- the amount of fissile material must not exceed 0,1 gram of fissile material per liter of waste form.

WASTE ACCEPTANCE PROCESS

A waste acceptance process has been enforced by ANDRA, it includes a process acceptance procedure.

The waste generator must therefore submit a "process book" to ANDRA for each waste form which gives a description of the waste stream and detailed information on the process design, they must submit an "activity evaluation book" too which specifies the method used to determine the activity level of the waste and its performances. The generator gives information on the quality assurance program to be implemented, both for determining the activity of the waste stream and for waste processing.

The waste generator has also to provide a characterization tests program on the waste form and on the waste package which is reviewed by ANDRA before carrying out the characterization tests. The whole waste acceptance file is evaluated by ANDRA and the tests carried out by the waste generator before final approval is given to accept the waste processing technic and the waste package.

To allow waste generator to meet ANDRA requirements, ANDRA has developed tools such as technical guidelines for "process books" and "activity evaluation books" and defined 11 standard Waste Packages which can be accepted and to which all the waste packages should conform.

The technical specifications relative to waste thereby accepted for disposal are recorded in a "Catalogue of Specifications", maintained by ANDRA as a reference manual, which include criteria on the type of the waste, the types and concentrations of radionuclides, the embedding material, the degree of immobilization achieved by the waste generator, the degree of immobilization to be performed at the disposal facility, the type of disposal method required etc.

QUALITY ASSURANCE AND CONTROL PROGRAM

The integrated waste management system requires complete control of the waste from the moment it is generated to its final disposal. A comprehensive quality assurance and control program is therefore a central feature of the system, and includes specifications for waste processing, packaging and labeling, requirements for transportation and acceptance at the disposal facility, and criteria for the siting, design, construction and operation of the disposal facility. Quality is conformity to requirements. The comprehensive quality assurance program assures that the prescribed actions in the

waste acceptance process are carried out and they assure that the specifications and waste acceptance criteria are met.

INSPECTION

ANDRA is responsible for verifying the compliance to quality assurance criteria of the waste processing conditions at the generator's facilities and for compliance to specifications of waste conditioning process and final waste form.

To ensure that the waste received at the disposal facility conforms to the performance developed during the process acceptance phase, periodic inspections and quality assurance audits are performed by ANDRA. Such inspections and audits occur before the beginning of the waste generation to verify that quality assurance procedures have been implemented and during all the waste generation, to verify that methods of determining the composition and activity levels of the waste stream follow pre-established quality assurance procedures.

Inspections are also performed on waste processing, from the beginning of the full-scale production, as well as prior to shipment and upon receipt at the disposal facility.

In addition, specific and extensive tests are carried out by ANDRA on selected packages from each type of waste form after their arrival at the disposal to confirm that specifications are met: these tests concern physical and mechanical properties of the waste form or of the waste package as well as the activity content.

TRANSPORTATION

Transportation, also a part of integrated waste management, must be carried out to ensure that international regulations concerning dose rates and non-fixed contamination are respected. In addition, waste transportation must be managed so that waste from many different locations can be delivered to one central receiving station near the disposal facility in a timely manner, while tracking each package from origin to delivery and providing detailed information on its contents.

Waste packages are transported either by rail or by road accompanied by a shipment manifest which provides identification and type of each container. The manifest is checked for accuracy through physical monitoring and other means at the points of origin and delivery. Upon acceptance of the waste at the disposal facility, the data from the manifest are entered into a computerized tracking system.

WASTE TRACKING

Another major component to the integrated waste management system therefore involves tracking the waste from the moment it is produced through its final disposal: throughout each step of waste management outlined above, as well as once the waste is disposed of, thorough records must be kept on the waste, including its activity level and form and its final location in the disposal facility.

For this purpose, ANDRA set up a computer network linking the waste generators, disposal facilities and its own headquarters.

The computerized waste package tracking system serves to verify the compliance of waste to some specifications (physical characteristics of the waste, dimensions of the package, activity, spectrum, etc) prior to shipment, to coordinate shipment schedules, to track waste during shipment, and to identify the location of each container of waste within the disposal facility.

Each waste package is labelled with computer codes which identify its main characteristics (composition, form, activity levels, container, etc.), these codes are entered into the tracking system prior to shipment for comparison with the waste acceptance criteria in the data base. Once acceptability for disposal is verified, the system can then follow the movements of that particular package of waste until it is placed in a disposal unit and record its characteristics such as location, radioactivity level, etc.

ADDITIONAL LLW PROCESSING

Some waste generators prefer to ship dry active waste that has not been immobilized through compaction and/or grouting to the disposal facility rather than investing in onsite processing facilities. Then this waste will be compacted and/or grouted by ANDRA in containers at the disposal facility for an additional fee. The resulting product must then be accepted for disposal through a process acceptance procedure.

WASTE GENERATION FORECASTS

Long-term forecasting of the types and amounts of waste requiring disposal is needed to determine the overall disposal facility capacity requirements and its annual receiving capability. The forecasts, which are revised annually based on actual generating statistics, provide information necessary for the smooth management of disposal operations, such as the waste source, activity levels, form and packaging, as well as the type of disposal method that will be required.

CONCLUSIONS

The integrated waste management system is the result of 24 years of practical operating experience at the Centre de la Manche disposal facility. It was designed to satisfy stringent French safety requirements and also to demonstrate to the public that radioactive waste can be safely managed over the long term. At the same time, it responds to the needs of the French nuclear energy program for cost-effective disposal services.

The integrated waste management system provides the framework needed to coordinate waste processing and disposal activities, while seeking and adopting ever-improved waste forms and disposal methods.

As progress is made in improving waste form, disposal structures can adjust in modular fashion to such improvements, but the fundamental principle of radioactive containment through the use of *reliable barriers* remains the same.