KENYA'S POLICY AND STRATEGY ON RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

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Abstract

Kenya is considering the development of a nuclear power programme for electricity generation in order to address the increasing national energy needs. The programme is currently in the second phase of implementation in accordance with the International Atomic Energy Agency (IAEA) milestone approach. One of the major infrastructure issues being developed is radioactive waste management. Currently, the bulk of radioactive waste generated in Kenya is disused sealed and unsealed radioactive sources. Small volumes of additional waste are also generated through the use of radioactive sources in medicine, industry, and research. However, with the planned introduction of nuclear power in Kenya, the radioactive waste from nuclear power generation will be orders of magnitude higher (in quantity, toxicity and half-life) than the waste generated from medical, research, and industrial practices. A national policy and strategy for managing radioactive waste and spent fuel is important as it sets out the nationally agreed position and/or plan for managing spent fuel and radioactive waste. It is also a visible evidence of the concern and intent of the government and the relevant national organizations to ensure that radioactive waste and spent fuel are properly taken care of. The absence of explicit policies and strategies can result in lack of transparency and accountability. There is, therefore, a need to develop a robust policy and strategy for the safe, secure and safeguard-able management of radioactive waste and spent fuel. The proposed national policy and strategy framework for Kenya takes into account a variety of technical and managerial elements/aspects that will ensure the radioactive waste, including spent fuel, from the nuclear power plants, is managed sustainably in the long-term so as to avoid imposing an undue burden on future generations.

1. INTRODUCTION

The bulk of radioactive waste generated in Kenya is disused sealed and unsealed radioactive sources arising from their use in medical application - diagnosis and therapy, education and training, industrial application (non-destructive testing, etc.), and Research and Development (R&D). The disused sealed radioactive sources (DSRS) are conditioned and stored at a central location operated by the Materials Testing and Research Laboratory (MTRD) under the Ministry of Transport and Infrastructure. The liquid and other types of unsealed radioactive wastes are stored in backyards of waste producers awaiting the formulation and implementation of the appropriate radioactive waste management strategy [1].

The Government of Kenya has also, constructed a facility referred to as Central Radioactive Waste Processing Facility (CRWPF) which will be used for processing, treatment, conditioning and interim storage of low and intermediate radioactive waste from conventional sources. This facility will provide a short relief of management of radioactive waste since it is not a permanent/final/long-term solution to radioactive waste. However, the CRWPF is not expected to handle waste from nuclear energy systems [2].

Kenya is considering the development of a nuclear power programme for electricity generation with spin-off initiatives such as research reactor also under consideration. The radioactive waste from nuclear energy systems will be orders of magnitude higher (in quantity, toxicity and half-life) than the waste generated from medical, research, or industrial practices. There is therefore, a need to develop a robust and comprehensive radioactive waste and spent fuel management framework including legal, regulatory, institutional, and policy and strategy [3].

The current legal status on radioactive waste management in Kenya is in accordance with the Radiation Protection Act (Cap 243 of the Laws of Kenya, 1982), which is an Act of Parliament to provide for the protection of the public and radiation workers from the dangers arising from the use of devices or material capable of producing ionizing radiation and for connected purposes [4]. Other laws that are important to the radioactive

waste management include: the Environmental Management and Coordination Act (EMCA), 1999 that provides for establishment of legal framework and mechanisms for the management of the environment and related matters [5]; and the Kenya Maritime Authority Act (Cap 370 of the Laws of Kenya, 2006) which establishes the Kenya Maritime Authority as a body with responsibility to monitor, regulate and coordinate activities in the maritime industry, and for all other matters connected therewith and incidental thereto [6].

The government has drafted the Nuclear Regulatory Bill 2017. The proposed Bill seeks to transform the current Radiation Protection Board to a National Nuclear Regulatory Commission. The Bill also provides for a comprehensive regulatory framework, for radiation and nuclear safety, nuclear security and safeguards. The Bill explicitly addresses the radioactive waste and spent fuel management unlike the radiation protection act [7]. However, there is no legally designated/established radioactive Waste Management Organization (WMO) in Kenya.

Currently, there is no comprehensive policy and strategy that provide a framework on the implementation of waste management that adhere to international standards and best practices. A national policy and strategy for managing spent fuel and/or radioactive waste is important as it sets out the nationally agreed position and/or plan for managing spent fuel and radioactive waste. It is also a visible evidence of the concern and intent of the government and the relevant national organizations to ensure that radioactive waste and spent fuel are properly taken care of [8]. Therefore, Kenya has formulated a draft policy and strategy for radioactive waste and spent fuel management [2]. This paper captures the key elements of the draft policy and strategy for radioactive waste and spent fuel management in Kenya.

2. POLICY FRAMEWORK

The following policy elements establish goals and/or requirements for the safe management of radioactive waste and spent fuel in Kenya. It also establishes the roles and responsibilities of the organizations and bodies to be concerned with radioactive waste and spent fuel management in Kenya. The proposed policy framework is consistent with the requirements of the national legislative system, relevant international principles and all international agreements to which Kenya is signatory.

2.1. Allocation of Responsibilities

The prime responsibility for the safety of radioactive waste and spent fuel shall rest with the waste generator, while the ultimate responsibility for the safety of radioactive waste and spent fuel management shall rest with the national government.

The government shall establish a legal and regulatory framework including the designation of an independent regulatory body for the safe management of radioactive waste. Also, the government shall establish a WMO which shall take responsibility for radioactive waste from past activities (legacy waste), orphan sources, and the long term management of radioactive waste and spent fuel.

The nuclear regulator shall define appropriate interface between waste generators and waste management organization. In addition, the nuclear regulator shall ensure that each waste generator takes the appropriate measures to meet its responsibility in radioactive waste and spent fuel management.

2.2. Provision of Resources

The waste generator shall ensure that personnel involved in radioactive waste and spent fuel management are qualified in accordance with the legal and regulatory requirements in Kenya as well as assure continuous training and qualification of the personnel. The waste generator shall also be financially responsible for the safe and proper management of radioactive waste and spent fuel (‘polluter pays’ principle).

The government shall however oversee the long term management of radioactive waste and spent fuel. To this end, the government shall ensure that:

— Qualified staff are available as/when needed for the safety-related activities during the lifetime of a radioactive waste and spent fuel management facility (education, training and R&D);

— Adequate financial resources are available to support the safety of radioactive waste and spent fuel management facilities during their lifetime, and for decommissioning so that adequate technical solutions are available in good time;
— Adequate financial resources are available for the appropriate institutional controls and monitoring arrangements to ensure the safety of radioactive waste and spent fuel facilities after closure.

2.3. Safety, Security, and Safeguards (3S) Objectives

In order to ensure that the 3S objectives are achieved, the nuclear regulator shall oversee the activities of the waste generator to ensure that individuals, society, and the environment are protected from the harmful effects of ionizing radiation due to radioactive waste and spent fuel now, and in the future. The nuclear regulator shall also ensure that the waste generator implements adequate physical protection measures to prevent unauthorized access to and/or unauthorized removal of radioactive waste and spent fuel. In addition, the nuclear regulatory body and waste generator shall accept and facilitate safeguards measures on all radioactive waste and spent fuel with demonstrably significant source and/or special fissionable materials.

2.4. Classification of Radioactive Waste

The regulatory body shall develop/adopt the waste management classification criteria in accordance with the International Atomic Energy Agency (IAEA) guidelines and international best practices.

2.5. Waste Minimization

The nuclear regulator shall ensure that the waste generator implements waste minimization measures so that radioactive waste and spent fuel generated are kept to a practicable minimum at the design (minimization at source), operation and decommissioning stages of facilities. This shall be achieved through among other means: recycling and reuse of materials which are slightly contaminated and/or free of contamination; and use of the "clearance concept" to determine which materials can be released from regulatory control.

2.6. Export/Import of Radioactive Waste and Spent Fuel

There shall be no import of radioactive waste and spent fuel into Kenya and/or its territories, in order to protect national resources, and at the same time take advantage of international solutions to radioactive waste and spent fuel. The government shall explicitly specify conditions on:
— The export of radioactive waste and spent fuel;
— The storage/disposal of radioactive waste and spent fuel on Kenyan territory after conditioning and/or reprocessing abroad;
— Seeking international /regional solutions to radioactive waste and spent fuel.

2.7. Management of Spent Fuel

The nuclear regulator and waste generator shall explicitly specify spent fuel as either a resource that can be utilized through reprocessing (nationally or internationally) or waste which should therefore be disposed of directly. The spent nuclear fuel shall be managed in accordance with the nuclear fuel cycle policy and strategy.

2.8. Management of Radioactive Waste

2.8.1. Disused sealed radioactive sources.

The licensed importers of DSRS shall make every effort to ensure that these sealed sources are returned to the supplier. In cases where this option is not possible, the sources shall be managed in the radioactive waste management facility within Kenya's territory, by the waste management organization. Kenya shall seek to leverage on international radioactive waste management solutions, where applicable.

2.8.2. Other types of radioactive waste.

The nuclear regulator shall identify/classify other types of radioactive waste including legacy, orphan sources, Technologically Enhanced Naturally Occurring Radioactive Material (TE-NORM). The waste management organization shall specify intended national arrangements for their management, and identify suitable 'end-points' for the various management processes.

2.9. Public Information/Participation

The nuclear regulator and waste generator shall strive to inform the public about all proposed plans for radioactive waste and spent fuel management, and to consult concerned parties and members of the public in decision making processes *(principle of openness and transparency).*

3. STRATEGY FRAMEWORK

The strategy framework illustrates the technical means and measures for achieving the goals and/or requirements set out in the policy framework for the safe management of radioactive waste and spent fuel in Kenya. Principal matters are addressed in general terms as national strategy. Detailed strategies shall be developed and implemented by the waste management organization (WMO) and waste generators.

3.1 Generic Technical Options

The general approaches/options for radioactive waste and spent fuel management regardless of their classification/characterization include:

3.1.1. Shared facilities

The government shall consider sharing dedicated radioactive waste and spent fuel management facilities with other countries. This approach has the benefit of decreasing the cost of waste management for all countries involved. There is however a risk from political/strategic differences and/or conflicts [8].

3.1.2. Centralized facilities

Strategic choice can be made between centralized and site specific radioactive waste and spent fuel management facilities. A centralized waste management facility capable of processing, storage and, possibly, the disposal of all, or a large part, of the radioactive waste and spent fuel in a country is usually more economic than the individual site approach, requires a smaller workforce than multiple individual sites and is likely to be more secure. On the other hand, managing the waste at the site at which it is generated has the advantage of reducing the need for waste transport. The choice is rarely made on purely economic grounds because there are usually local political factors, national historic nuclear development aspects, geographical factors and public opinion aspects to consider. In strategy development and/or review (upgrade), the choice between these options shall be given proper consideration for all or parts of the waste management activities in the country [8].

3.1.3. Mobile processing facilities

A possible partial alternative to centralized radioactive waste and spent fuel management facilities, which has many of the same economic advantages. Many waste processing systems are operated in 'batch' mode because a certain minimum amount of waste is usually needed for their efficient operation. Waste management costs for individual waste generators can be reduced if such processing systems are shared [8].

3.2 Optimal Strategy

The optimal strategy shall be determined by comparison of the relative advantages and disadvantages of each strategy option (multi-attribute analysis). Typically, issues related to different processing technologies and

their interdependence, synergies and relation to different disposal systems shall be considered. It shall be ensured that the chosen strategy can be implemented in the country, i.e. sufficient financial and technical resources exist and that there are no political, social or legal reasons to prevent its implementation [8].

3.3 Action Plan

Table 1 below illustrates timelines for the implementation of the proposed tasks in the radioactive waste and spent fuel management policy.

TABLE 1. ACTION PLAN FOR IMPLEMENTATION OF POLICY AND STRATEGY

Action	Short-term (≤5 years)	Medium-term (≤10 years)	Long-term (>10 years)
Adoption of the policy	✓		
Designation/establishment of a nuclear regulator	✓		
Designation/establishment of waste management organization	✓		
Capacity building (human, financial, and technical)	✓	✓	✓
Development of an optimized strategy for radioactive waste and spent fuel management		✓	✓
Research and Development for radioactive waste and spent fuel management		✓	✓
International cooperation on radioactive waste and spent fuel management (MoUs, Cooperation agreements, fellowships, scientific visits, etc.)	✓	✓	✓
Public participation and sensitization	✓	✓	✓

4. UPDATING POLICY AND STRATEGY

The policy and strategy shall be reviewed and analysed regularly (after 10 years). This will depend on:

— Experience obtained in their application (locally and from relevant experiences in other countries);
— New national circumstances (technical, political, social, etc.);
— New international agreements, conventions, treaties etc.

If/when appropriate, the policy and strategy will be revised based on the review/analysis. The technical working group shall lead/coordinate the review and/or update of the policy and strategy in consultation with all relevant stakeholders.

5. CONCLUSION

The bulk of radioactive waste generated in Kenya is disused sealed and unsealed radioactive sources arising from their use in medical application, education and training, industrial application, and Research and

Development. With the planned introduction of nuclear power in Kenya, the radioactive waste from nuclear power generation will be orders of magnitude higher (in quantity, toxicity and half-life) than the waste generated from conventional waste streams. The DSRS are conditioned and stored at a central location operated by the Ministry of Transport and Infrastructure while liquid and other types of unsealed radioactive wastes are stored in backyards of waste producers awaiting the formulation and implementation of the appropriate radioactive waste management strategy. The Government has also constructed the Central Radioactive Waste Processing Facility for processing, treatment, conditioning and interim storage of low and intermediate radioactive waste from conventional sources. However, this facility is not expected to handle waste from nuclear energy systems.

A national policy and strategy for managing spent fuel and radioactive waste is important as it sets out the nationally agreed position and/or plan for managing radioactive waste and spent fuel. Also, it is a visible evidence of the concern and intent of the government and the relevant national organizations to ensure that radioactive waste and spent fuel are properly taken care of. Therefore, Kenya has formulated a draft policy and strategy for radioactive waste and spent fuel management. The draft policy and strategy addresses the applicable legislation/conventions, policy framework, strategy framework, and updating/review of the document. The draft policy and strategy should be adopted and implemented for a safe, secure and safeguard-able management of radioactive waste and spent fuel in such a way as to avoid imposing undue burden on future generations

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