NRRC Stakeholders Guidelines

Kingdom of Saudi Arabia

# Application for Authorizing Containers Security Inspection by Using X-Ray Systems Practice

NRRC-SG-012

2023

هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

**Stakeholder Guideline**

Application for Authorizing Containers Security Inspection by Using X-Ray Systems Practice

2023

NRRC-SG-012

## Preamble

In accordance with the provisions of the NRRC's approved Regulations, this stakeholder guideline describes criteria and/or techniques that are considered appropriate for satisfying the requirements stipulated in the NRRC's regulations.

This stakeholder guideline has been prepared on the basis of International Atomic Energy Agency (IAEA) standards, as well as the and the international best practices and the experiences of similar international regulatory bodies, and in accordance with the Kingdom's international commitments, and it has been approved by the NRRC's CEO resolution No. 1411, dated 23/07/2023.

## Contents


| | | |
|---|---|---|
| **1.** | **Purpose** | **6** |
| **2.** | **Scope** | **6** |
| **3.** | **Definitions** | **7** |
| **4.** | **Abbreviations** | **8** |
| **5.** | **General and Administrative Information** | **8** |
| **6.** | **Integrated Management System** | **8** |
| 6.1 | Management structure and responsibilities | 8 |
| 6.2 | Description of regular assessment of protection, safety and security | 9 |
| 6.3 | Confirmation of the procedures and programs | 9 |
| **7.** | **Technical Information** | **10** |
| 7.1 | Information on radiation generators (Inspection Imaging Device) | 10 |
| 7.2 | Description of the facility / facilities | 12 |
| 7.3 | Technical information of radiation monitoring equipment | 13 |
| **8.** | **Safety Assessment** | **14** |
| 8.1 | The safety assessment consideration | 14 |
| 8.2 | The safety assessment basis for decision making | 14 |
| 8.3 | The safety assessment Revision | 15 |
| **9.** | **Radiation Protection Program** | **16** |
| 9.1 | Protection of Workers | 16 |

9.2 Protection of the Public 20

**10. Emergency Preparedness and Response Plan 20**

10.1 The content of a basic emergency plan 20

10.2 Reporting 21

10.3 Development of Emergency Plans 22

**11. Related Documents and Files 24**

## 1. Purpose

Nuclear and Radiological Regulatory Commission (NRRC) has developed an effective regulatory framework for the safe and secure authorization of Use of X-ray systems for cargo/container screening Practice throughout its life cycle. Under the regulatory framework, the prime responsibility for safety and security within Use of X-ray systems for cargo/container screening Practice lies with the authorized person.

The purpose of this guideline document is to give the applicant and/or the authorized person a clear and specific guidance on the submission for the purpose of authorization of Use of X-ray systems for cargo/container screening practice that include the following:

- Human non-medical radiation imaging
- Use of X-ray systems for cargo/container screening.
- Non-X-ray system for cargo/container screening.

## 2. Scope

This guideline addresses practice related to containers security inspection by using X-ray systems, in particular, address the management system, radiation protection, safety and security aspects of Containers Security Inspection by Using X-ray systems Practice, including use, storage and transport. This will include Containers Security Inspection by Using X-ray systems work that uses radiation sources, both in the authorized facility and outside facilities. However, it is considered appropriate that a graded approach in the application of the requirements will be taken into account and should

be adapted to the risks inherent to each facility.

This guideline includes the required information relating to radiation safety and security by the NRRC in order to verify the adequacy of the proposed safety and security measures as part of the authorization process.

This guideline includes the required information relating to authorization of new license, renewal as well as amendment of license.

## 3. Definitions

***Assessment***

The process, and the result, of analyzing systematically and evaluating the hazards associated with sources and practices, and associated protection and safety measures.

***Inspection imaging device***

An imaging device designed specifically for imaging persons or cargo conveyances to detect concealed objects on or within the human body or within cargo or a vehicle.

***Radiation generator***

A device capable of generating ionizing radiation, such as X rays , neutrons, electrons or other charged particles, that may be used for scientific, industrial or medical purposes.

***Controlled area***

means a defined area in which specific protection measures and safety provisions are or could be required for controlling exposures or preventing the spread of contamination in normal working conditions, and preventing or limiting the extent of potential exposures.

***Supervised area***

means a defined area not designated as a controlled area but for which occupational exposure conditions are kept under review, even though specific protection measures or safety provisions are not normally needed.

## 4. Abbreviations

| ABBREVIATION | DEFINITION |
|---|---|
| **NRRC** | Nuclear and Radiological Regulatory Commission. |
| **RPP** | Radiation Protection Program. |
| **RSO** | Radiation Safety Officer. |
| **QS** | Quality Control. |
| **SP** | Security Plan. |

## 5. General and Administrative Information

The applicant should fill and sign the application form.

## 6. Integrated Management System

### 6.1 Management structure and responsibilities

The applicant should fill and sign the application form.

- Describe overall organizational system and integrated management system assuring that protection and safety and security are effectively incorporated into the overall management system of the applicant.
- Describe and clearly define responsibilities for radiation safety and security for the following parties as appropriate: RSO(s), person responsible for security, workers, itinerant

workers, radiation safety committee and clients including responsibilities for cooperation and consultation.

- Positions with responsibility for regulatory matters, including any positions such as the licensee, radiation safety officer, security personnel, advisers, guards, and other security related positions specifically required by regulation. Provide an organization chart showing the staffing structure with lines of authority and supervision to demonstrate how the security organization and responsibilities fit within the overall site organization.

### 6.2 Description of regular assessment of protection, safety and security

The applicant should verify the compliance by Providing description of regular assessment of protection and safety and security such as Quality Assurance (QA) program and plans for regular reviews.

### 6.3 Confirmation of the procedures and programs

The applicant should confirm by affirmation by the applicant and/or submittal of the following procedures and programs to the NRRC.

- Radiation source inventory, supply of sources, prior assessment of the radioactive sources and radiation generators and inventory of disused sources.
- Education, training and competence of the staff and their training, retraining, and informing.

- Investigation of incidents and accidents.
- Emergency preparedness and response.
- Control of modification(s) of facilities, equipment, and activity.
- Management of disused sources and depleted uranium if applicable.
- Safe transport.
- Import and export of radioactive sources.
- Control of visitors.
- Program for the improvement of the integrated management system.

## 7. Technical Information

### 7.1 Information on radiation generators (Inspection Imaging Device)

- The applicant should provide details about X-ray generator(s):
  - Type of the X-ray generator (X-ray tube or linear accelerator).
  - Manufacturer of the X-ray generator.
  - Model of the X-ray generator.
  - Serial number(s) of the X-ray generator housing and panel.
  - Supplier of the X-ray generator.
  - Type, model, and serial number of the tube.
  - Manufacturer of the tube.
  - Maximum voltage.
  - Maximum current intensity.

- Supplier of the tube.
- Permanent filters.
- Use of collimators.
- Maximum leakage radiation by the manufacturer.
- X-ray generator equipment.

- If the baggage inspection units using X-ray equipment typically operating in the range of 80–160 kVp are fixed systems at the entrance to public buildings (including airports), the applicant should provide the description of interlocks and other safety features to prevent internal access to the area where radiation is produced.
- If the maximum operating voltage of the X ray generator tube is in the range of 80–160 kVp, the applicant should provide the description of interlocks and other safety features to prevent internal access to the area where radiation is produced.
- If the fixed cargo scanning devices utilizing the radiation beams, typically with a photon energy of up to 9 MeV are used, the applicant should provide the description of a purpose-built facility with walls of sufficient thickness to provide adequate shielding. The description of the interlocked doors at entrances to the screening area facility should be provided, if any.
- If the relocatable scanning devices typically operated at 6 MeV are used, the applicant should provide the designation of a controlled area during operation, from which all employees and members of the public are excluded during the scanning of conveyances.

- If the mobile scanning devices typically operate at 3–6 MeV are used, the applicant should provide the description of the controlled area during operation that should be determined on a case by case basis.
- The applicant should provide Information on the radioactive sources (on all non-exempt sources, including sources for checking equipment and calibration sources): (if applicable)
  - o Radionuclide.
  - o Manufacturer of the source.
  - o Model.
  - o Source serial number.
  - o Source activity and reference date.
  - o Design, manufacturing and testing of the source.
  - o Leak test.
  - o Working life of the source.
  - o Certificate for sealed radioactive source.

### 7.2 Description of the facility / facilities

#### 7.2.1 Description of use on site

- The applicant should specify in detail how a work with container scanner is going to be prepared.
- The applicant should specify in detail how work with container scanner is going to be conducted, e.g. establishment of controlled areas, use of temporary shielding, use of warning signals and notices in a language understood by person at the location, establishment of all other precautions before, during and after a use of a scanner

- The applicant should specify use of all sources and equipment to be available at the site, such as monitoring equipment, personal dosimeters and alarm dosimeters, warning signals and notices, and emergency kit.
- The applicant should describe what and how radiation monitors are used.
- The applicant should demonstrate that arrangements are in place for the transport of container scanner and specify the safety training provided to drivers as well as data related to vehicle to be used to transport the scanner.

### 7.3 Technical information of radiation monitoring equipment

**7.3.1 The applicant should provide and demonstrate the following equipment:**

Portable survey meters.

- The applicant should demonstrate suitability and calibration of portable survey meters.
- The applicant should specify their use and number, e.g., specify that survey meter(s) used for this practice are suitable and the applicant has sufficient number of portable meters.

**7.3.2 Personnel monitoring devices are provided to all workers.**

- The applicant should demonstrate that following functions are in place: personal dosimetry, direct reading, and alarming. Specify all technical information.

## 8. Safety Assessment

### 8.1 The safety assessment consideration

- The dose rates from shielded and unshielded radioactive sources and from radiation generators (X-Ray), as appropriate.
- The exposure of workers and the public from normal operation of container scanner, and potential exposures from reasonably foreseeable incidents
- Limits and technical conditions for operation of the radiation scanner(s).
- Ways in which structures, systems, and components, as well as procedures relating to protection and safety, might fail or might otherwise lead to potential exposures, and the consequences of such failures or potential exposures.
- Ways in which external factors, operating errors and human factors could affect protection and safety.
- The implications of any proposed modifications for protection and safety.
- Any uncertainties or assumptions, and their implications for protection and safety.

### 8.2 The safety assessment basis for decision making

- The engineered control measures that are necessary for safety, for example to prevent access to the primary beam of a container scanner.
- The administrative controls that are necessary for

safety, for example the procedures required to control entry scanner gate, particularly when the beam is operational.

- The development of safe working procedures (local rules) for storage, operation, maintenance of a source inventory, servicing and maintenance, and management of disused sources.
- Procedures for designating controlled areas and supervised areas (permanent and temporary).
- Any measures necessary for the protection of the public.
- The assessment of occupational exposures.
- The training program for container scanner operators and other persons.
- An effective emergency preparedness and response program to manage reasonably foreseeable events (including very low probability events). This should include: information on reasonably foreseeable incidents, the measures necessary to prevent or minimize the likelihood of occurrence of such incidents, and the necessary emergency response arrangements (including emergency plans and procedures, and emergency equipment).

**8.3 The safety assessment Revision**

The safety assessment should be reviewed annually and whenever any of the following factors apply:

- When safety might be compromised or affected as a result of modifications to facilities or to activities.
- When the acquisition of a new radiation source or a source with different characteristics is planned.
- When operating experience or the investigation of incidents, failures or errors indicates that current safety measures are invalid or are not fully effective.
- When significant changes to relevant standards, regulations or guidance have been made or are envisaged.

The licensee should ensure that the safety assessment reflects current working practices and that no changes have been overlooked.

## 9. Radiation Protection Program

The applicant should provide radiation protection program as follow:

### 9.1 Protection of Workers

#### 9.1.1 Personal dosimetry

- The applicant should specify and provide the personnel dosimetry service and arrangements related to monitoring of personal doses.
- The applicant should provide the results of the review on past occupational doses. Provide workers' (including itinerant) records of past occupational exposure if not already recorded in the registry of occupational doses.

**9.1.2 Education and training of workers.**

- The applicant should specify names, qualification, education, training, and retraining.
- The applicant should describe how staff (including assistants and trainees) are trained and qualified.

**9.1.3 Workers' health surveillance.**

- The applicant should specify programs for health surveillance.

**9.1.4 Itinerant workers (if applicable).**

- The applicant should describe the allocation and documentation of the responsibilities of the employer and the applicant for safety and protection of itinerant workers.

**9.1.5 Female workers**

- The applicant should describe the procedure for the employer notification on pregnancy for female worker.

**9.1.6 Persons under 18**

- The applicant should guarantee that no person under the age of 16 years is or could be subject to occupational exposure. While probably unlikely, a trainee operator aged 16 to 18 years could commence training under supervision to become an operator of an inspection device.

**9.1.7 Arrangements for the Radiation Protection Program (RPP).**

- The applicant should demonstrate that all elements of the RPP are in place, e.g., provide a copy of a RPP:
- Assignment of responsibilities for the RPP.
- Designation of controlled areas or supervised areas.
- The applicant should specify designation of controlled and supervised area using safety assessment and measured dose rates at working room(s)/area(s), storages(s).
- The applicant should demonstrate appropriate managing of labels, marks, and notices.

**9.1.8 Practice specific local rules.**

- The applicant should demonstrate that local rules applicable for workers are prepared for all processes of the applicant and that an adequate number of workers is involved in the practice.
- The applicant should specify roles and responsibilities as well as demonstrate that supervision of processes is taking place.
- The applicant should demonstrate that rules, labels, and marks are in a language understood by those for whom they are intended.
- The applicant should demonstrate that the necessary amount of radiation monitoring equipment is available and specify their technical specification, selection, calibration, maintenance, testing and use of radiation monitoring equipment. Demonstrate that monitoring program takes

into account all processes of the applicant, e.g., use and maintenance of radiation equipment, accepting packages with new radioactive sources and preparing packages for transport.

**9.1.9 Personal protective equipment.**

- The applicant should demonstrate that need to rely on administrative control and personal protective equipment for protection and safety is minimized giving the priority to engineering controls.
- The applicant should demonstrate that appropriate personal protective equipment is provided, and arrangements are made for its proper use, testing and maintenance.

**9.1.10 Record and reporting of information.**

- The applicant should describe the system for recording and reporting all information related to exposure control, decisions regarding measures for occupational radiation protection and safety as well as individual radiation monitoring.

**9.1.11 Audit and review of the RPP**

- The applicant should specify the methods for periodic auditing and review of implementation of the RPP.

### 9.2 Protection of the Public

#### 9.2.1 Procedures of protection and safety to protect members of the public:

- The applicant should describe the procedure of protection and safety to protect members of the public.
- The applicant should demonstrate that optimization of radiation protection of public is in place.
- The applicant should demonstrate that assessment, control, and surveillance of external exposure of public are in place, i.e., use of dose constraints for the member of the public. Provide assumptions used to assess external exposure of public.
- The applicant should describe training of personnel having functions relevant to protection and safety of members of the public. Demonstrate that monitoring program and management of records are in place.
- The applicant should describe the use of signs, labels, marks, and notices to be noticed by members of the public. Confirm that they are in a language to be understood by members of the public.

## 10. Emergency Preparedness and Response Plan

### 10.1 The content of a basic emergency plan

- Advice on when to implement the emergency plan.
- Prior training as necessary for workers who will be implementing the procedures.
- Description of, and information on, the availability of

emergency response equipment.

- Technical data and data relevant to radiological protection for each situation.
- Procedures to be followed at various stages, specific to each type of emergency identified:
  1. Initial stage, to contain the situation.
  2. Planning stage, to plan and rehearse the recovery stage.
  3. Recovery stage, to regain control of the situation.
  4. Post-emergency stage, to return the situation to normal.
  5. Reporting stage: preparation of a report, including an assessment of doses.
  6. Referral to medical experts following overexposure, if indicated.
- Identification of persons authorized to implement the various stages of the plan.
- Identification of all persons and organizations who should be contacted as necessary at the various stages of the plan, as well as the relevant telephone numbers, fax numbers and email addresses.

### 10.2 Reporting

A report of an incident or an emergency should include the following:

- A description of the incident or emergency, with as much detail as possible of the specific equipment involved. The

details should include model numbers and serial numbers wherever possible.

- Environmental conditions at the time of the incident or emergency, with particular reference to whether or not these conditions played any significant part in causing the emergency or incident or affecting the outcome.
- The specific cause of the incident or emergency.
- Details of actions taken to regain control of the situation and to restore conditions to normal, with special reference to any actions that were notably beneficial or detrimental.
- The training and experience of the personnel involved.
- An assessment and summary of the doses received by all affected persons.
- Recommendations made with the aim of preventing similar incidents and emergencies in the future and mitigating the consequences if a similar or related incident or emergency were to occur.

### 10.3 Development of Emergency Plans

The applicant should develop the emergency plan and each of which should be addressed by the licensee:

- Identification of potential incidents during the operation of a container scanner, followed by an evaluation of the associated risks.
- Development of emergency plans and procedures for dealing with the risks identified.

- Specification and acquisition of emergency equipment.
- Training in implementing the emergency plan and procedures, including training as necessary in the use of emergency equipment.
- Exercises at appropriate intervals to test and evaluate the implementation of the emergency plan.
- Periodic reviews and updates of emergency plans.
- Reports and notifications of incidents and emergencies.

## 11. Related Documents and Files

| Document Name | Document Type | Document Number | Relation to the guideline |
|---|---|---|---|
| Radiation Safety | Technical Regulation | NRRC-R-01 | This Regulation set out the general safety requirements in ensuring protection of people and the environment against the harmful effects of ionizing radiation and for the safety of radiation sources. in addition, this regulation harmonize the requirements applicable in the Kingdom with the international best practices in order to achieve the highest standards of safety in activities and facilities that give rise to radiation risks |
| Notification on and Authorization of Facilities and Activities with Radiation Sources | Technical Regulation | NRRC-R-02 | Prescribes the general requirements for notification on and authorization of activities, facilities and practices with radiation source, nuclear material and/or ore containing uranium and thorium in the Kingdom |

| | | | |
|---|---|---|---|
| Safe Transport of Radioactive Materials | Technical Regulation | NRRC-R-15 | This regulation is to prescribe requirements that shall be fulfilled to ensure safety, security and to protect persons, property, and the environment from any harmful effects of radiation on the transport of radioactive materials or nuclear material. |
| Management of Radioactive Waste | Technical Regulation | NRRC-R-16 | This regulation sets out the safety objectives, criteria and requirements for the protection of human health and the environment that shall be applied to the activities and the requirements that shall be met to ensure the safety of such activities and facilities. |
| Security of Radioactive Material | Technical Regulation | NRRC-R-17 | This regulation that addressed security of radioactive material, associated activity, and associated facility against unauthorized removal of radioactive material and sabotage performed with the intent to cause harmful radiological consequences |

**King Fahd National Library Cataloging-in-Publication Data**

**L.D. no. 1445/250**
**ISBN:978-603-92074-2-9**

هيئة الرقابة النووية والإشعاعية

Nuclear and Radiological Regulatory Commission

Kingdom of Saudi Arabia

@saudinrrc

nrrc.gov.sa