

Conditioning of Radioactive Wastes Prior to Disposal; Segregation and Repackaging

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1. Introduction

We stored several types of radioactive wastes at interim storage facility of KAERI ; the combustible wastes (cloths, decontamination paper and vinyls) from Hanaro multipurpose research reactor, nuclear fuel cycle facility, RI production facility and laboratories, and the non-combustible wastes (metals and glass) dismantled and discarded from the apparatus of laboratories which deteriorated, and also the miscellaneous wastes (spent air-filters). After a segregation of these wastes as the same type, they were treated by using a proper method in order to meet both the national regulation and the waste acceptance criteria of Kyung-ju disposal site. For a safe disposal of waste drums, the waste characterization system including a scaling factor which is hard to measure special radionuclides is established completely. All data of those repackaged drums were input into an ANSIM system so that we could manage them clearly and effectively such like an easy transparent traceability. Through a decontamination of empty drums generated in a repackaging process of the stored drums, these drums can be reused or compressed to reduce their volume reduction for disposal. As a result, the space to store radioactive waste drums are secured more than before, and also the interim storage facility are maintained in a good state.

2. Treatment Procedure

2.1 Unloading, transport and classification of the stored waste drums

At the end of 2013, 11,073 drums (200L, solid wastes) generated at KAERI were stored at the interim storage facility (ISF) of KAERI. The number of combustible waste drums was 3,927 (about 35% of the total, Fig 1). To segregate these all waste drums into the same type, first of all, they were classified according to the year of generation, the facility type and the nuclide type. And then these drums were transported from the storage facility to the Radioactive Waste Treatment Facility (RWTF). At the segregation working booth of RWTF, after checked all records about waste drums, the wastes inside drum were poured on the tray. Firstly, the wetting wastes were removed from them and then were dried in a separate tray, while the non-combustible wastes (the metals, glass, soils and etc.) were also removed from them. Finally, the remained wastes (like

clothes, papers, vinyls, rubbers and plastics) were classified into the appropriate vinyl bags for repackage.

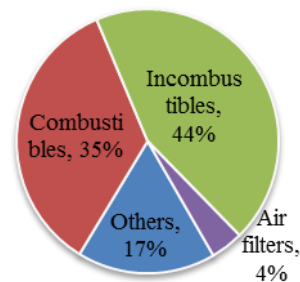


Fig 1. Distribution of stored radwastes

2.2 Sample collection

2.2.1 Purpose of sampling

The representative samples of combustible wastes were collected from the above repackaged drums according to waste type. The purpose of a collection of samples is to analyze their characterizing items (radiological and physico-chemical properties) described in the specifications of the waste acceptance criteria of disposal site.

2.2.2 Sampling instructions

When collecting the representative samples from the combustible waste drums at RWTF, the working area must be established, and the ventilation system must be operated for purging a clean air continuously. The dose rate meter must be calibrated prior to use. If there are some changes in response of the survey meter, the workers must be contact with the radiation control personnel. If founding the contamination in the survey meter during and after the measurement, the meter must be decontaminated immediately.

2.2.3 Measurement device

The survey meter to measure a dose rate is used for the very low-level combustible wastes. The readability of a weighing balance must be 0.1 kg for wastes and 0.1 g for the representative samples.

2.2.4 Procedure of sampling

After selected the drum to be taken the representative samples, all of waste history (facility name, originated

data, surface dose rate, weight and drum number and etc.) must be confirmed and recorded. The combustible waste drum was opened, and the small vinyl package bags were taken out of drum, and the wastes inside them were placed on the tray to spread out uniformly. Through a visual inspection of all of them, the existence of other combustible debris, waste containing free liquid, chelating agents, and the other substances (which is flammable, hazardous, explosive, corrosive, and ignitable) must be checked. If the corresponding wastes are present, they must be removed from the tray and kept them separately. The comparative higher contaminated wastes of all combustible wastes measured directly by the survey meter, were taken as representative samples. At this time, the decontamination papers might be taken as representative samples because they could be shown representative characteristics conservatively of all wastes. After taken the representative samples in the small vinyl bags (Fig. 2), their weight was measured. At this time, if the weight of a representative sample was under 1/200 smaller than the total weight of the wastes in drum, the above procedure must be repeated as the same manner. After marked the facility name and the sample number on the outside of vinyl bag and cleaned it, they were transferred and stored at the separate location of RWTF. Samplings of new combustible waste drums also are repeated in succession according to the above procedure.



Fig. 2. Sampling of wastes

2.3 Repacking and compression

The collected plastic bags which were contained in the repackaged drums were compressed with the small compressor simply, and then taken out them from drum, and finally were compressed by the compressor, the capacity of 60 tons. Classification, repackaging, sampling and compression work of radioactive wastes to prevent spreading out of dust to the surrounding must be carried out at the restricted and controlled working area where was installed the air purification system. At this time, the drum must be compressed in a proper compression force to prevent causing a deformation of drum (over compression force). In the process of classifying the contents (wastes), after collected the substances containing liquid such as the decontamination papers separately, they were dried in the electric dryer and then repackaged in the collection bags. As a result of such as the above treatment (classification, drying, repacking, and compressing), the volume of 3 drums were reduced to that of 1 drum.

2.4 Crushing of spent plastics

The plastic bucket (20 L) is using to transport the liquid radioactive waste from the laboratories to RWTF at KAERI. After a completion of their usage, the 4 plastic buckets were stored as a bundle in the past. For a volume reduction, the 8 plastic buckets were cut and collected in a drum, but at present the volume reduction was increased greatly due to crushing the small fragments to about 2 mm pieces (Fig. 3).



Fig. 3. Scraps of plastic after shredding

2.5 Interim storage prior to disposal

After measured the dose rate and the contamination level, and after marked the facility name, the contents, and the collection date outside drum, and after also recorded the manifests, the repackaged drums were stored at the separate and temporary storage space of RWTF. These drums will be disposed of through the analysis of radionuclides and the evaluation of total activity. As a result of such a repacking of drums, the storage space of drums were secured more than before, and the storage facility were kept in a good state against a corrosion and the radionuclides release due to the long-term storage, and also the cost of disposal will be reduced because of the high reduction of waste volume.

2.6 Marking items of disposal drums

According to the marking instructions of national regulation for the disposal of radioactive waste drum and the general requirements of waste package specified in the waste acceptance criteria of disposal site, the marking contents (such as the total activity, the number peculiar to the drum, the originated place and date, and the surface dose rate) must be printed to the surface of drum in order to identify easily. The number peculiar to the drum must be in accord with the serial number of drum described in the application sheet of delivery for disposal. The number of waste drum package of KAERI is given such as a AR-0000-B00-0000. This means the organization – the originated year – waste type - the serial number. Here, B is applied to the miscellaneous solid waste, C the concentrated waste, F the spent filter, R the spent ion-exchange resin, respectively. And also in the type of waste, B01 is applied to the combustible waste, B02 the non-combustible waste, B03 the spent filter of HVAC, B04 the immobilized waste, respectively.

3. Treatment of Spent Drums

3.1 Decontamination

The empty drums generated during the repackaging step of the miscellaneous combustible waste drums, were decontaminated by using high pressurized water (attached at Sand Blaster) for their reuse or clearance. Before and after decontamination, the contamination level was measured to determine whether to be reuse or not. If the drum was not contaminated and was in good state, the drum was reused to collect the radioactive wastes generated at KAERI's laboratories. Decontamination was carried out inside the sand blasting system of RWTF. To reduce the volume of liquid wastes produced during decontamination, the liquid wastes were reused as the decontamination agent while recycling after the filtration of soils, rust and dregs. While circulating the demineralized water as a decontamination solution, the solution was sprayed out inside drum using a 4.5 bar of the compressed air. When the decontamination solution was used for a certain period of time, if their contamination level was measured higher, they were sent to the liquid waste storage tank through the drain valve.

3.2 Removal of marks of radioactive waste drum

If the decontaminated drums were not contaminated after measured the contamination level, they could be reused as the collection drums. The contaminated drum will be compressed to reduce their volume for disposal. And if the drums were not contaminated but corroded or deformed, they will be managed as clearance substances. For the drums to be clearance, the marks displayed a radioactive material must be removed, and cleared away with a paint.

3.3 Sample collection

The samples (diameter of specimen: 50 mm) were taken in the drum and analyzed by MCA. If the activity of radioactive wastes is below the concentration limits of disposal, they will be handled as a clearance.

3.4 Compression for volume reduction

The compression equipment installed at RWTF is the hydraulic type (the capacity of 60 ton) which can be possible to adjust the compression force from 10 bar to 200 bar. When compressing drums, the compression system could be compressed all drums in a certain shape by adding the sleeve to prevent them compressing irregularly. As a result, the drum height of 900 mm was compressed to that of 100 mm.

compliance with the specifications of the national regulations and disposal site. Through the classification and repackaging of them, the storage space of drums at RWTF was secured more than before, and the storage facility was kept in a good state, and also the disposal cost of all stored waste drums of KAERI will be reduced due to the reduction of waste volume. Base on the experiences, the non-combustible wastes will be treated soon.

4. Conclusions

The combustible wastes, which stored at the interim storage facility of KAERI, are managed safely in