

## CONDITIONING OF DEGRADATED PACKAGES WITH RADIOACTIVE WASTE

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### ABSTRACT

The development of the nuclear techniques in Romania and the commissioning of the WWR-S research reactor belonging to the Institute of Physics and Nuclear Engineering -(NIPNE) demand to deal with the storage and disposal of radioactive waste. The institute decided to store the radioactive waste inside a building that belonged to the Defense of Capital City System (the Army) called "Fort" which is located on the Magurele site. There are still about 800 packages containing cement conditioned radioactive in the storage facility of NIPNE which need to be repackaged, because they are in an advanced state of degradation. The new package obtained the regulatory design approval. It consists in an internal basket in which the degraded package are placed, a cement containment system, and an external cask in which the basket are placed and conditioned with the cement.

### INTRODUCTION

The development of the nuclear techniques in Romania and the commissioning of the WWR-S research reactor belonging to the Institute of Physics and Nuclear Engineering -(NIPNE) demand to deal with the storage and disposal of radioactive waste. The institute decided to store the radioactive waste inside a building that belonged to the Defense of Capital City System (the Army) called "Fort" which is located on the Magurele site. This building was used by the institute as a storage facility for radioactive waste and sealed spent sources since the 1950's. At that time sealed sources were imported by Romania and consisted of Ra-226 and Cs-137 sources. The first attempt to decommission the Fort building was made in 1975, the same year the Radioactive Waste Treatment Plant RWTP was commissioned. A large quantity of wooden radioactive waste stored in the surrounding area was incinerated; the other radioactive waste and the SSRS remained in the Fort building. After the adjacent area was cleared, all windows and doors of the Fort building were closed.

In 1977 the Fort building was broken and a lot of containers, some containing SSRS, were spread in the surrounding area. After this event NIPNE decided to decommission the Fort building and to transfer all radioactive waste and SSRS to the RWTP. Every procedure during this operation phase was recorded as well as the present radioactive waste, but still a lot of the data were lost. The decommissioning process resulted in about 1500 packages containing the radioactive waste and the SSRS conditioned in cement [1].

RWTP has maintained a separate record of the radioactive waste and SSRS since it's commissioning but it is incomplete, the missing data are the activities of the radwaste.

A part of the total number of the packages could be transferred to disposal facility because the limits of the activity per package established by regulatory authority allowed this. There are still about 800 packages containing cement conditioned radioactive in the storage facility of the RWTP which need to be repackaged, because they are in an advanced state of degradation. The figure 1 shows a sample of degraded package.



Fig. 1 Sample of degraded package

Packages were continuously degraded and their contents can not be characterized. The decision was made to repackage the content of each package into a larger drum. After performing of this task the activity and radionuclide will be measured.

The first model of package was not approved by regulatory authority because the matrix cement stability as well as the mechanical stability of the drum could not be proved.

The second model of packages has got the type approval issued by regulatory authority.

The packages are in an advanced state of degradation and can not be moved. Almost all operations and procedures are made on the storage site and it is necessary to take special radiation protection measures. Piece by piece of the degraded packages was moved into a metallic basket, which is a part of the final package. The basket is put into a larger drum and then cemented. The procedure of this process will be present. The packages, which meet the acceptance criteria, will be transferred to the National Repository for Radioactive Waste-NRRW. It is expected that almost all packages to be transferred to NRRW.

## DESIGN AND CONSTRUCTION

Type A packages for the transport of conditioned radioactive waste are identified on the code CA-420-X where: CA - means type A package;  
420 - means volume in liters  
X - means construction materials OC- carbon steel, OI stainless steel.

The package consists of the three main components:

- basket
- concrete containment system
- external cask.

The basket is a cylindrical, metallic structure made of metallic net equipped with two lids. The main aim of the basket is to retain the radioactive content, which is the degraded package. Another function of the basket is to assure the stability of the concrete containment system. The complete integrity of the waste package should be assured during the conditioning process, interim storage, transport and emplacement in a repository

The external cask is a shielding for the transport and handling operation. It is made of metallic sheet and it is protected against the corrosion on internal. For extending its life the cask is equipped with the watertight fittings. The figure no. 2 shows the design of the package.

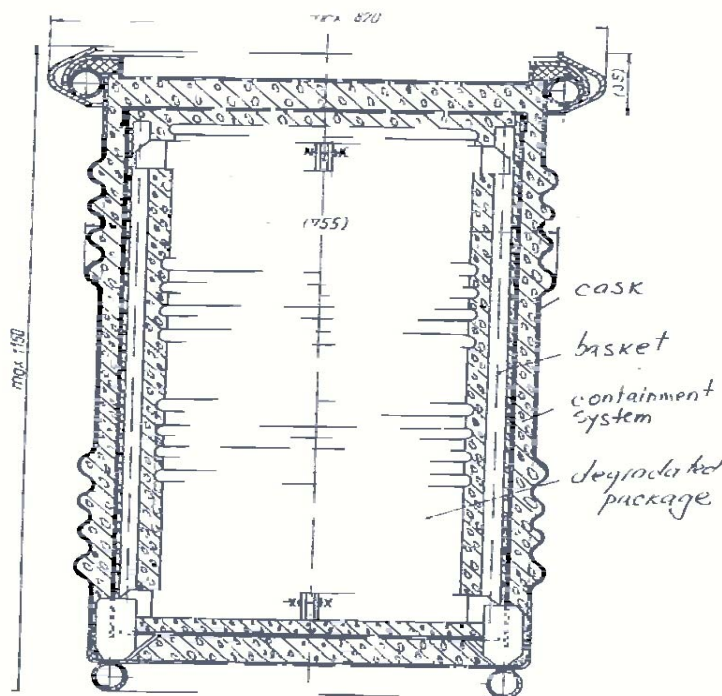


Fig. 2 The design of the package

## REGULATORY REQUIREMENTS

The package must fully meet the requirements of the transport and disposal regulations. The package design was approved by competent authority and it attributed to the design an identification mark. The identification mark attributed by competent authority to the package is D03/2001.

## WASTE CHARACTERISTIC

The origin of the radioactive waste is unknown. The procedure for conditioning was not a rigorous one, and it permitted to place the waste in the drums in different form, which are not compatible with the repository facility. For example, there were placed in the drums the liquid wastes packaged in the glass container, paper and combustible waste non treated by burning, wastes compactable placed non compactable which permitted to created a lot of air gaps. Over the time the liquid and air in the packages contributed to the degrade of the metallic cask and the cement containment system. The packages were placed overlapped in the storage facility of the Radioactive Waste Treatment Plant. The liquid dropped from one to other and in short time a lot of packages become degraded and unacceptable for the transport to the repository. There are about 800 packages like these in the storage facility. The competent authority imposed the repackaging and transfer them to the repository till the end of the year 2002. The radionuclide inventory is unknown but it is estimated to the following radionuclides:  $^{137}\text{Cs}$  -  $10^{12}$  Bq,  $^{226}\text{Ra}$  -  $10^{13}$  Bq,  $^{60}\text{Co}$  -  $10^{14}$  Bq.

## THE MANAGEMENT OF THE DEGRADATED PACKAGES

The management of the degraded packages consists of:

- Preparing of the work area
- Preparing of the degraded packages
- Conditioning of the degraded packages:
  - Handling of the degraded packages
  - Placed of the degraded packages in the basket
  - Transport from the stored place to the conditioning area
  - Conditioning in cement
  - Storing of the new packages
  - External dose, surface contamination and activity radionuclides measurements
  - Mark and labeling of the packages
  - Records according the quality assurance system
- Transport to the repository.

The packages are handled and transported to the conditioning area with the carrying device. Then they are placed in the cask and conditioned by cementation. The packages are then vibrated in order to remove all the air gaps. The activity measurement is performed by the special spectrometer installation.

The figure no.3 shows a sample of degraded package into the basket. The figure no. 4 shows a sample of a package ready to transferr to the repository.



Fig. 3 Sample of degraded package inside the basket



Fig. 4 Sample of conditioned package

If the content activity are grater than the accepted level for the repository Baita Bihor the packages are kept into the storage facility until the activity decreases in the acceptable limits. The storage facility is not a modern one and there is the risk that the new packages to become in short time degraded.

After a period of 28 days the packages can be transported and disposed to the repository.

## **CONCLUSIONS**

The degraded packages have to be repackaged an disposed to the National Radioactive Waste Repository Baita Bihol untill the end of the year 2002. The cost of a package reпреzented by cost of materials and a manual labour is about 800USD it is no incuded the disposal activity.

## **REFERENCES**

1. Proc. Int. Symp. WM'01, Tucson Arizona, USA, February 25-March 2 2001.
2. Dogaru, Gh., Quality Assurance System for collection and check the radioactive waste, ICEM'01.