

**The Challenge: Safe Management on Spent & Disused Sealed Radioactive Source in Thailand –
15654**

Nathavan Ya-anant *, Juan Carlos Benitez-Navarro **, Panya Nuanjan *, Archara Phattanasub *,
Thunyaras Akharawutchayanon *, Nikom Prasertchiewchan *, Anan O-manee *

* Thailand Institute of Nuclear Technology

** IAEA

ABSTRACT

When sealed radioactive sources are no longer in use, they should be returned back to the country of origin. However, most of them could not be returned to the country of origin, therefore the safety management of spent and disused radioactive source is need. Thailand Institute of Nuclear Technology (TINT) where is as the national waste management center, has the duty to ensure on the safety and the security for long term storage of spent and disused sealed sources before final disposal. The Radioactive Waste Management Center at TINT, is authorized to operate treatment, conditioning and storage of radioactive waste. This paper will describe the proper operational procedures on characterization technique, identification of unknown sources, volume reduction technique, re-packaging, registration and record keeping of spent and disused radioactive source. The successful results exhibit that the record keeping of spent and disused source is developed, and the national inventory of spent and disused source is up to date. This paper would confirm the safety management of radioactive waste in Thailand.

INTRODUCTION

The earliest use of radioactive source in Thailand, typically used Radium-226 in medical applications since 1950. Today sealed radioactive sources are made of numerous artificial radioisotopes. Up to now sealed radioactive sources are used in Thailand in various applications such as medicine, agriculture, industry, transportation, construction, geology, mining, research, education and consumer products. When sealed radioactive sources are no longer in use, and there is no intention of using them again, they are usually called “Disused Sealed Radioactive Source” or “DSRS”. Worldwide, the number of sources that are considered disused is very large and warrants dedicated efforts for their management in a safe and secure manner. If lost or not properly controlled, disused sealed sources can be a threat to human health and the environment. Exposure to large doses of radiation from an unshielded high activity source can be lethal or cause severe radiation injury. If the source capsule is damaged the radioactive material can be released and dispersed, resulting in contamination to the environment, social and economic impacts.

WHY DO WE NEED THE SAFETY AND SECURITY MANAGEMENT ON DSRS

The serious radiological accident in Thailand occurred in Samut Prakan province in 2000, when cobalt-60 head was partially dismantled, and taken from that storage to sell as scrap metal. Three victims died and 10 people received high dose from the radioactive source. It is an expensive lesson to be learned in Thailand⁽¹⁾. Therefore, we really need the safety and security management on DSRS. The picture of the Samut Prakan radiological accident is shown in Figure 1.



Figure. 1 Samut Prakan Radiological Accident in Thailand in 2000⁽²⁾

The safety and security concerning on sealed radioactive sources became a high light topic after the attack on the United States on 11 September 2001. The US itself, including the International Atomic Energy (IAEA) and other countries put an increased awareness of the need for safety and security measures to protect radioactive sources against terrorism. The planning of security measures of radioactive source must take greater account of the potential for deliberate acts to attack or use radioactive sources to expose people and cause contamination. These include fatal and injurious radiation exposure, contamination of the environment, the serious economic and psychosocial costs the total effect of which is mass disruption. So that the management of DSRS is determined to be justified, the need for special security measures to protect against terrorism should then become part of the safety assessment.

MANAGEMENT OF SPENT RADIOACTIVE SOURCE AND DSRS

In Thailand, when radioactive source has no longer in use, it shall be returned back to the country of origin⁽³⁾. However, most of spent radioactive source and DSRS could not be returned to the origin, therefore the Radioactive Waste Management Center (RWMC), Thailand Institute of Nuclear Technology (TINT) as the Centralized Waste Management Center has a duty on managing of spent source and DSRS under the regulatory controlled⁽³⁾ by the Office Atoms for Peace (OAP) as the Nuclear Regulatory Body in Thailand. The procedures of DSRS management in Thailand are as follow;

- History of source/ Record keeping
- Identification,
- Characterization,
- Volume reduction (if possible)
- Conditioning/ Re-Packaging
- Interim Storage/ Final Disposal (in the future)
- Inventory of spent source and DSRS
- Registration of spent source and DSRS

TECHNICAL PROCEDURES

Due to some DSRS in the TINT storage facilities were unknown and/or the information may be uncertain, so that the mission on reorganization of DSRS has been operated under the technical support from the IAEA Regional project- RAS9071 and funding from THA2014 in order to develop the safety management of spent sources and DSRS.

The reorganization operation of DSRS has been conducted at the TINT storage facility No.1, including proper technics on identification, characterization, record-keeping and the development on inventory of DSRS.

The technical procedures are as follows;

- 1) Prepare the operational area by using plastic sheet to cover the operation area
- 2) Check the radioactive contamination of each DSRS before moving for operation as shown in Figure.2
- 3) Take the individual source to the operational area and check dose rate (Figure.2)
- 4) Check the identification label, and take photos (Figure.3)



Figure.2 Checking contamination and dose-rate of DSRS

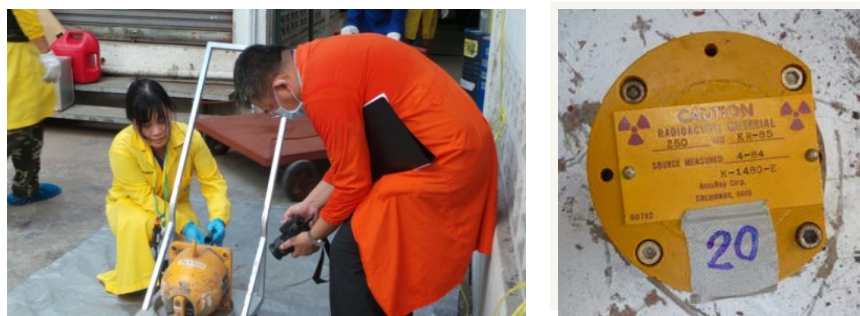


Figure.3 Identification of DSRS



Figure.4 Segregation and Grouping by category/ shape of sources and radionuclides

- 5) Place temporary the sources in the empty room, segregation by category/shape of source and radionuclide as shown in Figure.4
- 6) Reduce the volume by removing the radiation source and re-pack the source in the new container as shown in Figure 5.and 6 respectively.



Figure.5 Volume reduction by removing DSRS from big containment and re-packing



Figure.6 Re-packing of DSRS in 200 Liter Drum

- 7) Complete inventory of DSRS

- 8) Improve the storage conditions by cleaning the floor and cellar
- 9) Arrange sources in baskets and put in shelves, grouping by radionuclide /type of radiation
- 10) Keep record of spent sealed sources and DSRS including photos for the safety report submitted to regulatory body. The following information should be recorded:
 - Former owner who possess the source and associated device, including contact information
 - Unique identification of the source (manufacture, model number, serial number, and date of manufacture)
 - Unique identification of the associated device(manufacture, model number, serial number, and date of manufacture)
 - Location of the source
 - Radionuclide, the sources activity and the date on which the activity was measured
 - Category of the source
 - Form of the radioactive material (physical and chemical) including its special form status
 - Record of where the source was received from or transferred to
 - Dated when the source and associated device was entered into the register
 - Planned disposition of the sources such as the planned date of its transfer to any waste storage/ disposal facility

RESULTS AND DISCUSSION

The progress of reorganization and re-location of spent sealed source and DSRS is shown in Figure 7. The outputs achieved as the results of activities implemented as follows:

- The record keeping of DSRS is developed and updated
- The reorganization of DSRS was well done within the storage facilities as shown in Figure.7)
- Unknown DSRS was determined to the known DSRS and was segregated, due to the characterization technique.
- The national inventory of stored DSRS is up to dated.
- Proper operational procedures and quality control at the storage of DSRS was established and implemented.
- A training material by recording (filming) all activities was carried out during the operation and it will be used to other IAEA member states for demonstration.

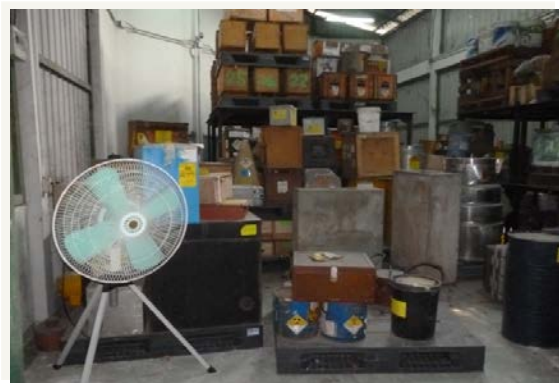


Figure 7 Before and after the reorganization of DSRS at the TINT storage facility No.1.

CONCLUSION

In general, the users and owners of radioactive sources would have some information about their sources, by may also have documents or records of sources that they possessed or used in the past. But the fact, some sources may have been transferred to others without regulatory control. This was sometimes happen, so that the national Radioactive Waste Management Center has to characterize and specify the stored DSRS to get the correct information for record keeping. Also old records from the national waste storage facilities at TINT should be checked and up to dated. Sometimes individual old workers will need to be provided an ascertain information about unknown sources. It is especially important to tap into this information resource before such individuals die. The mission on re-organization of DSRS is very useful and really in need. The characterization and segregation of disused radioactive sources, and identify the sources with a label to complete the records are absolutely important procedures to organize the DSRS for regulatory control according to the radionuclide and the category of sources. The outcome of this work is the updated inventory of DSRS in regulatory control. Additional advantage of this work is volume reduction of DSRS at the TINT storage facilities.

REFERENCES

- 1) Ya-anant, N.; Tiyaun, K.; Saiyut, K. (10 May 2011). *"Radiological accident and incident in Thailand: lesson to be learned"*. Radiation Protection Dosimetry volume **146** No.1–3,(2011): page 111–114.
- 2) .International Atomic Energy Agency, *The Radiological Accident in Samut Prakan*, IAEA (2002), ISBN 92-0110902-4.
- 3) Ministry of Science and Technology, *Ministerial Regulation on Procedure on Radioactive Waste Management* B.E.2546, (2003)

ACKNOWLEDGEMENTS

The author wishes to express her deep gratitude to the IAEA, especially the Technical Officer, Dr. Jaun Carlos Benitez Navarro, who has been giving all his support, valuable advice, and guidance throughout this work. Many suggestions and technical support provided by Ms. Mercedes Salgado and Mr. Juan Miguel, the external experts from Cuba, are deeply appreciated. The author is very grateful to the Bureau of Radiation Safety Regulation, the Office of Atoms for Peace (OAP), for their kind co-operation. Finally, the author wishes to extend her sincere appreciation to the Radioactive Waste Management Center and the Safety Unit, Thailand Institute of Nuclear Technology (TINT) and their staff members for their assistance and providing equipment as well as the facilities throughout this work.