

IMPROVING THE REGULATORY INFRASTRUCTURE IN EGYPT TO MANAGE SEALED RADIOACTIVE SOURCES

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ABSTRACT

Sealed radioactive sources (SRSs) are used daily in Egyptian life for many applications, including oil exploration, construction, inspection of pipelines, research and medical applications. High-curie SRSs are highly radioactive materials in the public sector and appropriate radiation safety and security standards are necessary to prevent serious accidents or malicious acts.

The Egyptian Ministry of Health and Population and its Executive Office for Radiation Protection (EORP) and the Egyptian Atomic Energy Authority (EAEA) are modernizing their regulatory infrastructures to manage SRSs. The EORP and the EAEA are receiving assistance from the U.S.-funded Integrated Management Program for Radioactive Sealed Sources in Egypt (IMPRSS).

This paper describes the first step of this modernization, which is the comparison of existing Egyptian regulations to the International Atomic Energy Agency (IAEA) guidance on the *Organization and National Regulatory Infrastructure Governing Protection Against Ionizing Radiation and the Safety of Radiation Sources*. This preliminary comparison has identified weaknesses in the current regulations governing the management of the SRSs. Based on IAEA guidelines possible new regulations will be suggested for modernizing the Egyptian regulatory infrastructure.

INTRODUCTION AND USES OF RADIOACTIVE SOURCES IN EGYPT

The daily applications of SRSs in Egypt include: medicine, inspection of pipelines, construction of roads and foundations, industry, manufacturing, scientific research, and oil and gas exploration. The medical uses include the treatment of solid tumors with brachytherapy and teletherapy. In many cases radiation from SRSs is used as a beneficial tool for tasks that would otherwise be difficult or impossible. In most of these applications, the radiation is from radioactive isotopes such as Cobalt-60, and Cesium-137 (Co-60 and Cs-137). Such isotopes are typically encapsulated in airtight and durable containers. These containers and their radioactive contents are known as SRSs. Worldwide, there are several million SRSs [1].

There is a cobalt sterilization facility (~ 370 k Ci) being operated at the National Center for Radiation Research and Technology in Cairo. The Center has other Co-60 or Cs-137 irradiators manufactured in Canada, India and Russia [2]. Also, there are two research reactors in Egypt that may be used for the production of isotopes for industrial and medical applications and neutron physics research. One of the reactors is a 2 Mw water moderate reactor and the other is a 22 Mw open pool multipurpose reactor.

Approximately 200 SRSs were imported into Egypt in 2002. In total, approximately 4,200 licenses have been issued for the use of SRSs in Egypt [3]. While the vast majority of these SRSs emit low radiation, and hence do not represent a threat to human health or the environment, a small ratio of these sources are highly radioactive and have the potential to cause great harm or death if mismanaged.

Some of these SRSs are capable of causing death after a few minutes to a day of exposure to the unshielded radioactive sources. Three years ago, a contractor working in a village near Cairo lost a small Iridium-192 (Ir-192) SRS used in radiography. A farmer found the Ir-192 SRS and not recognizing the hazard took the SRSs to his home. This unfortunate accident led to the over exposures and deaths of the farmer and one of his sons [4]. This accident has increased the awareness of the need for the safe management of SRSs in Egypt.

Because of this increased awareness and because of the increasing diversity of the uses of SRSs in Egypt, the Egyptian Ministry of Health and Population and its EORP are reviewing the existing regulatory infrastructure to determine if modernization is needed. Also the EAEA has certain regulatory authorities for the recovery, storage and disposal of unwanted SRSs in Egypt. For this reason, the EAEA is also reviewing its regulatory infrastructure for possible modernization.

The Integrated Management Program for Radioactive Sealed Sources (IMPRSS) is supporting the efforts of the EORP and the EAEA [5]. IMPRESS is a joint project between Sandia National Laboratories, U.S. and the Government of Egypt, funded by the U.S. Agency for International Development and implemented through the U.S. Department of Energy. The broad objectives of IMPRSS are:

- Greatly reduce the threat to human health from mismanaged SRSs.
- Greatly reduce the threat to the environment from mismanaged SRSs.
- Develop self-sustaining program in Egypt for the integrated management of radiation sources.

These broad objectives are divided into thirteen work elements. One of the thirteen work elements is Regulatory Reform. The Regulatory Reform work element has the following goals:

- Review and summarize the existing Egyptian regulations that govern the tracking, licensing, import/export, transportation, storage and disposal of SRSs and compare these regulations to IAEA guidelines to determine if there are weaknesses.
- If weaknesses in Egyptian regulations are identified, then review and summarize IAEA and U. S. Nuclear Regulatory Commission regulations for possible use to supplement Egyptian regulations.
- Develop regulatory recommendation package (proposed regulations and briefing information) to the Government of Egypt addressing all aspects of sealed sources management in Egypt.

The overall process of regulatory review and improvement is conceptually simple; first, existing regulations are compared to IAEA guidelines for a regulatory infrastructure to safely manage SRSs.

Second, if weaknesses are identified in the existing infrastructure, the parties will develop a regulatory recommendation package (proposed regulations and briefing information) for the Government of Egypt. The IAEA guidelines that will be used as a reference for the comparison were taken from the IAEA's *Organization and Implementation of a National Regulatory Infrastructure Governing Protection Against Ionizing Radiation and the Safety Of Radiation Sources* [6] and the IAEA's *Code of Conduct on the Safety and Security of Radioactive Sources* [7].

This regulatory review and modernization process is in the early stages of updating the regulations. This article summarizes the process and preliminary findings.

THE CURRENT EGYPTIAN REGULATIONS

Existing Egyptian regulations that concern ionizing radiation are based on the Decree of the President of the United Arab Republic, Law Number 59 of 1960 and its implementing regulations, the Law of Environment Number 4 of 1994 and the Decree of the Minister of Health number 204 of 2000 [8]. Law No. 59/1960 and its implementations address some fundamental safety issues including:

- licensing,
- licensee responsibilities,
- inspections,
- penalties, and
- assign to the Minister of Health the responsibility for developing and enforcing other implementing regulations for the “closed sources” or SRSs.

The Ministry of Health, through its EORP regulates all SRSs that are “in-use” in Egypt (excluding SRSs used by the military).

The EAEA is responsibilities for the recovery, storage and disposal of all unwanted SRSs in Egypt. The EAEA also regulates the use of “open sources” and the EAEA provides consultation to the EORP. There is on-going research to determine the government agency that is responsible for the transportation of SRSs.

THE AREAS COVERED IN THE EGYPTIAN REGULATIONS

Egyptian regulations are based on the Law No. 59/1960, the Law No. 4/1994 and the Decree Number 204 of 2000 and their implementations. These regulations covered some areas that related to the in-use SRSs such as [8]:

The Regulatory Bodies

Article No. 3 of the law No. 59/1960 gives the Ministry of Health (and its EORP) the responsibility to license installation and use of x-ray machines, cyclotrons and SRSs so as to protection human health from their hazards. The EAEA is given responsibility for licensing reactors, opened sources and the protection from ionizing radiation within the EAEA buildings. The EAEA is also responsible for the recover, storage and disposal of unwanted SRSs and research is being conducted to determine the regulatory basis for these EAEA responsibilities.

The License Requirements and Licensee Qualifications

The EORP determines the licensing provisions either for the place of use, or for the use. These licensing provisions include administrative, technical, educational and experience qualifications.

The Radiation Protection Provisions

The Egyptian regulations required protection provisions for each facility or for each use. For example, a stationary teletherapy SRSs is licensed as a facility and a mobile radiography SRSs is licensed by use. These provisions require the use of protection tools, validation and periodic investigation of these tools, medical examinations for the person who works with radiation, periodical medical examinations for the workers (for example, dosimeters), and the consultation or presence of a radiation protection expert.

Licensee Responsibilities

Based on the current regulations the licensees (x-ray specialists and their assistances) have many responsibilities but the vast majority of these responsibilities are administrative.

Penalties

The regulations define the penalties to be imposed when the facility owner or the facility operator fails to meet the required protection provisions. These penalties were emplaced 43 years ago so they need to be updated according to the present situation.

Dose Constraints

Based on the dose limitations set in the Safety Series of the IAEA, the Egyptian regulations determined the maximum whole body doses that can be received by the workers in the radiation field and in some times determined the maximum dose that can be received by the different organs within the human body.

Importing and Exporting Radioactive Sources

There are limited regulations that deal with importing and exporting SRSs. Article No. 4/1994 and Decree No. 204/2000 state that permission shall not be granted for importing radioactive materials unless the importer commits to re-exporting the sources to the original supplier after the SRSs become unwanted. Also the EORP has three forms related to this issue. The first form is an application form that must be completed and approved to receive permission to import a SRS into the country of Egypt. The second form must be completed and approved to re-export SRSs and the third form is a form for the release of a SRS from Egyptian customs. Importantly the EORP must grant permission prior to importing or exporting SRSs and the EORP tracks all imports and exports.

Transporting of Radioactive Sources

Article No.7 of the decree No. 204/2000 states that the transportation of the radioactive sources within Egypt must be carried out in safe transporting containers and under the supervision of a radiation protection expert. Also in Article No. 9 from the same decree, all the ports in Egypt (marine, air or land) shall notify the EORP with complete information about any radioactive source imported or exported. Other requirements for the transportation of radioactive materials are defined by the rules of navigation through the Suez Canal.

This is a general overview of all the areas covered in the Egyptian regulations.

COMPARISON BETWEEN IAEA AND THE EGYPTIAN REGULATIONS

The IAEA has developed guidelines for Member States to take into consideration as Member States develop their own regulations to control and manage SRSs. These guidelines address both SRSs in-use and unwanted SRSs. To determine the adequacy of current Egyptian regulations, a comparison is being made between IAEA guidelines and the current regulatory infrastructure. IAEA guidelines are taken from two references: (1) *Organization and Implementation of a National Regulatory Infrastructure Governing Protection Against Ionizing Radiation and the Safety of Radiation Sources Interim Report for Comment* [6] and (2) *Code of Conduct on the Safety and Security of Radioactive Sources* [7]. To facilitate the comparison, these IAEA guidelines are summarized in a table. Table I, provides a draft example of this comparison table.

Table I Draft Example Comparison of Egyptian Regulations to IAEA Guidelines

IAEA Guideline [6] and [7]	Egyptian Regulations		
Occupational Exposure Protection	Classification of Areas	Article No. 34	No law
	Personal Protective Equipment	Article No. 36	Articles No. 18 of the law No. 59/1960 and No. 33, 34 and 39 of the Executive Regulation of the law No. 59/1960
	Monitoring of Workplace	Article No. 38	No law
	Records of Worker Exposure	Article No. 40	Article No. 22 of the Executive Regulation of the law No. 59/1960
Requirements for the Safety of Sources	General Responsibilities	Article No. 57	No law
	Accountability and Security of Sources	Article No. 59	No law
Radioactive Waste Management Requirements	Radioactive Waste Classification	Article No. 62	No law
	Discharge or Release of Radioactive Substances to the Environment	Article No. 69	No law
	Disposal of Radioactive Waste	Article No. 70	No law
Transport Requirements	Packaging/Package	Article No. 83	No law
	Maximum Radiation Level	Article No. 86	No law
	Transport Index	Article No. 87	No law
	Labeling Requirements	Article No. 89	No law
	Notification of Regulatory Authority	Article No 97	EAEA procedure and Rules of Navigations through Suez Canal

From the draft examples presented in Table I, the authors note that existing Egyptian regulations addressed some topics recommended by the IAEA guidelines and that there are weaknesses in other areas.

We can extract two broad observations about the existing regulations. First, the existing Egyptian regulations are focused almost exclusively on medical practitioners, ray-specialists and their assistances,

while these regulations do not address other applications that use the SRSs, such as the industrial and scientific applications of SRSs. Second, existing regulations address the “use” of SRSs, with little regulatory infrastructure to address unwanted SRSs.

IMPROVEMENT OF THE EGYPTIAN REGULATIONS

The EORP and the EAEA will be working with the IMPRSS in the future to finalize this comparison, and then identify requirements to supplement existing weaknesses in the regulatory infrastructure. It is hoped that the final regulatory infrastructure will meet the IAEA guidelines presented in the IAEA *Code of Conduct on the Safety and Security of Radioactive Sources* and *Organization and Implementation of a National Regulatory Infrastructure Governing Protection Against Ionizing Radiation and the Safety of Radiation Sources*.

SUMMARY AND CONCLUSION

SRSs are used for many peaceful and beneficial applications in Egypt. Because of an increased awareness of the need to safely manage SRSs, an effort is underway to determine the adequacy of the existing regulatory infrastructure governing the management of SRSs.

The current regulatory infrastructure in Egypt is based on Law No. 59/1960 and its implementing regulations that assign to the Ministry of Health (EORP) the responsible to manage in-use SRSs, while the EAEA is responsible for management of unwanted SRSs.

A preliminary comparison between the IAEA guidelines and the current regulations in Egypt has been undertaken and is summarized in this article. Weaknesses in these current regulations were identified in the draft comparison. The EORP, and the EAEA, with assistance from the IMPRSS will be finalizing the comparison in the near future. After finalization of the comparison, these parties will suggest upgrades necessary to bring Egyptian regulations in line with the IAEA guidelines.

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