

# DEVELOPMENT OF PACKAGES FOR LOW LEVEL RADIOACTIVE MATERIALS IN TANZANIA

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## 1. Introduction

In Tanzania, practices that produces low level radioactive waste (LLW) are medical, industry, agriculture and research. The LLW is safely managed, and often transported to the Central Radioactive Waste Management Facility (CRWMF) which is located in Arusha, Tanzania. Shipments are done in recommendable packages, either in the original containers or overpacks.

There are domestic and international regulations for the packaging and transport of radioactive material [1-3] consistent with activity strength. As far as the level of activity is concerned, LLW can be transported in Type A packages. A well designed, manufactured, tested and approved design needs to be used for such purposes. This paper presents the status of Type A packages that are used particularly in Tanzania and proposes that the country should start production of its own transport packages as country intends to acquire a its first nuclear research reactor.

## 2. Regulatory Framework

The transport of radioactive materials in Tanzania is regulated by the Atomic Energy Act No. 7 of 2003 [1] which repealed the Protection from Ionizing Radiation Act of 1983. Since then Tanzania Atomic Energy Commission assumes the responsibility for the safety in the possession, use and transfer (including transport) of radioactive materials. Due to the increased number of radioactive materials users (Fig. 1), Tanzania promulgated the packaging and transportation of radioactive materials regulations of 2011 [2]. These regulations are consistent with the IAEA regulations, 2005 [3].

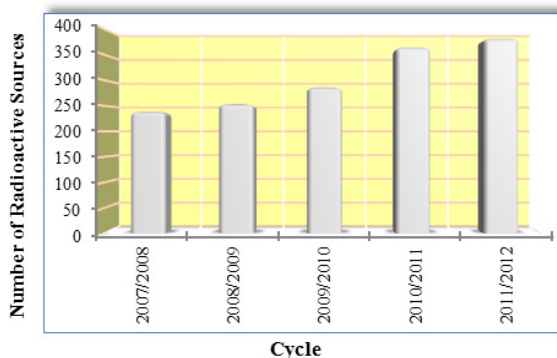


Fig. 1. Number of Radioactive Sources in Tanzania, 2012.

## 3. Types of Packages

Since radioactive wastes are produced in many different forms and volumes and with a different range of specific activities, several different types of packages are used to transport the waste [4]. There are five categories of packages (Table 1); the activity and/or risk posed by the contents, and the design requirements both increase from the excepted packages to the Type B and Type C packages [5].

Table 1. Type of Packages [5]

Package Type	Permitted Content
Excepted Content	Very small content of radioactive materials
Industrial Packages	Low specific activity materials or surface contaminated objects
Type A Packages	Less than A <sub>2</sub> of radioactive materials
Type B Package	Generally limited by the package design unless being transported by air, in which case certain limits apply
Type C Package	Generally limited by the package design and only required for air transport

According to [2] [3] approval is required for the following package design only:

- Packages containing 0.1 kg or more of UF<sub>6</sub>.
- All packages containing fissile materials; and
- Type B and Type C packages

## 4. Status of Transport Packages in Tanzania

Radioactive materials, in the Tanzania that are used in particular for medicine, industrial and research institutions, are shipped in their original Type A packages. Fig. 2 below show the number of Type A packages that were shipped in URT by the end of the year 2012, according to their source categories or strength. As of now there is no manufacturer or designer of such packages.

Type A packages have also been used at the CRWMF were spent high activity radioactive sources (SHARS) are immobilized in Type A 200 L metallic standard drums, that are shielded with concrete, in order to prevent radiation doses to both workers and the public at large. Caesium-137 sources with activity of 1639 Ci and 3228 Ci that

were previously used for sterilizations of tsetse flies are stored in such packages. In some cases Type A packages are used for storage and transportation of orphan disused sources and contaminated scrap metals.

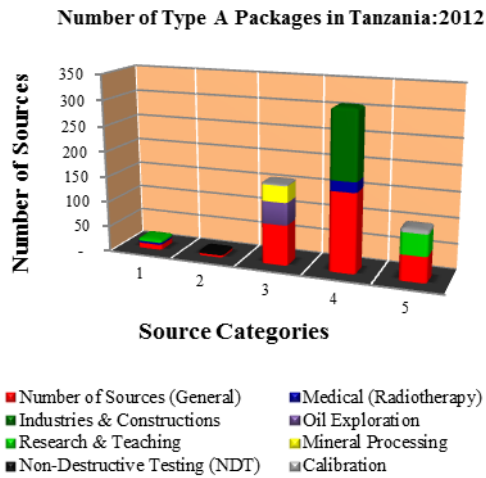


Fig. 2. Type A packages in Tanzania (2012).

Currently Tanzania is undertaking a pre-feasibility study for the consideration of its first nuclear research reactor. For that reason there will be a significant increase in the production of LLW. A research reactor produces about 150 m<sup>3</sup> of liquid wastes and 5 m<sup>3</sup> (25 drums) of solid LLW annually. This needs to be managed safely and the major challenges will be the packaging and transportation of the LLW

### 5. Requirement for Industrial Packages and Type A Packages

According to [2, 3], Industrial packages (IP) and Type A packages shall be designed to meet the following requirements:

- iv. The smallest overall external dimension of the package shall not be less than 10 cm.
- v. The design of the package shall take in account an operating ambient temperature range of -40°C to +70°C for the components of the packaging.
- vi. The Type A package shall be equipped with device that provide evidence that package has not been opened. The device shall not be easily breakable.
- vii. The design shall include the containment system securely closed by a positive fastening device that cannot be opened unintentionally or by pressure that may arise within the package.
- viii. If the containment system is represented by separate component it has to be closed by independent fastening device.
- ix. The design and manufacturing techniques shall be in accordance with national or international standards or other requirements acceptable to the competent authority.

Both IP and Type A packages must be able to prevent the loss of dispersal of radioactive materials contents, and loss of shielding integrity which would result in more than a 20% increase in the radiation level at any external surface of the package.

### 6. Discussion and Conclusion

In Tanzania, LLW is expected to increase in the near future as the country considers the acquisition of its first nuclear research reactor. Consequently the number of packages needed for transportation would rise. As such, Tanzania should strategies on the design and manufacturing of its own packages. Given the amount of resources, and technology that is available in the country, it is possible to manufacture Industrial Packages and Type A packages that can be used for storage and transportation of LLW. Their designs could make use of the conventional mechanical engineering technologies and materials. Moreover, IP and Type A package does not require approval from international or national authorities. Transportation risks will be assessed for these types of packages as follow up.

### 7. Acknowledgments

The research was supported by the 2015 Research Fund of the KEPCO International Nuclear Graduate School (KINGS), Republic of Korea.

### 8. References

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