SAFETY OF LEGACY RADIOACTIVE WASTE

Gheorghe C. Dogaru, Felicia Dragolici

National Institute of Reserch&Development for Physics and Nuclear Engineering – Horia Hulubei, Magurele, Ilfov, Romania

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 named "Fort" which is located on the Magurele site. About 5000 packages were produced and transferred to the storage facility of radioactive waste treatment plant after decommissioning of Fort building. In the mean time a repository was commissioned and the most part of the waste has been disposed. There still were remained about 800 packages which, in time, became corroded. A huge effort was put in place in order to repack the waste for disposal. At the end of 2008, the whole amount of legacy waste have been treated, and disposed or stored.
The paper describes the management of legacy radioactive waste from the storage facility of Radioactive Waste Treatment Plant.

1. INTRODUCTION

About 5000 packages with radioactive waste were produced and transferred to the **storage facility after decommissioning of "Fort" building.**
"Fort" building belonged to the Defense of Capital City System and it served as storage facility for radioactive waste produced by operation of WWR-S research reactor belonging to the Institute of Physics and Nuclear Engineering -(NIPNE), from radioisotopes production as well as from import. Spent sealed radioactive sources, empty contaminated containers, wooden radioactive waste, low specific activity radioactive waste, contaminated waste as well as radioactive waste from operation of WWR-S research reactor have been conditioned into cement based waste form [1, 2]. No records on the waste as well as on the packages were done. In order to protect the workers, some high activity spent sealed sources and neutron sources have been removed, stored in a distinct place and shielded. All any others waste has been conditioned into cement, the packages marked and transferred to storage facility.

After the commissioning of the repository, many packages have been transferred and disposed as they were. The waste acceptance criteria established by regulatory authority allowed high activity limits for disposal without any restriction on the radionuclide. In the mean time, new requirements on the transport of radioactive materials have been issued and the transfer and disposal of packages was stopped. In order to get type approval for transport and disposal packages the institute started to develop procedures for verification of compliance with transport regulations as well as with new waste acceptance criteria imposed by regulatory authority for current waste. For stored waste, no action was taken. In 2000, in the storage facilities of institute there still were about 800 packages containing cement conditioned radioactive waste in an advanced state of degradation, declared by authorities as "legacy waste". At the end of 2008, the whole amount of legacy waste which met waste acceptance criteria has been conditioned and transferred to disposal facility [3, 4].

2. IDENTIFICATION OF LEGACY RADIOACTIVE WASTE

The legacy waste intended to be managed were staked in two of the five rooms of storage facility. They were in an advance corroded state and handling procedures as well as the conditioning techniques were established prior to start their management. One of the major challenge consisted of unknowing of the status of packages located behind the first row.

During the management of legacy waste campaign were identified: radium spent radioactive sources, containers containing other than radium spent sealed radioactive sources, 73 packages containing low specific activity waste consist of thorium scrap allow, 30 larger packages (316 L) containing conditioned waste in cement, packages with activity lower than activity limit for disposal, packages with activity higher than activity limit for disposal. Some unconditioned waste consists of high contaminated wood which could not be incinerated as well as large metallic pieces were identified. The figure 1 shows samples of corroded packages in storage facility.

Fig.1 Corroded packages

3. MANAGEMENT OF LEGACY WASTE

3.1 Description of the re-packaging procedure

In order to comply with transport regulations as well as with new waste acceptance criteria for disposal, a larger package used for re-conditioning of corroded drums has been developed [2]. In the figure 2 are shown the packages ready for transport.
The larger package used for re-conditioning of corroded packages consists of the three main components: basket, concrete containment system, external cask. The volume of the packaging is 420L.
The basket is a cylindrical, metallic net equipped whit two lids. The main aim of the basket is to retain the radioactive content as well as to assure the stability of the concrete containment system. The basket with radiological content, in this case the corroded package, is centrally placed into the external cask. The external cask is a metallic shield designed for the transport and handling operation.
Due to the specific risk a designated area for handling as well as for repackaging were arranged, just near the storage facility. The corroded packages are handled and transported to the conditioning area with the carrying device, one by one. The corroded packages are placed in the basket and the basket is placed into the external metallic cask.

Fig.2 420 L packages ready for transport

New techniques for identification as well as estimation of radiological content were developed. These techniques consider the possibility to exist sealed radioactive sources in containers.
The radiological characterization of the packages with radioactive waste consists of global gamma activity measurement, dose rate to the any point on surface of the package as well as the surface contamination. The global gamma activity of the packages is measured prior the conditioning into cement.
After the radiological characterization, the concrete containment is made, filling with cement grout the space between the external cask and basket. Each new package bears a unique identification number. The results of radiological characterization as well as the weight of each package are recorded.
After 28 days for solidification of cement the packages are weighted, and the dose rate at any point on the surface as well as surface contamination is determined. The packages are marked and labeled for transport.

3.2 Management of spent sealed radioactive sources and empty containers

The spent sealed radioactive sources which have not met waste acceptance criteria are stored into storage packaging type EcoL-rad.

Most of the spent sealed radioactive sources consisted of radium source. The long term conditioning of radium spent sealed sourced is based on encapsulation into stainless steal capsule and placing of these capsules into a shielding. The radiological characterizations as well as conditioning of sources have been performed into a special arranged workshop. Equipped with radiological characterization devices, local ventilation system, welding machine, testing devices. For protection of personnel the existing radiation protection measures had to be improved based on the radium hazards. Step by step working procedures were developed and implemented for this specific activity.

The preparation of packaging as well as of the stainless steal capsule followed the approved technical specifications. Different types of stainless steal capsule for different size of sealed sources were created and each of them was marked and the content was recorded.

Three shielding packaging was manufactured for different type of stainless capsule but only one is filled with radium sources. Each location performed into packaging was permanently marked on the packaging. According to the procedure each capsule was permanently marked with: a unique identification number, acronyms of "Ra-266", radioactivity sign and "IFIN-HH" logo. The content of each capsule as well as the location of capsule into the shielding packaging were recorded.

The techniques for long term conditioning of alpha bearing sources including Am-241 contaminated wastes are similarly with long term conditioning techniques for radium. Alpha bearing sources including the sources from dismantling of fire detectors are conditioned into stainless steal capsules dimensionally designed for them.

About 80,000 pieces of alpha sources are collected and stored in different packaging. Due to their radiological hazard and due to their small size specific handling measures have to be taken. Each capsule was permanently marked with: a unique identification number, acronyms "Am-241", radioactivity sign and "IFIN-HH" logo. The content of each capsule as well as the location of capsule into the shielding packaging are recorded.

The empty containers have been identified and checked for contamination in order to be removed from regulatory control. A clearance procedure has been developed and it was approved by regulatory authority.

After the control of contamination both on internal and external surface an independent radiological control is performed by the health department of institute. The containers which could not be opened or they were contaminated are considered radioactive waste. For their management current procedure is applied, they are conditioned for disposal or stored on site.

3.3 Management of legacy waste which met waste acceptance criteria for disposal

After radiological characterization 377 packages met waste criteria for disposal into National Radioactive Waste Repository located at Baita Bihor. They have been prepared for transport and shipped to repository.

In the storage facility has been found about 37 larger packages (316 L) some of them corroded and some in a well state. The larger packages were prepared before 1990 for reconditioning of corroded packages and their shipment by rail. The loading into the train was performed on a platform arranged in the institute and downloading was performed at a rail station located near repository. The download rail platform was under CNU Bihor branch administration and it was used also for loading of uranium ore extracted for Bihor area. After 1990 CNU Bihor branch stopped its extracting of uranium ore activity and the rail station operation, as well. These larger packages had not been qualified as transport packages and, because there was no any possibility to transport them by rail, the preparation of such packages has been stopped. There were still remained into the storage these 37 packages which in the mean time, some of them become corroded. Repackaging of them into 420L packaging is no dimensionally possible, so a special arrangement of them to the repository was arranged.

The external surface of the packages was painted, and in case that was not possible due to corrosion some remediation were done. The global activity of each package was measured and recorded. Each package was checked, prepared for transport, marked and labeled.

Thorium scrap alloy waste was collected many years ago from aeronautic industry. According to the national regulations the thorium scrap waste is considered radioactive waste. For the management of low specific activity waste arrangements with National Uranium Company – Feldioara branch were made and agreed with regulatory authority. National Uranium Company – Feldioara branch is licensed for storage of uranium contaminated waste from fuel fabrication plant. The packages with low specific activity waste consisted of thorium scrap alloy were arranged for transport by coating with plastic in order to avoid any lose of material. The entire quantity was transported to CNU Feldioara branch in three shipments.

3.4 Management of legacy waste which does not met waste acceptance criteria for disposal

After radiological characterization, about 11 packages have not met waste acceptance criteria exceeding the activity limits for disposal into National Radioactive Waste Repository. These packages are still stored into storage facility waiting for further management. A deep characterization of each package is in plan to be performed, in order to identify hot spots and removed them from packages.

The large contaminated wooden and metallic pieces were identified, and placed into a distinct area into the storage facility. The pieces were shielded; the place was labeled and marked.

The containers which can not be opened, contaminated containers are stored, for them current management procedure is applicable.

Regular control of contamination into the storage facility is performed.

4. CONCLUSIONS

After decommissioning of Fort building about 5000 packages with radioactive waste were produced and transferred to the storage facility. A large amount of packages have been transferred and disposed of to repository, but at the end of 2000 there were still about 800 packages containing cement conditioned radioactive waste in an advanced state of degradation, declared by authorities as "legacy waste".

During the management of legacy waste campaign were identified: radium spent radioactive sources, containers containing other than radium spent sealed radioactive sources, packages containing low specific activity waste consist of thorium scrap allow, 30 larger packages (316 L), packages with activity lower than activity limit for disposal, packages with activity higher than activity limit for disposal, empty containers, large contaminate wooden and metallic pieces.

At the end of 2008, the whole amount of legacy waste which met the waste acceptance criteria has been conditioned and transferred to disposal facility.

Empty containers, large contaminated pieces, spent sealed sources as well as the packages which have not meet waste acceptance criteria for disposal are still stored in safely condition in storage facility.

REFERENCES

[1] Dogaru, D.M., Dogaru, Gh., Relevant data on the spent sealed radioactive waste, IAEA Conference, Bordeaux, 2005

[2] Dogaru, Ghe., Conditioning of Degradated Packages with Radioactive Waste, WM'02 International Conference, Tucson, Arizona (2002)

[3] Dogaru, Gh., Dragolici, F., Rotarescu, Gh., Nicu, M., Romanian Experience in the Radium sources conditioning, WM'08, Phoenix, USA, 2008

[4] Dogaru, Gh., Dragolici, F., Nicu, M., Techniques for Long Term Conditioning and storage of Radium Sources, Nuclear 2008 International Conference, Pitesti, 2008.