Developing Safety Regulatory Framework for Radioactive Waste Management in Kenya

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1. Introduction

Radioactive waste contains materials that emit ionizing radiation which has been recognized as a potential hazard to human health since the beginning of the twentieth century. The safe management of radioactive waste is therefore essential to ensure the protection of human health and the environment.

Radioactive waste in Kenya is generated through the use of radioactive materials in medicine, industry and research. The Radiation Protection Act (Cap. 243) of Kenya, makes provision for activities involving ionizing radiation. However radioactive waste in Kenya is currently being managed without a common framework. The Kenyan Government, through the regulatory authority Radiation Protection Board is constructing a facility for treatment, conditioning and interim storage of radioactive waste. Therefore, development of guidelines to be used during the management of radioactive waste is essential.

In line with the Published International Standards on safety procedures and requirements for disposal and management of radioactive waste materials, waste disposal requires strict regulation. This regulation must give sufficient assurance that the assessment of the radioactive inventory will suit given requirements.

The majority of the important long lived radionuclides contained in radioactive waste are difficult to measure from outside of the waste packages using non-intrusive techniques because they are low energy, beta emitting nuclides. Furthermore, detection of these difficult-to-measure (DTM) nuclides using complex radiochemical analysis is not practical for large numbers of waste packages. However, scaling factor methodology has been identified as a means of detecting the DTM nuclides and therefore can be used to evaluate the radioactive inventory of DTM. Scaling factor depends on establishing a relationship between easy-to-measure nuclides (ETM) and DTM ones. "The inventory of the ETM nuclides in a waste package can be derived based upon external gamma radiation measurements carried out on the waste package, and the DTM nuclides can be estimated from the inventory of the ETM nuclides using established scaling factors" (IAEA-TECDOC 1537). This paper will suggest guidelines for Kenyan radioactive waste characterization, and then safety regulatory framework of radioactive waste management in Kenya.

2. Radioactive Sources contributing to radioactive waste from various facilities in Kenya.

The following table consist of a list of nuclides used in Kenya in the Medical, Industrial and Research facilities. The nuclides were selected based on their half-lives. The sources are in the form of unsealed and sealed. The unsealed sources are commonly used in nuclear medicine and their half-lives are shorter as compared to the sealed sources. The other sources half-lives vary with their application. The following nuclides contribute to radioactive waste from various facilities in Kenya.

Table 1: Radioactive sources.

Radioactive Sources used in Medical, Industries and Research.
Ir-192,I-131,Tc-99,Ni-63,Mo-99,S-35,P-32,H-3,Am-241Be,Cs-137,Y-90,Co-60,Ra-226,Th-228,Kr-85,Sr-90,Cf-252,Du-238,Cd-109,Fe-55,Ba-133,C-14,Fe-59,Cr-51.

To apply scaling factor, Key Nuclides (KN) are needed and selected as described in IAEA –TECDOC 1537. They are selected on the basis of correlation with the DTM nuclides and the ETM nuclides. Co-60 and Cs-137 are the ETM nuclides from the list of nuclides in table 1. The key nuclides are those that can be measured using the method of radiochemical analysis and can be used to determine the DTM nuclides. Another important aspect during selection of the KN are their half-lives which should be longer they be used. Cobalt-60 for instance has a half-life of 1925 days while Caesium-137 has a half-life of 30 years. From this evidence of the wastes produced we noted that the minimum duration for storage of these wastes is at least 5 years. These are the main sources to be regulated and managed.

3. Elementary factors for regulatory framework of radioactive waste management

Long-term radioactive waste management options in Kenya might be considered:

(a) Shallow land disposal facilities: disposal of radioactive waste in above ground surface engineered facilities, especially for the bulk of

mining waste containing naturally occurring radioactive materials.

(b) Near surface disposal: disposal of waste, with or without engineered barriers, on or below the ground surface where the final protective covering is of the order of a few meters thick, or in caverns a few tens of meters below the earth's surface.

(c) Deep geological disposal: isolation of radioactive waste, using a system of engineered and natural barriers at depths up to several hundred meters below the earth's surface in a geologically stable formation.

Sites shall be developed suitable for each of the radioactive waste classes. The regulatory authority shall initiate investigations into the best long-term option for the management of radioactive waste. The process of selecting a site for long-term radioactive waste management shall involve public participation.

Radioactive waste management shall follow the following guideline;

Maximum levels of security in storage and disposal is the standard to be adhered to when dealing with radioactive waste management. Regulatory framework set by international bodies for the establishment, operation and decommissioning of radioactive waste generating facilities will be adhered to.

The sequence to be followed to while dealing with radioactive waste management shall be as follows:

(i) Waste minimization.
(ii) Re-use, reprocessing and recycling.
(iii) Conditioning and storage.
(iv) Disposal

The national strategy on radioactive waste management shall deal with the whole cycle of waste management. Relevant decision makers shall receive recommendations that are essential to legitimize decisions on how to proceed with actions.

The development of a new course of action shall be guided by:

(i) Openness and transparency
(ii) Involvement of stakeholders
(iii) A deliberative and accessible process
(iv) Commitment to participative peer review of the technical basis
(v) Provision of adequate time for the resolution of issues

As when step by step management of waste is acceptable; disposal shall be viewed as the final step in the management of radioactive wastes process.

Regulator shall provide specific time frame that an active institutional control shall be assumed for the regulator to be in a position to review the safety as assessment.

The possibility of retrievability of radioactive waste shall be possible as long as a defined period is set. The regulator to determine such a time frame. The safety disposal option for the long term should not be affected by means set at enhancing retrievability

For movement of wastes between different generators or waste producer consideration shall be considered as long as ownership, liability, safety and security are taken into account. Decommissioning of facilities and furthermore their closure should be carried out as soon as possible so as to reduce the weight on the future generations. It will not be acceptable to deliberately dilute radioactive wastes.

It should be recommended that the facility standards for disposal facilities must consider various factors such as the distance from large populations, consideration of hydrological and meteorological conditions. The facility should be high from surface water and also the seismic conditions should be investigated. It should also put into consideration hazard from air contamination so as to prevent it.

Air contaminated by radioactive waste materials should also be prevented to have a backflow. Where we have structures that are able to purify the air, these structures must be made in such a way that parts can be replaced. The building should also be made in such a way that the walls, floors and other building parts that can be contaminated by radioactive wastes are eliminated.

Of great importance is also the capacity of the waste storage facilities. The facility should have enough capacity to hold the waste produce and also resist the decay heat from the waste.

The facility should also prevent radiation contamination spread for instance building of dikes in storage facilities that store liquid radioactive waste so as to prevent water from flowing in and therefore risking contamination of other parts of the environment. All these conditions should be implemented for any type of disposal structure; may it be shallow disposal facilities or deep disposal facilities.

On the performance the facilities must be constantly monitored to ensure that the following aspects are up and running at all times.

- Structures, systems and equipment
- Exhaust and ventilation
- Protection of facility against fire
- Monitoring and control facilities
- Emergency electrical power supply
- Drainage to deal with overflow and flooding of rivers
- Radiation control ensuring the radiation dose is within acceptable dose limits
- The radioactive material handling and processing capacity.

On disposal of radioactive wastes, the storage and processing the wastes are to be contained in an appropriate container. The concentration and quality of waste should not go beyond the set limit which is a mandate of the regulatory authority. Radioactive signs should be erected in open spaces so that they can ensure easy noticing. The location and the boundary of the storage and disposal facility should be well marked. The radiation workers should be regularly monitored to ensure that the dose level does not exceeds the dose limit of the individual workers.

4. Suggestion & Summary

As Kenya lacks a working legal framework for radioactive waste, it would therefore be wise to use the best practices from countries that have a working legal framework. Most of the developed countries have been able to create working and sensible models that can easily be applied in a Kenyan context. Countries like South Korea, Japan, United Kingdom, France, Germany, Russia, USA, to name a few have good regulations. South Korea has a good regulatory framework that Kenya could apply. Their regulatory commission has stated that their mission is "to protect people and the environment and to contribute to world peace." A few words that have a wide scope. All the regulations should work to ensure that all people wherever they are, are protected from radioactive waste. This cannot be done alone as people and environment are inseparable. No matter what you do to the environment, it is good to note that it will adversely affect man at present or in the future.

These recommendations should therefore ensure that the safety of the people, environment and peace in the world is attained and in so doing Kenya will be contributing positively to the safety of the environment.

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