# Syrian Arab Republic

## Atomic Energy Commission of Syria

# National Report

## On the Implementation of the Obligations under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

Submitted for the purposes of the 7 th Review Meeting of the Convention Vienna, Austria, 27 June – 7 July 2022

Damascus, Syria March 2022

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## List of Abbreviations

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| Joint Convention | Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management |
| NR | National Report |
| IAEA | International Atomic Energy Agency |
| AECS | Atomic Energy Commission of Syria |
| RNRO | Radiological and nuclear Regulatory Office |
| RSSC | Radiation Protection and Safety and Security of Radiation Sources Committee |
| SRR-1 | Syrian Research Reactor |
| MNSR | Miniature Neutron Source Reactor |
| DG | Director General |
| RB | Regulatory Body |
| DSRS | Disused Sealed Radioactive Sources |
| NORM | Naturally Occurring Radioactive Materials |
| HEU | Highly Enriched Uranium |
| LEU | Low Enriched Uranium |
| NEP | National Emergency Plan for response to radiological and nuclear emergencies |
| NSTTC | Nuclear Science and Technology Training Center |
| CRWMF | Central Radioactive Waste Management Facility |

## Section A. Introduction

The current National Report (NR) highlights safety issues related to radioactive waste management and the actual status of implementation of the "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" (Joint Convention) in the Syrian Arab Republic. Syria had acceded to the Joint Convention on September 26, 2021, with the enactment of the ratification Law No. /22/2021 and the Joint Convention is officially entered into force on 23 February 2022 (no declarations or reservations were attached to the instrument of accession). This report is therefore, the first NR submitted for the Seventh Review Meeting of the Contracting Parties based on the Joint Convention obligations.

In order to meet the provisions of the Joint Convention, especially Article /32/, the Atomic Energy Commission of Syria (AECS) had prepared this NR which is structured according to the "Guidelines regarding the Form and Structure of National Reports" (INFCIRC/604/Rev.3, Date: 18 September 2014).

Since 2005, a remarkable progress has been made in Syria in the development of a comprehensive legal framework for nuclear and radiological safety and security above all, the issuing of the Legislative Decree No. 64 that empowers the AECS to prepare Regulations. Consequently, general Regulations were prepared and issued in January 2007 to implement the Decree No. 64 (The Prime Minister's Decision No. 134 dated 17 January 2007 "General Regulations on Radiation Protection and Safety and Security of Radiation Sources"). These Regulations are in line with the BSS and GS-R-1 and contain a whole Chapter with 10 main legal-articles devoted to the Safe Radioactive Waste Management. Finally, in order to regulate the authorization of radiological practices and activities through a process of licensing, "Instructions on Licensing Radiation Practices" had issued by AECS Director General (DG) Decision No. 623/2008, dated 22 May 2008. The paramount objective of these legal and regulatory frameworks is to ensure adequate and sustainable protection of workers, the public, society, and the environment against the adverse effects of ionizing radiation.

There are neither nuclear power plants in operation, under construction nor nuclear fuel processing facility in the Syrian Arab Republic and there is no intention to embark on a nuclear power program in the near future. However, Syria has a Chinese-

designed 30 kW research reactor (SRR-1) a "Miniature Neutron Source Reactor" (MNSR).

The main use of radiation sources and radioactive materials in the country is in medical, industrial, academic research, agriculture and environment application areas. Syria's sole facility of radioactive waste management, "the Central Radioactive Waste Management Facility (CRWMF)", is located within AECS premises at Deir El-Hajjar near Damascus. All radioactive waste generated in Syria (non-nuclear radioactive waste with low volumes and low/intermediate radioactivity levels) is safely managed and comes from practices and activities of nuclear medicine, or modern technology used in the area of medical diagnostics and treatment, or radioisotopes production (radioactive pharmaceuticals), nuclear gauging, research as well as disused sealed radioactive sources (DSRS). Taking into account that all sources of ionizing radiation used in the country are imported from abroad and all practices, activities, and radioactive waste that is produced from them are subject to all aspects of regulatory control carried out by the Radiological and Nuclear Regulatory Office (RNRO) at the AECS.

A revised and updated version of the Policy and Strategy on the safe radioactive waste and DSRS management (in line with IAEA Recommendations and safety Standards) has been prepared by RNRO, reviewed by the "Radiation Protection and Safety and Security of Radiation Sources Committee (RSSC)" and subjected for official approval by the AECS Board of Management.

## Section B. Policies and Practices

### B.1 Spent Fuel Management Policy

### B.2 Spent Fuel Management Practice

As already mentioned above, Syria is a country that has no nuclear industry. However, Syria has successfully and safely operated a 30 kW tank-in-pool MNSR research reactor located at Deir El-Hajjar (25 km southeast of Damascus). The SRR-1 is mainly used for neutron activation analysis, research, education and training purposes. Historically, MNSR was built by China in 1991, went critical on 4 March 1996 and became operational in 1998, since then MNSR being subjected to IAEA routine safeguards inspections.

MNSR is a low power research reactor that uses highly enriched uranium (HEU) as fuel (90 percent U-235), light water as a coolant and moderator, and a beryllium reflector. It would be necessary to indicate that China provided Syria with an initial fuel supply of /980.4/ grams intended to ensure the reactor's operation for 2,000 hours per year for ten years. Accordingly, over the past decade, MNSR has undergone various interventions related to research reactors ageing management. Therefore, in 2015, Syria had requested IAEA assistance in converting MNSR to run on Low Enriched Uranium (LEU) fuel and shipping the HEU out of the country. In this respect, several working meetings were held between the AECS and IAEA on MNSR fuel conversion programme over the past five years, (the last one took place on November 2021). Noting that at the end of this programme it is planned that the irradiated HEU core will be repatriated to China.

According to IAEA nuclear fuel cycle facilities database, Syria has a micro-pilot plant facility under construction to recover uranium from the process of purification of phosphoric acid. The above mentioned micro-pilot plant stopped working at the end of 1996; and since 1999 the recovery of U from phosphoric acid is performed by a pilot plant situated near the city of Homs at a distance of 160 km to the north of Damascus. It is important to mention that the yellowcake produced, as a by-product of the purification of phosphoric acid process, is stored at the pilot plant under IAEA supervision and Safeguards Agreements.

**B-3 Radioactive Waste Management Policy**

As cited above, a national strategy and a comprehensive policy on the safe radioactive waste and DSRS management is in the processes of obtaining approval from the AECS Board of Management.

The updated policy and strategy serves as the national commitment to address the country's issues on the management of radioactive waste in a safe, secure, and sustainable manner. Moreover, this policy is in line with IAEA Recommendations in order to: (1) protect people, society, patrimony and the environment against ionizing radiation risks, or the release of radioactive materials, (2) minimize the volume/quantity of radioactive wastes arising from the utilization of radioactive material and nuclear technology, and (3) avoid placing undue burdens on future generations.

The national policy on the safe radioactive waste and DSRS management is based on the following general principles:

*1- International cooperation and commitment to the obligations stipulated in multilateral conventions related to nuclear energy (IAEA safety and security Conventions), to which Syria is a contracting party.*

*2- Maintaining a high level of safety and security regarding the safe radioactive waste management by developing and improving national regulations and procedures.*

*3- Keeping the production of radioactive waste to the minimum possible or practicable and avoid imposing undue obligations and burdens on future generations.*

*4- Establishing specific criteria for designating a disused or orphan sealed radioactive source as radioactive waste, taking into account the possible consequences of such designation on subsequent management options.*

*5- A disused sealed radioactive source should not be dismantled or opened for the purpose of recycling or reusing it or using parts of it, taking into account, in some certain cases, the possibility of reusing or recycling a disused or orphan sources Category 3-5 in accordance with IAEA guideline "Guidance on the Management of Disused Radioactive Sources" of 2018, and on condition that fulfills the principals of radiation protection and safety and security of radiation sources.*

*6- Adopting openness and transparency principle, disseminating information and making it accessible to all, and informing the public at an early, timely and effective stage regarding all aspects of radioactive waste management.*

The mechanisms, technical options and procedures adopted to implement the national policy on radioactive waste management are given in the national strategy.

### B-4. Radioactive Waste Management Practices

Three technical options (concepts) for effective predisposal management of radioactive waste has been applied in Syria; they could be summarised as follows:

1- "Delay and Decay": Radioactive waste is kept in a temporary storage at the owner/operator's premises in order to decay and meet the clearance levels; applicable for very short-lived radioactive waste.

2- "Concentrate and Contain": Minimization the volume of the radioactive waste, treatment and conditioning for disposal.

3- "Dilute and Disperse": Discharging of effluents/very-low level of radioactive waste to the environment by ensuring no radiological impact.

Furthermore, "Recycle and Reuse" concept regarding DSRS Category 3-5 would be also considered in Syria after issuance of related regulatory instructions.

Noting that limited quantities of low and intermediate level radioactive waste are produced from licensed radiological practices and activities throughout the country including nuclear medicine, radioisotope labeled pharmaceuticals (Cyclotron unit), industrial applications research centers and higher education establishments.

- In hospitals applying therapeutic/diagnostic nuclear medicine, the radioactive wastes (mainly I-131, 8-day physical half-life, quantities in liquid or solid form) are managed as follows: the generated solid wastes sent to a temporary storage trolley, while the liquid form are collected in delay tanks. Trolley and tanks contents are allowed to decay (2 to 3 months, by applying the criterion of "ten half-life's decay and release") until their radioactivity levels decrease below the levels of release (clearance level) and then are disposed as usual (non-radioactive) waste.
- Most of the waste generated at the Cyclotron unit at the AECS falls into the categories of short lived, low level or intermediate level radioactive waste. The main sources of these wastes are spent targets, chemicals used in the processing of targets and separation of radioisotopes from the target materials. These by-product materials are placed in a well of 6 m depth (onsite temporary storage of waste) and allowed to decay. The well is kept locked and under surveillance.
- DSRS that awaiting return to suppliers are stored, under RNRO supervision, on the users' premises; while DSRS for which secure storage could not be guaranteed are collected and stored in the CRWMF. Further details on DSRS and orphan sources management are given in Section J. of this report.

**B-5. Criteria Used to Define and Categorize Radioactive Waste**

Various schemes have developed for classifying radioactive waste according to the physical, chemical and radiological properties. Syria follows the guidelines of IAEA regarding the definition and classification of radioactive waste, as described in the

General Safety Guide No. GSG-1 "Classification of radioactive waste". The classification scheme is as follow:

1- **Exempt waste (EW)**: Waste that meets the criteria for clearance, exemption or exclusion from regulatory control.

2- **Very short-lived waste (VSLW)**: Waste that can be stored for decay over a limited period of up to a few years and subsequently cleared from regulatory control according to arrangements approved by the regulatory body.

3- **Very low-level waste (VLLW)**: Waste that does not necessarily meet the criteria of EW, but that does not need a high level of containment and isolation.

4- **Low level waste (LLW)**: Waste that is above clearance levels, but with limited amounts of long-lived radionuclides.

5- **Intermediate level waste (ILW)**: Waste that, because of its content, particularly of long-lived radionuclides, requires a greater degree of containment and isolation.

6- **High level waste (HLW)**: Waste with levels of activity concentration high enough to generate significant quantities of heat by the radioactive decay process or waste with large amounts of long lived radionuclides.

In general, the main radioactive waste in Syria actually comes from activities and practices in the fields of nuclear medicine. Radioisotopes in this waste have short half-lives and are kept within the premises of licensees until their radioactivity levels decrease below the levels for release (clearance levels) and then are disposed as non-radioactive waste.

## Section C. Scope of Application

### C-1. Reprocessing

Syrian Arab Republic has no nuclear power plants and does not have spent fuel facilities or reprocessing plant subject to the Joint Convention. Thus, Syria has not declared any spent fuel for the purposes of the Joint Convention, pursuant to Article 3(1).

### C-2. NORM wastes

Naturally-Occurring Radioactive Materials (NORM) have not been declared as radioactive waste for the purposes of the Joint Convention, pursuant to Article 3(2).

The Prime Minister Decision No. 134 donates a whole Chapter (Chapter VIII) for NORM wastes. The main sources of NORM wastes in the country are generated from phosphate fertilizer and oil & gas industries.

Phosphate fertilizer industry by the "wet process" of phosphoric acid produces large quantities of phosphogypsum as a by-product that is estimated about 30 million tons in 2011. The by-product is accumulated as piles in a large open landfill lined with high density polyethylene, constructed in 1995, nearby Qattina Lake close to Homs city (i.e. 180 km to the north of Damascus).

Four types of NORM waste are generated from the petroleum industry; they are oil co-produced water, which is re-injected into the production wells; contaminated soil which had been disposed in an engineered near-surface landfill near Der Elzour city (i.e. 700 km to the northeast of Damascus); sludges and hard scales, mainly containing Ra-226 and produced as a consequence of decontamination of contaminated equipment using high pressure water jetting, have been stored in standard barrels in a proper storage in order to be treated and processed for eventual disposal.

### C-3. Spent fuel or radioactive waste within military or defence programmes.

Syrian Arab Republic has no spent fuel or radioactive waste within military or defence programmes for the purposes of the Joint Convention, pursuant to Article 3(3).

## Section D. Inventories and Lists

### D-1. Reporting

The CRWMF is licensed for storage of untreated/treated/conditioned radioactive waste awaiting disposal. It is also used to store DSRS waiting to be returned to suppliers/manufacturers. Radioactive wastes are registered once handled to the CRWMF in a national registry programme, which is subsequently updated whenever further treatment takes place. An inventory of DSRS is also developed at the CRWMF based on Microsoft excel database. The national DSRS inventory is currently updated in order to meet the international standards.

Moreover, RNRO maintains records of sealed radioactive sources, DSRS and orphan sources, taking into account sources characteristics and locations, which cover the whole country using IAEA's RAIS 3.0 software.

These national records provide a sufficiently broad set of information for radioactive waste and DSRS, such as the radionuclide content, the amount, composition, chemical and physical form, as well as the categorization of sources in accordance with IAEA Safety Guide RS-G-1.9 Recommendations.

Syria notices the necessity to detect orphan sources across its borders (Syria has 2253 km land border with its 5 neighboring countries). Moreover, the possibility of detecting orphan sources or other contaminated materials in metal scrap yards is also considered in the country. The list of DSRS at the CRWMF is shown in Annex V.

## Section E. Legislative and Regulatory System

### E-1. Implementing measures

The Legislative Decree No. 64 of 2005 on "Radiation Protection" constitutes the legal basis for regulating the use of ionizing radiation, radiation protection requirements, medical and industrial use of radiation, radioactive waste, emergency planning, and responsibilities and penal provisions. The overall objective of the Decree is to ensure adoption of the necessary safety and security measures to protect people, society, patrimony and environment against radiation and to limit the harmful effects of such radiation. Furthermore, the Decree has been assigned promotional roles to the AECS regarding the peaceful uses of ionizing radiation and enabled the AECS to exchange information and to cooperate with the relevant international organizations; and to represent the Syrian Arab Republic in conferences and meetings related to radiation protection, safety and security of radiation sources.

### E-2. Legislative and regulatory framework

The main legislative and regulatory frameworks with regard to radiation protection and safety in the Syria consist of:

-Law No. 12 dated 5 April 1976 and its amendments.

-Legislative Decree No. 64 dated 3 August 2005, this decree canceled all previous provisions that contravene or contradict its provisions and supplemented by regulations, decisions, instructions and other normative documents including:

-Prime Minister's Decision No. 134 dated 17 January 2007, "General Regulations on Radiation Protection and Safety and Security of Radiation Sources" This decision is issued to implement the Decree No. 64.

-AECS Director General Decision No. 623/2008, dated 22 May 2008, "Instructions on Licensing Radiation Practices".

-AECS Director General Decision No. 206/2016, dated 15 December 2016, "Detailed Regulations for the Safe Transport of Radioactive Materials".

The "General Regulations" is largely consistent with the BSS and GS-R-1, while the transport regulations are in line with the IAEA Safety Standards Series No. SSR-6.

The Legislative Decree No. 64 nominates the AECS as: the regulatory body with respect to radiation protection and safety and security of radiation sources; the body responsible for emergency planning and coordination of radiological or nuclear accidents; and the competent authority responsible for issuing approval certificates for package design. In addition, it requests the AECS to establish a Regulatory Organ. The AECS Board Decision No. 23/6/2006 (2006) designated the RNRO as the Regulatory Organ.

The Decree No. 64 empowers to the AECS to: prepare regulations to be approved by the Prime Minster, issue authorizations, perform inspections (inspectors have the powers of Judicial Police), impose enforcement actions and sanctions in case of non-compliance, undertake measures to detect illicit trafficking, verify the absence of contamination exceeding permissible limits in the goods imported or crossing Syria, and promote protection, safety and security culture among the public. Finally, under this Legislative Decree, an advisory committee (RSSC) has been established to support the AECS.

In January 2007, "General Regulations on Radiation Protection and Safety and Security of Radiation Sources" were issued by the Syrian Prime Minister Decision No. 134. These "General Regulations" included several chapters on:

-Occupational, Medical and Public Exposure,

-Safety of Radiation Sources,

-Evaluation of Radiation Protection and Safety and Security of Radiation Sources,

-Management Responsibilities,

-Radiation Protection Officers,

-Exposure to NORM and

-Safe management of Radioactive Waste.

**E-3. Regulatory Body**

As mentioned earlier, AECS Board of Management Decision No. 23/6/2006 (2006) has designated the RNRO as the Regulatory Body in Syria on radiation and nuclear safety and security; and takes the responsibility for the administration of relevant legislation and authorization of all activities and practices involving exposure or potential exposure to ionizing radiation. RNRO reports directly to AECS DG and assumes the responsibility of preparing regulations, issuing authorization, performing inspections and enforcing legislations and regulations. Since that time the Office, acting through the AECS, has been given the necessary specific needs to discharge its duties and responsibilities and had permanently stopped providing services to user organizations.

Below is a chart indicating the position of the RNRO within the AECS (Fig. 1).

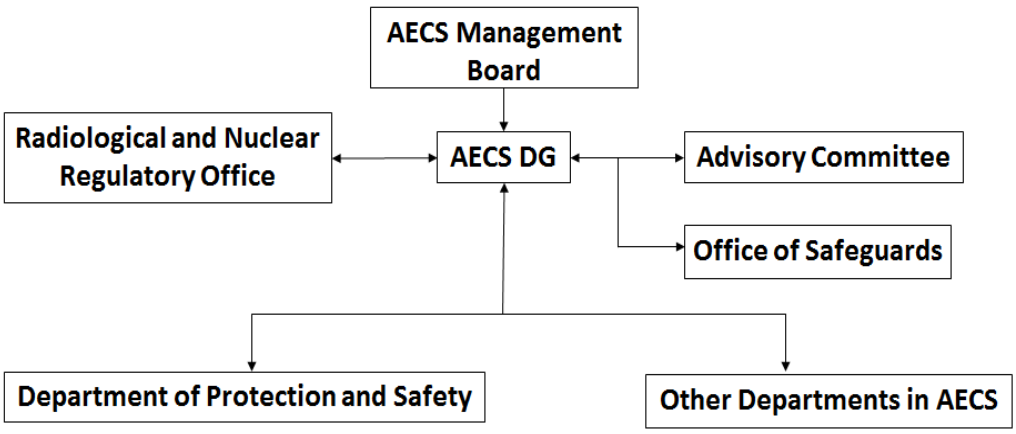


**Figure 1. Organizational chart of the RNRO**

According to the chart, RNRO is fully independent from other AECS different Departments and Offices with the legal capacity and responsibility to make independent regulatory decisions. It's also worth noting that RNRO has a staff of 18 people, of which 9 were allocated to licensing and inspection and most of the technical staff members of the Office hold higher university degrees.

### E-3.1. Overview of RNRO's processes

***Review, assessment and authorization***

Review and assessment of information relevant to safety constitutes one of the principal functions of RNRO regulatory activities. The licensing process is proportional to the relative radiation risks and differs depending on whether it is larger facilities or less complex activities that are to be assessed. Thus, the graded approach concept has adopted in RNRO regarding the content of documents to be submitted in an application of license and the duration of licenses. In fact, a system of authorization, based on IAEA Standards and Recommendations, is completely established and has become fully operational since 2009. In certain cases, RNRO seeks professional advice or assistance, as appropriate, provided by external experts. (IAEA Safety Standards Series No. GSG-12). It might be useful to mention that assessment processes at RNRO are fully transparent, impartial, unbiased, comprehensive, timely and up-to-date and not based upon impressions, feelings or any subjective considerations.

The process for obtaining a license from RNRO (assessment methodology) could be summarized as follows:

- Licensee submits an application form to the Office containing all detailed data and information about the activity.
- RNRO reviews and assesses the application and the radiation protection programme documents to determine whether the facilities and activities comply with the regulatory requirements (preliminary assessment). Based on the outcome of the review and assessment, the Office may set conditions to the license.
- So far (a follow-up assessment), a decision may be taken to issue an authorization. The regular renewal of authorizations is proportional to the practice risk and carried out by IAEA computer programme (RAIS 3.0 Software).

***Inspection***

- RNRO possesses a comprehensive inspection programme and consistent with the overall regulatory strategy. The inspections of facilities and activities were performed to verify that the authorized party is in compliance with the regulatory requirements and with the conditions stipulated in the authorization. These inspections include programmed inspections and reactive inspection; both announced and unannounced. Inspections of facilities and activities commensurate with the radiation risks associated with the facility or activity, in accordance with a graded approach. The majority of planned inspections are announced however several unannounced inspections are also carried out. The inspection programme could be modified, where appropriate, to consider for instance reactive inspections due to an unexpected, unplanned situation or incidents.

- In general, the inspection includes examination and evaluation of the facility, records, surveillance, interviewing of personnel, detecting degraded performance and potential non-compliances, as well as tests and measurements. The inspectors at the RNRO are highly experienced, inspection professional and largely familiar with safety and protection principles, regulatory requirements and various safety aspects of the regulated practices. All inspection activities are formally certified with written procedures including a set of checklist forms and guidelines in sufficient detail for different types of inspected practices.

***Enforcement policy and corrective actions***

- A broad set of enforcement actions depending on the severity level of a violation, may range from recorded verbal notifications, written notifications, confiscation of a radiation source, penalties to eventually suspension or revocation of the authorization was described under Chapter V of the Legislative Decree No. 64 and Article 29 of the "Instructions on Licensing Radiation Practices". RNRO has established and implemented enforcement policy, strategy and procedures within the legal framework for responding to non-compliance by authorized parties with regulatory requirements or with any conditions stipulated in the authorization.

- Inspectors at the Office have not yet been granted immediate enforcement actions for non-compliances with regulatory requirements, stop entirely/partially reduce

of non-regulated/regulated activities**,** or violations of authorization conditions. Normally, the Office in accordance with its established procedures takes decisions concerning these types of enforcement actions. Finally, implicit and explicit processes for appealing against AECS/RNRO decisions are not yet established. However, authorized parties could contest against RNRO regulatory decisions through raising a written grievance to DG of the AECS, the Presidency of the Council of Ministers, or go to court.

**E-3.2. Organization, financial resources and independence of the RNRO**

***Organization and financial resources***

AECS DG is entitled to employ, through an open competitive opportunity or a direct contracting arrangement according to an evaluation interview, RNRO staff members needed to conduct the tasks given by the Head of the Office (annual contracts or permanent jobs). Prior to this, the case is discussed in the DG and Head of the Office regular meetings. The jobs at the AECS/RNRO are security classified, a security check is performed before a decision on employment can be taken. The work of RNRO is conducted by means of planned activities arranged on Section level. All of these activities are linked either to an operational area or to a process/sub-process.

On the basis of its legal duties, regulatory responsibilities and recruitment needs, the Government obviously provides RNRO through the AECS with adequate financial and other means for human resource management, staff training, buildings, and facilities in order to discharge its responsibilities and maintain its independence. As previously mentioned, AECS has delegated its regulatory functions to RNRO, and at the same time, it provides the Office, as requested and through an annual budgetary process, with sufficient financial resources. Moreover, RNRO have convenient and appropriate space as well as technical and office support equipment to fulfill its responsibilities. It is worth mentioning that even RNRO unexpected expenses or unforeseen expenditures are totally covered through the overall AECS budget.

To summarize, RNRO has sufficient finical resources to cover all of its operating costs, prioritizes its financial needs based on radiation risk and importance of radiation safety and possess the infrastructure needed to achieve its objectives effectively and efficiently.

***RNRO independence***

RNRO have the entire responsibility for activities towards license holders and other authorized parties regarding radiation safety and security. RNRO is effectively independent in its licensing and inspection operations (core functions) with the full capacity to make independent regulatory decisions related to safety and security. The organizational chart indicating the position of RNRO within the AECS (Fig. 2) which clearly shows that RNRO has no relations with other AECS Departments and if there is any, it will be through AECS DG.

If we get back to Syria regulatory body position within the AECS, according to the current nuclear and radiological activities in the country, the AECS is acting as Regulator rather than Operator except for licensing AECS radiological and nuclear research activities. Furthermore, it is admitted that when the Syrian government decides to embark on a nuclear power programme and if the Ministry of Electricity decides to operate the nuclear power plant, the AECS at this time will entirely play the role of a regulatory body (RB).

There are many challenges to achieving the independent regulatory decision-making and an effective regulatory independence remains a problematic topic in many IAEA's Member States (MS). IAEA recommendations require separation of the RB from the promoters of radiological and nuclear technologies. Nevertheless, at the same time, the IAEA admits that any RB must function within the national legal and budgetary framework of the State; this means that the RB should be a governmental organization in order to legally exercise its authority and procedures (licensing, inspection, enforcement, etc.). In other words, the IAEA recognizes that an independent regulatory body will not be entirely separate from other governmental bodies. Such situation might create conflicts of interest between the RB and other government agencies and any RB cannot be completely independent in all respects of other parts of the government.

Therefore, the AECS believes that the effective independency of a RB is a relative matter and there are levels of independence in function of the national system of radiation protection in each of IAEA's MS's. Reaching an advanced level of RB independence is highly desired and the RB should acquire the necessary scientific and technical expertise alongside qualified and competent personnel to support its

independence. In other terms, RB independence is positively correlated with its staff competency that contributes to effective independence in regulatory decisions "the higher your RB independence level reaches, the more competent and professional staff you will need".

## Section F. Other General Safety Provisions

### F-1. Responsibility of the license holder

Radiation/nuclear safety within locations including the safety of radioactive waste management facilities and/or activities is reposed on license holders, and this responsibility cannot be delegated. The main responsibilities of the licensee are:

-Comply with the regulatory aspects and requirements stated in the authorization related to the safety and security of radioactive waste management.

-Performing his activities ensuring the safety and security of sources under his control, according to the conditions of the authorization.

-Taking all proper measures to protect workers, the public, property and the environment from the risks arising due to exposure to radiation.

-Establishing technical procedures to prevent accidents and mitigate the consequences of accidents.

-Minimizing as reasonably achievable the quantity of radioactive waste generated by his activities.

-Develop and maintain an emergency plan reviewed and approved by the regulatory body for radioactive or nuclear accidents that may occur in his own facility.

-Providing the necessary equipment and facilities, including radiation instruments with appropriate detectors to measure the concentration of radionuclides in the waste or the dose rates resulting from it.

-Providing qualified personals, training programs and safe work procedures to perform activities related to stages of dealing with radioactive waste.

-Preparing a radiation protection programme.

-Verifying before classifying a disused sealed radioactive source as waste, whether there are other users that can benefit from this radioactive source.

### F-2. Human and financial resources

License holders are required to provide for and maintain adequate financial and human resources to fulfil their obligations with respect to the safety of radioactive waste management. The licensee has the responsibility for ensuring that the employees are trained and qualified to undertake their duties with good judgement and according to the specified procedures. All licensees have to designate a radiation protection officer who is responsible for implementing the radiation protection program.

Staff at the CRWMF/AECS have been trained on matters concerning radioactive waste management of all types with assistance from the IAEA. Training and refresher training is frequently carried out via training courses delivered by the Nuclear Science and Technology Training Center (NSTTC) at the AECS. Considering the importance of well-trained personnel with relevant competencies and skills, a close cooperation has established between the AECS and the University of Damascus to provide special and high education in the field of radiation protection and medical physics based on IAEA standard syllabus.

### F-3. Quality assurance

The existing legislation on radiation and nuclear safety and security (Decision No. 134) provides that, a licensee shall establish an appropriate management and filing system, commensurate with the size of the undertaking or practice licensed. Risk assessment and an assessment of the effectiveness of protective measures applied by the licensees, in relation to sources of ionizing radiation, are commensurate with the complexity of the radiation risks associated with the activity. The designated radiation protection officer in any facility is responsible to establish and implement a quality assurance program with regard to the implementation of internal procedures, such as regular verifications and calibrations of the used radiation measurement equipment. In addition, the license holders have to take all appropriate security measures for securing radioactive wastes generated in his facility.

### F-4. Operational radiation protection

The radiation protection criteria are detailed in the Decision No 134 of 2007 and its amendment. These include prescribing of dose limits for workers and members of the public as well as the setting of dose constraints for public exposure

*a) Occupational Exposure*

The occupational exposure of any workers aged over 18 years of age, the recommended dose limits are:

- An effective dose of 20 mSv per year averaged over five consecutive years (100 mSv in 5 years), and not to exceed 50 mSv in any one year.
- An equivalent dose to the lens of the eye of 20 mSv per year averaged over five consecutive years (100 mSv in 5 years), and not to exceed 50 mSv in any one year.
- An equivalent dose to the extremities (hands and feet) or the skin of 500 mSv in a year.

*b) Apprentices and Students*

For apprentices of 16 to 18 years of age who are undergoing training for employment involving exposure to radiation and for students of age 16 to 18 who are required to use sources in the course of their studies, the recommended dose limits are:

- An effective dose of 6 mSv in a year.
- An equivalent dose to the lens of the eye of 20 mSv in a year.
- An equivalent dose to the extremities or the skin of 150 mSv in a year.

*c) Public Exposure*

The recommended dose limits for individual members of the public are:

- An effective dose of 1mSv in a year.
- An equivalent dose to the lens of the eye of 15 mSv in a year.
- An equivalent dose to the extremities or the skin of 50 mSv in a year.

**F-5. Emergency preparedness**

A revised National Emergency Plan for response to radiological and nuclear emergencies (NEP) had been issued in 2018. The revised NEP is in compliance with the IAEA General Safety Requirements No. GSR Part 7. This NEP specifies threat

categorization according to IAEA standards (five threat categories) and covers potential scenarios with ionizing radiation, from either abroad or within the country, including incidences with radioactive waste. Three radiological emergency teams each consists of 4 personnel and two vehicles were nominated by the AECS and assigned to have a weekly shifts. In case of emergency, the team in duty will responded and the other two teams will notified to be in alert if needed.

The RNRO requires the establishment of an emergency preparedness and response plan for any activity or practice for which authorization is sought (on-site emergency plan). The emergency plan includes a description of facilities, identification of conditions that could create a need for emergency intervention (potential accidents), training and exercising arrangements, and liaison with off-site authorities.

Appropriate arrangements have also been made for combating illicit trafficking of radioactive materials. In this context, customs officers and AECS personals involved have been trained in these matters and appropriate detection equipment has been installed at Syrian border checkpoints (land borders, seaports and airports).

### F-6. Decommissioning

There are no facilities of radioactive waste in closing process in Syria.

## Section G. Safety of Spent Fuel Management

No nuclear applications that could lead to the generation or disposal of spent fuel exist in Syria. In addition, no facilities that could treat, process, condition spent fuel exist in the country. However as previously mentioned, Syria operates a 30 kW tank-in-pool research reactor, which used HEU as fuel, and there is no spent fuel for the moment. Noting that Syria is in the process of converting its research reactor to run on LEU and it was foreseen that the irradiated HEU core will be send back to China.

## Section H. Safety of Radioactive Waste Management

### H-1. General safety requirements

The general safety requirements for radioactive waste management in Syria are consigned in Prime Minister Decision No. 134 of 2007 on Radiation Protection and Safety and Security of Radiation Sources (Chapter IV), and the various sets of Regulations issued under the Legislative Decree No. 64 of 2005. Furthermore, an

updated national policy and strategy, in accordance with IAEA recommendations, on safe management of radioactive waste is awaiting for approval from the AECS Board of Management

Provisions in the Decision No. 134 regarding waste management regulations ensure that all facilities in the country involved in radioactive waste management address the following issues:

- Radioactive wastes produced are kept as low as reasonably practicable (ALARP).
- There is effective protection of individuals, society and the environment.
- Radioactive waste shall be managed in such a way that will not impose undue burdens on future generations.

**H-2. Existing facilities and past practices**

Syria has neither disposal facility nor borehole disposal. In contrast, The AECS operates a Central Radioactive Waste Management Facility (CRWMF) which had been officially inaugurated in 2001. The radioactive waste management practiced in Syria involves reception of radioactive waste, characterization and safe storage, pending the development of a disposal facility.

The CRWMF is responsible for handling of radioactive waste, treatment, conditioning and storage pending disposal as well as the safety and security of radioactive waste. The management and storage of radioactive waste is performed by the AECS, while NORM from oil, gas and phosphate industries are properly stored at the site, under AECS supervision.

The CRWMF embraces two sections. The first section includes offices, radiochemical laboratories, and the main radioactive treatment-hall (with surface area of 470 $m^2$) in addition to controlled access area. The treatment-hall is provided with an appropriate shielding, ventilation system, an underground drainage tank (of 2 $m^3$) and equipment for radioactive waste conditioning processes (compactor, ion exchange unit, glove boxes, cementer, mechanical crane and manual forklift). The second section comprises two stores each of 300 $m^3$). One storage is dedicated for treated radioactive waste that awaiting disposal. The second storage is designated for DSRS which includes ten wells (eight of 2 m depth while two are 8 m depth). Noting that CRWMF is also equipped with the necessary radiological measurement meters, such as

radiation dosemeters, radiation contamination meters, hands and feet contamination detection meter, identifier, etc., in addition to personal protection equipment.

The CRWMF and the operator team are licensed by RNRO upon an updated radiation protection programme that annually renewed. Documentation and Record keeping are well revised and periodically inspected. Visual check and radiological measurements are performed at the storages and periodically reported.

The examination of safety and security of the CRWMF is carried out periodically by RNRO's inspectors. If the CRWMF requests to make substantial modifications regarding safety and radiological protection system, RNRO will review and assess the request and an appropriate decision will be taken. The location of the CRWMF was chosen at Deir El-Hajjar in view of the supporting infrastructure being in place, the availability of land and the location of the site (25 km southeastern of Damascus). The site also has good security measures in place (all AECS premises have good security arrangements).

**H-3. Siting of proposed facilities**

According to the "Instruction on Licensing Radiation Practices" of 2008, the process of authorization for facilities or activities that give rise to higher risk of radiation exposure (including waste management facilities) shall be delivered in two-steps licensing process for construction and utilization.

**H-4. Design and construction of facilities**

The construction of any new radioactive waste management facility in the country will be submitted to two authorizations: (1) Authorization for construction; and (2) Authorization for operation. All these authorizations are subject of a report submitted by the user of the facility where he specifies all the safety and radiation protection measurements taken to protect individuals, society and the environment. All these authorizations are assessed and granted by RNRO.

**H-5. Assessment of safety of facilities**

During the authorizations process for the construction, commissioning and operation, of any higher risk of radiation exposure facility (including radioactive waste management), the applicant has to submit to RNRO all documents related to safety

and security. RNRO shall review and assess these documents in order to deliver the requested authorization.

### H-6. Operation of facilities

The operational limits and conditions for CRWMF are listed in the authorization document, any changes in these operational limits and conditions must to be approved by RNRO before they are carried out. The licensee is the first responsible for the safety and the security of the facility; he has to notify to RNRO, and in a timely manner, any incidents or accidents occurred in the facility.

### H-7. Institutional measures after closure

The institutional arrangements after closure is not yet established, because it has not been planned or held the closure of the CRWMF. Moreover, there is no plans to design or construct any new facility for radioactive waste management in the near future.

## Section I. Transboundary Movement

The legislative framework in Syria (Decree No. 64, Article 4) requires that no person can perform any practice/activity involving radioactive substances or radioactive waste including the possession, production, handling, use, storage, manufacture, import or export, supply, distribution, transfer, transport, disposal, recycling, re-use of radioactive substances or radioactive waste unless this person has a license granted by the RNRO.

Syria applies the relevant international standards for transport of radioactive materials, the IAEA Safety Regulations for the transport of radioactive materials and the United Nations Recommendations on the transport of dangerous goods export, import and internal transport of any radioactive materials is subject to a licence granted by the RNRO in accordance with IAEA Supplementary Guidance on the Import and Export of Radioactive Sources. The main method of transport in Syria is by air cargo, rail transport and road transport. Syria does not import/export any radioactive waste, the only transboundary movements involving Syria are shipments of open and sealed radioactive sources. The disposal of radioactive waste material in Antarctica is prohibited (Antarctic Treaty); thus there has never been a shipment of radioactive waste from Syria to a destination south of latitude 60 degrees south.

RNRO has established a memorandum of understanding with the Syrian Directorate of Customs to detect and monitor radioactive substances at all Syrian border checkpoints. Finally, transport of radioactive materials, in quantities above exemption level, across the county is performed according to AECS Director General Decision No. 206/2016, dated 15 December 2016, "Detailed Regulations for the Safe Transport of Radioactive Materials".

## Section J. Disused Sealed Sources

It is already cited that the AECS is operating a radioactive waste facility (CRWMF) dedicated to receiving, treating, conditioning and storing DSRS from hospitals, laboratories, industries, institutions, and research centers.

No manufacturing or remanufacturing of sealed radioactive sources currently takes place in the country. However, a variety of sealed radioactive sources of different radioactivity levels have been widely used in medical, industrial applications, and academic research purposes. DSRS for which further use cannot be excluded are not considered as radioactive waste. Nonetheless, when a sealed radioactive source becomes disused, it is the responsibility of the license holder to ensure that the source is handled and stored in a safe manner prior to its returning to the manufacturer/supplier. Taking into account that DSRS that there is no intention of using them anymore, or the current license holder is unable to arrange secure storage and could not be repatriated to suppliers are stored in a safe and secure manner, according to the radionuclide type and half-life, in CRWMF wells for their management in the future.

To date, a few hundreds of DSRS such as Cs-137 and Co-60 irradiators, sources used in nuclear gauges, smoke detectors, and small sources for education purposes as well as orphan sources are safety and securely stored at the CRWMF.

The limited number of DSRS in Syria does not require the removal of sources from source holders (original devices) in order to reduce the volume for storage. However, preliminary experiments at the CRWMF/AECS were performed to dismantle some DSRS Category 3-5 and the recovered sealed radioactive sources were placed in a retrieval storage for subsequent recycle/reuse or conditioning and eventual disposal in the future.

In case of orphan sources, there are several methods to search for and recover orphan sources. The taking action to address the problem in Syria is that RNRO takes control of the source, to ensure its safe storage and initiates procedures to find the original owner/user and if the owner cannot be identified, the source is transferred to CRWMF for its management. Orphan sources are not often identified in Syria, there have only been very few cases over the last years, and in all cases involving low/intermediate activity sealed sources.

## Section K. General Efforts to Improve Safety

### K-1. Suggestions and Challenges identified at the previous Review Meeting

Not applicable.

### K-2. Efforts to improve safety

For the purpose of improving the safe management of radioactive waste, RNRO has plans to:

- Strengthen the regulatory infrastructure with the development of regulations and guidelines and international cooperation.
- Finalize and approve of the national radioactive waste management Policy and Strategy prepared. The document was reviewed and approved by the RSSC and it will be submitted to AECS Board of Management for the official adoption.
- Establish and issue instructions for the reuse or recycling of low radioactive DSRS (mainly Category 3-5) as technical option for the management of DSRS. Noting that long term storage and disposal of old DSRS might be a challenge for developing and non-nuclear countries, such Syria, managing small quantities of radioactive waste. Such sources can often not be returned to suppliers/manufacturers, and there is a risk that the sources are to be kept indefinitely at the storage facility without a defined procedure for eventual disposal.
- Develop national instructions for radioactive waste acceptance criteria in terms of its physical, mechanical, chemical, radiological and biological properties.

**K-3. Openness and transparency**

As a governmental organization, all activities of RNRO, in any issue concerning the public interests, are carried out in an open and transparent manner. Furthermore, the national policy and strategy on the safe management of radioactive waste provides the following:

"*Adopting openness and transparency principle, disseminating information and making it accessible to all, and informing the public at an early, timely and effective stage regarding all aspects of radioactive waste management. This requires the adoption of an appropriate media mechanism, using electronic media or other appropriate means, to provide the public and interested parties with all relevant information, where this does not infringe on the security aspects, so that any specialist or legal entity can provide information, suggestions or opinions regarding these aspects within a reasonable period of time."*

**K-4. RNRO function during pandemic outbreak:**

RNRO have already gained experience from Covid-19 coronavirus pandemic crisis and adopted special regulatory approaches in response to Covid-19 scourge. In fact, all RNRO operations are continued during the lockdown period, but with some work disruption due to reduction of employee working hours. Good practices and lesson learned during this unprecedented pandemic situation regarding RNRO activities could be summarized as follow:

1- RNRO is obliged to operate with reduced staffing, but staff remain on call if needed.

2- Employees at the Office were regularly subjected to medical screenings.

3- Social/physical distancing was maintained at the Office rooms and spaces with meeting and travel restrictions.

4- Physical inspections to critical radiological facilities were mostly carried out and the probability of catching Covide-19 were kept to a minimum by following certain general guidelines/measures including:

- Inspections are conducted preferably at facilities in low urban densities with respecting health recommendations (short conversations; maintain a clear 2 m physical distance and other precautionary measures).

- On-site inspections were carried out by young inspectors (less than 45 years old), while elderly inspectors continued working from home or office.
- Hospitals treating Covide-19 patients were temporary excluded from scheduled inspections, but kept under regulatory control through review of documentation and virtual communication (remote inspections).

## Conclusion

The current NR provides an exhaustive information on radioactive waste management practices in the Syrian Arab Republic. Syria has neither nuclear power plant nor nuclear fuel cycle installation. The amounts of radioactive waste to be managed in Syria are relatively in limited quantities or small volumes mainly consisted of radiotherapeutic materials and DSRS from medical services, research and industrial applications. In the choice of processes and technologies adopted in the Syrian radioactive waste management facility (CRWMF), priority is given to reduce/minimize the volume of radioactive waste that needs to be treated or managed according to the national Regulations. The main objective of Syrian Regulatory Body (RNRO) is to continuously ensure and enforce radiation safety/security and enhance radiation protection in all practices/activities which involve a risk from ionizing radiation.

## Section L. Annexes

**Annex I. List of Spent Fuel Management Facilities**

None.

**Annex II. List of radioactive waste management facilities**

The Central Radioactive Waste Management Facility located at Deir El-Hajjar and operated by the AECS.

**Annex III. List of nuclear facilities in the process of being decommissioned.**

None.

**Annex IV. Inventory of spent fuel.**

None.

**Annex V. Inventory of radioactive waste**

**Number of disused sealed radioactive sources at the Central Radioactive Waste Management Facility at the AECS**

| Categories<br>Radionuclides | I | II | II | IV | V | Half-life |
|---|---|---|---|---|---|---|
| $^{241}$Am-Be | | | 15 | 16 | | 432 a |
| $^{238}$Pu-Be | | | | 1 | | 87.8 a |
| $^{226}$Ra-Be | | | | 1 | | 1600 a |
| Ra-226 | | | | 4 | 10 | 1600 a |
| Ti-204 | | | | 1 | | 3.8 a |
| Cs-137 | | 26 | 91 | 31 | | 30.1 a |
| Sr-90 | | | 8 | 10 | | 28.6 a |
| Kr-85 | | | | 5 | | 10.7 a |
| Co-60 | | | 36 | 27 | | 5.3 a |

**Annex VI. Reference to national laws, regulations, requirements, guides, etc.**

-Legislative Decree No. 64 dated 3 August 2005,

-Prime Minister’s Decision No. 134 dated 17 January 2007, "General Regulations on Radiation Protection and Safety and Security of Radiation Sources",

-AECS Director General Decision No. 623/2008, dated 22 May 2008, "Instructions on Licensing Radiation Practices",

-AECS Director General Decision No. 206/2016, dated 15 December 2016, "Detailed Regulations for the Safe Transport of Radioactive Materials".

## Annex VII. References to official national and international reports related to safety

### Multilateral Agreements and Conventions signed by the Syrian Arab Republic

The Syrian Arab Republic has been a Member State of the IAEA since 1963, and the status of Syria vis-à-vis major multilateral Agreements and Conventions is mentioned below:

*- Agreement on the Privileges and Immunities of the IAEA (P&I). Acceptance since 18/12/19.*

*- Convention on Nuclear Safety (CNS). Party since 17/12/2017.*

*- Convention on Early Notification of a Nuclear Accident (CENNA). Party since 17/10/2018.*

*- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (CACNARE). Party since 17/10/2018.*

*- Convention on the Physical Protection of Nuclear Material (CPPNM) and the Amendment to the Convention on the Physical Protection of Nuclear Material (CPPNM/A). Party since 04/01/2020.*

*- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (JC). Party since 23/02/2022.*

*- Co-operative Agreement for Arab States in Asia for Research Development and Training Related to Nuclear Science and Technology (ARASIA). Acceptance since 29/07/2002.*

*- Agreement between the Government of the Syrian Arab Republic and the IAEA for the Application of Safeguards in connection with the NPT. Signatory since 18/05/1992.*

*- Syria is also a signatory to the Radiation Protection Convention, ILO, 1960.*

Syria is already implementing most of rules stated in the Code of Conduct on the Safety and Security of Radioactive Sources. In this regard, the contact point was nominated; Syria made available its responses to the Importing and Exporting states Questionnaire. Recently, a notification pursuant to GC(48)/RES/10D "the

Supplementary Guidance on the Import and Export of Radioactive Sources" was prepared by the AECS and sent to the Syrian Ministry of Foreign Affairs and Expatriates to be duly signed and mailed to IAEA administration.

**Annex VIII. Reference to report on international review missions performed at the request of a Contracting party**

None.

**Annex IX. Other relevant material**

None.

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