NRRC Stakeholders Guidelines

Kingdom of Saudi Arabia

Application for Authorization of Industrial Radiography Practice

NRRC-SG-002

2023

هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

Stakeholder Guideline

Application for Authorization of Industrial Radiography Practice

2023

NRRC-SG-002

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. 1403, dated 23/07/2023.

Contents

1.	**Purpose**	**6**
2.	**Scope**	**6**
3.	**Definitions**	**7**
4.	**Abbreviations**	**8**
5.	**Integrated Management System**	**8**
5.1	Management structure and responsibilities	8
5.2	Compliance	10
5.3	Procedures and Programs	10
6.	**Technical Information**	**11**
6.1	Information on radiation sources	11
6.2	Information on the radioactive sources	12
6.3	Information on depleted uranium	12
6.4	Information on source changers and storage containers	13
6.5	Information on X ray generator	13
6.6	Description of the facility	13
6.7	Technical information of radiation monitoring equipment	19
7.	**Safety Assessment**	**21**
8.	**Radiation Protection Program**	**22**
8.1	Protection of Workers	22
8.2	Personal dosimetry	22
8.3	Workers' health surveillance	22
8.4	Itinerant workers	22

8.5	Arrangements for the Radiation Protection Program (RPP)	23
8.6	Protection of the Public	25
9.	**Radioactive Sources Security Plan**	**26**
9.1	Assignment of radioactive material to category and security levels	26
9.2	Site description	26
9.3	Operational description	27
9.4	Security training and qualification	27
9.5	Access authorization	28
9.6	Information protection	29
9.7	Threat information	30
9.8	Security assessment methodology	30
9.9	Security system design	31
9.10	Access control	31
9.11	Procedures for accounting and inventory	32
10.	**Emergency Preparedness and Response Plan**	**34**
10.1	content of a basic emergency	34
10.2	Reporting	35
10.3	Development of Emergency Plans	36

1. Purpose

Nuclear and Radiological Regulatory Commission (NRRC) has developed an effective regulatory framework for the safe and secure authorization of industrial radiography practice throughout its life cycle. Under the regulatory framework, the prime responsibility for safety and security within industrial radiography 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 industrial radiography that include the following:

- Industrial radiography using X-ray systems.
- Industrial radiography using High Activity Sealed Sources.

2. Scope

This guideline is addressed to industrial radiography facilities and activities using X-ray systems and using high activity sealed sources, in particular, will address the management system, radiation protection, safety and security aspects of industrial radiography practice, including use, storage and transport. This will include industrial radiography 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

Ancillary equipment or associated equipment

Equipment that is used in conjunction with a radiographic exposure device to make radiographic exposures that drives, guides, or comes in contact with the source, (e.g., guide tube, control tube, control cable, removable source stop) tube and collimator when it is used as an exposure head.

Radiographer

Any individual who performs or who, in attendance at the site where the sealed source or sources are being used, personally supervises industrial radiographic operations and who is responsible to the licensee for assuring compliance with the requirements of the Commission's regulations and the conditions of the license.

Quality control (QC)

Part of quality management intended to verify that structures, systems and components correspond to predetermined requirements.

Source changer

A device designed and used for replacement of sealed sources in radiographic exposure devices, including those also used for transporting and storage of sealed sources.

Storage container

A container in which sealed sources are secured and stored.

Controlled area

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

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. Integrated Management System

5.1 Management structure and responsibilities

The applicant should provide the following

5.1.1 Overall organizational system and integrated management system

- 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.

5.1.2 Responsibilities for radiation safety

- 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.

5.1.3 Security roles and responsibilities

- Document the assignment of all roles and responsibilities with respect to the security of radioactive material, including the roles and responsibilities of the following:

- Site leadership, management, and supervisors.
- Positions directly responsible for the security of radioactive material.
- Positions with responsibility for regulatory

matters, including any positions such as the authorized person, 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.

5.2 Compliance

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

5.3 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.
- Radiation Protection program

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

6. Technical Information

6.1 Information on radiation sources

The applicant should provide Information on radiation sources as following:

- Information on gamma exposure device(s) / projector(s): (if applicable)
- Manufacturer.
- Model.
- Serial number(s)
- Design, manufacturing and testing of the exposure devices.
- Safety features of crawler equipment using gamma source.

6.2 Information on the radioactive sources

The applicant should provide Information on the radioactive sources (on all non-exempt sources, including sources for checking equipment, calibration sources and crawler control sources): (if applicable)

- Radionuclide.
- Manufacturer of the source.
- Model.
- Source serial number.
- Source activity and reference date.
- Design, manufacturing and testing of the source.
- Leak test.
- Working life of the source.
- Certificate for sealed radioactive source.
- Source assembly (such as "pigtail").
- Design, manufacture and test of the source assembly.
- Compatibility of the equipment by demonstrating compatibility of the source assembly with exposure device and compatibility of all ancillary equipment (such as guide tube and collimators), including any source storage and storage container used by applicant.

6.3 Information on depleted uranium

The applicant should provide details about depleted uranium used for exposure devices(s)/projector(s), sources changer(s), storage container(s) and collimator(s) and the mass of the depleted uranium (if any).

6.4 Information on source changers and storage containers

The applicant should provide details about source changers and storage containers:

- Dose levels requirements and labelling requirements.
- Safety of changer and storage containers.

6.5 Information on X ray generator

The applicant should provide details about X ray generator(s): (if applicable)

- Type of the X ray generator.
- Manufacturer.
- Model.
- Serial number(s) of the X ray generator housing and panel.
- Type, model and serial number of the tube.
- Maximum voltage.
- Maximum current intensity.
- Permanent and added filters.
- Use of collimators.
- Maximum leakage radiation by the manufacturer.
- Safety features of X ray generator equipment.
- Safety features of crawler equipment using X ray generator.

6.6 Description of the facility

The applicant should provide description of the

facility / facilities as following:

6.6.1 Radioactive source storage:

- Layout of the radioactive source storage facility.

  - The applicant should provide a layout by using a scale enabling analysis of storage characteristics, e.g., entrances, doors, windows, roof, floors, penetrations, and adjacent offices or buildings. In particular, all construction materials may be specified e.g., material, thickness and density. Specify which sources and equipment given before will be stored in the storage area and the maximum capacity of the storage.

- Shielding calculation and assumptions used.

- The applicant should demonstrate that assumptions used (e.g., shielding design, including the shielding of exposure devices and storage containers, workload, and occupancy factor) took into account radiation fields produced by all sources to be stored. Demonstrate that doses are below dose limits, dose constraints for workers and member of the public are established, and doses are optimized.

- Safety features.

- The applicant should specify position within facility layout of all technical safety systems, e.g., monitors, sensors, access control measures,

barriers, detectors causing warning signals and notices.

- The applicant should describe design and function of safety and warning systems.

6.6.2 Irradiation room(s):

- Layout of any shielded enclosure to be used.
- The applicant should provide a layout by using a scale enabling analysis of the irradiation room and adjacent areas characteristics, e.g., entrances, maze, doors, roof if any, floors, and penetrations (e.g. used for ventilation and electricity). the layout should includes details related to any control room outside the irradiation room and to all other adjacent offices, working places or buildings. The applicant should provide all construction materials may be specified, e.g., material, thickness and density.
- The applicant should specify which sources and equipment given before will be used in the irradiation room and process flow diagram. Position(s) of source(s) and equipment is given. The applicant should specify all adjacent equipment, such as crane.
- Shielding calculation and assumptions used.
- The applicant should demonstrate that design and shielding as well as assumptions used (e.g. use factor and occupancy factor) took into

account radiation fields produced by sources during irradiation.

- The applicant should Provide dose rate calculations related to exposure for workers and members of the public. In designs with minimal or no roof, the applicant should demonstrate that due consideration has been made of the air scattering of radiation (or 'sky shine') and to scattering from objects outside the enclosure, such as higher ceilings or walls in the vicinity of the enclosure, if it is to be constructed inside another building.
- The applicant should demonstrate that leakage radiation is taken into account.
- The applicant should specify maximum operating condition of equipment, e.g., maximum activity of radioactive source and directions of the beam.
- The applicant should provide a plan of irradiation room surroundings and demonstrate that doses are below dose limit, dose constraints for workers and members of the public are established, and doses are optimized.

• Safety features.

- The applicant should specify position of all technical safety features and warning systems such as emergency cord or button, radiation

monitor(s) (e.g., dose rate monitor in the irradiation rooms), door interlocks, use of key control, sensors, access control measures, barriers, monitors, and warning signals (i.e. audible and visible) and notices.

- The applicant should Describe design and function of safety and warning systems, including independence of safety systems, their redundancy and diversity.
- The applicant should specify how fire protection manages hazard related to the existing radioactive sources. Demonstrate that good engineering practice is taken into account.

• controlled and supervised areas

- The applicant should specify the boundaries of controlled and supervised areas.

6.6.3 Location for site radiography

- The applicant should specify in detail how site radiography is going to be prepared, e.g. cooperation with the client, assessment of the location, preparation of time schedule, use of local rules, and emergency preparedness taking into account any additional risks at the site.
- The applicant should specify in detail how site radiography 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, and establishment of all other precautions before, during and after irradiation.

- The applicant should specify the use of all sources and equipment to be available at the site, such as X ray generator(s), collimators, guide tube(s), control tube(s), monitoring equipment, personal dosimeters and alarm dosimeters, warning signals and notices, and emergency kit.
- The applicant should demonstrate that radiation monitors are used. In particular, demonstrate that radiation monitor is used after each exposure using radiation sources.
- The applicant should specify how the applicant ensures that at least two radiographers are performing radiography with one source and demonstrate that security is ensured.
- The applicant should demonstrate that arrangements are in place for the transport of radioactive source(s).

6.6.4 On-site radioactive source storage

- The applicant should provide procedures requiring appropriate arrangements to be established with the site operator ensuring that the same level of protection as in the user's

source storage is granted at the temporary on-site source storage in the operating facility's main base.

- The applicant should provide and describe the basic elements of the layout of a typical temporary storage of radioactive source in remote locations and specify maximum capacity of the storage.
- The applicant should Demonstrate that doses are to be kept below dose limits, dose constraints for workers and member of the public are established, and doses are optimized to be as low as possible.
- The applicant should demonstrate that controlled and supervised areas are to be put in place.
- If the radiography vehicle is to be used as temporary storage of radioactive sources, specify all safety and security systems as well as assumptions used in the assessment of exposures of workers and members of the general public. Demonstrate that controlled and supervised areas are to be put in place.

6.7 Technical information of radiation monitoring equipment

The applicant should provide and demonstrate the following equipment:

6.7.1 Installed radiation monitor(s) in irradiation room

- The applicant should demonstrate suitability and calibration of the monitor(s).

6.7.2 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 industrial
  radiography are suitable and the applicant has sufficient number of portable meters.

6.7.3 Personnel monitoring devices are provided to all workers

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

6.7.4 Safe and secure management and control of radiation sources once it has been decided to take them out of use

- The applicant should demonstrate that all disused sources, including depleted uranium, are managed in line with safety requirements,

e.g., demonstrate that storage(s) for disused sources are designed and controlled applying optimization and dose limitations, and that management of the storage(s) includes all safety and security precautions.

7. Safety Assessment

The safety assessment should include:

- Consideration of the dose rates from both shielded and unshielded radioactive sources and radiation generators.
- radioactive sources and X-Ray generators; Potential exposures of radiographers, other workers and the public, for a range of scenarios representing normal use and reasonably foreseeable incidents.
- Limits and technical conditions for operation of sources.
- The 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.
- The Ways in which external factors could affect protection and safety.
- The ways in which operating errors and human factors could affect protection and safety.
- Evaluation of the implications of any proposed modifications for protection and safety.

8. Radiation Protection Program

The applicant should provide radiation protection programme as follow:

8.1 Protection of Workers

8.1.1 Education and training of workers

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

8.2 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.

8.3 Workers' health surveillance

- The applicant should specify programs for health surveillance.

8.4 Itinerant workers

- The applicant should describe the allocation and

documentation of the responsibilities of the employer and the applicant for safety and protection of itinerant workers.

8.5 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:

8.5.1 Assignment of responsibilities for the RPP

8.5.2 Designation of controlled areas or supervised areas

- The applicant should specify the 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 management of labels, marks, and notices.

8.5.3 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 Workplace and area monitoring program.

- 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 the 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.

8.5.4 Personal protective equipment

- The applicant should demonstrate that the 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.

8.5.5 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.

8.5.6 Audit and review of the RPP and the Security Program (SP)

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

8.6 Protection of the Public

8.6.1 System of protection and safety to protect members of the public:

- The applicant should describe the system 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.

9. Radioactive Sources Security Plan

9.1 Assignment of radioactive material to category and security levels

9.1.1 Basis for radioactive material categorization and security level

- The applicant should identify and explain the basis for the categorization of each radioactive material and its associated security level.

9.2 Site description

9.2.1 physical features

- The applicant should describe the physical features of the site on which the practice is conducted and its surrounding environment, including diagrams and scale floor and building

drawings and photographs. This information must include:

- The location and layout of the site, particularly indicating areas accessible to the public, roads and parking areas, nearest public thoroughfares, central security office, building and site perimeter, access points, and physical barriers.
- The site's surrounding environment such as industrial, commercial, residential, or other uses; indication of distances to nearest police stations and other response services; proximity to other buildings and roads; and other features of security or operational interest such as other facilities with hazardous materials.

9.3 Operational description

- The applicant should describe site operations in relation to the practice, including working and non-working hours; the number and type of staff involved in the site's operations; and the typical number, type, and frequency of other people, such as visitors, public, customers, service personnel or contractors, who may be at the site during scheduled operations or at any other time.

9.4 Security training and qualification

9.4.1 The applicant should provide the following

information:

- Requirements for qualification of staff with security responsibilities.
- Training to be provided to each individual, including the required initial, specialized, advanced, or refresher training for each position with security responsibilities; security awareness training for all staff; and other relevant, specific, on-the-job training such as procedures and work instructions.
- Provider(s) of the identified training and how frequently each part of training must be conducted.
- How training records that document satisfactory completion of all security related training are established and maintained.

9.5 Access authorization

9.5.1 Process used for authorizing personnel

- The applicant should describe the process used for authorizing personnel who need unescorted access to radioactive source locations, secured areas, and/or security sensitive information in order to perform their duties (which may or may not be directly related to security), including how the following functions are performed:

- Identify the positions requiring unescorted

access.

- Verify individuals holding the identified positions are trustworthy.
- Verify individuals holding the identified positions have the necessary training.
- Perform timely withdrawal of access for individuals who no longer require it.
- Conduct periodic review and re-evaluation for particular circumstances, such as withdrawing access authorization when personnel or positions no longer have need for unescorted access, transfer of job responsibilities, or termination of employment.
- Maintain up to date records of personnel authorized for unescorted access.

9.6 Information protection

9.6.1 protecting information

- The applicant should describe the measures for protecting information whose unauthorized disclosure could compromise security of radioactive material, including the following:
- The information that needs protection.
- How the protected information is identified, such as the use of markings or other designators that will ensure all users of this information recognize it as requiring protection.

- The forms of protected information such as paper documents, electronic media, or video recordings.
- Where the protected information is stored and who has custody of it.
- Who has access to sensitive information and how is that access determined.
- The protection measures in place to prevent unauthorized access when the information is being used or is being stored (for example physical protection, encryption).

9.6.2 Maintenance program

- The applicant should describe the program for maintaining security equipment to ensure continuous and reliable operation.

9.7 Threat information

- The applicant should describe the types of information on threat provided, and how it is provided.

9.8 Security assessment methodology

- The applicant should describe the process or methodology used to design the security system and assess its vulnerabilities, taking into account the threat information provided.

9.9 Security system design

- The applicant should describe how the security system has been designed to provide the level of protection required, taking into account the graded approach and principles of defence in depth and balanced protection. Indicate how each secured area and associated radioactive material are protected by detection, delay, and response measures in an integrated and balanced way. Identify the types of equipment and systems installed and their location.

9.10 Access control

9.10.1 Physical measures

- The applicant should describe the physical measures for controlling access, including:
  - How personnel are physically controlled at each control point to limit access only to authorized persons according to the access authorization procedure and to prevent unauthorized access.
  - Specific media used to authenticate the identity of authorized persons such as key card, personal identification number, biometric device, or a combination.
  - Procedures to be followed by authorized persons to access a secured area, including application of the two-person rule, where relevant.

9.10.2 Detection, assessment, and delay measures

- For each controlled or secured area, the applicant should describe:
- Means of detection, including intrusion detection systems and observation by site personnel.
- Method of assessment, including people and equipment supporting the assessment.
- Delay measures used to increase adversary task time relative to response time.

9.10.3 Procedures for key and lock control

- The applicant should describe the procedures used for control of all keys, locks, combinations, passwords, and related measures used to control access to secured areas and security systems. Identify who is responsible for changing access control measures and the specific conditions that require them to be changed, such as the compromise of a combination or password, loss of a security key, or termination of a staff member's access.

9.11 Procedures for accounting and inventory

9.11.1 accounting for radioactive material

- The applicant should describe how the site performs periodic accounting for radioactive

material, including:

- Verification method used, such as a physical check, remote video monitoring, examination of seals or other tamper indicating devices, or radiation measurements.
- Records generated indicating results of each verification, when, by whom, and by what method.
- Requirements for corrective actions and reporting if the presence of radioactive material cannot be verified. Also describe how the site establishes and maintains an inventory of its radioactive material.

9.11.2 Procedures for receipt and transfer of radioactive material

- The applicant should describe the procedures for ensuring that security and control of a radioactive source is maintained when it is being received from outside the site and when it is transferred to another authorized person.

9.11.3 Security event reporting

- The applicant should describe how security events are reported to the operator's security organization. Describe how events are documented, who is responsible for

documenting the event, and subsequent external reporting requirements.

9.11.4 Security during emergencies and contingencies

- The applicant should summarize arrangements and actions to be taken during non-security emergencies or other contingency situations to ensure the protection of the radioactive material is maintained.

10. Emergency Preparedness and Response Plan

10.1 content of a basic emergency

- The applicant should ensure the content of a basic emergency plan includes the following:

10.1.1 Advice on when to implement the emergency plan

10.1.2 Prior training as necessary for workers who will be implementing the procedures

10.1.3 Description of, and information on, the availability of emergency response equipment

10.1.4 Technical data and data relevant to radiological protection for each situation

10.1.5 Procedures to be followed at various stages, specific to each type of emergency identified:

- Initial stage, to contain the situation.
- Planning stage, to plan and rehearse the recovery stage.
- Recovery stage, to regain control of the situation.
- Post-emergency stage, to return the situation to normal.
- Reporting stage: preparation of a report, including an assessment of doses.
- Referral to medical experts following overexposure, if indicated.

10.1.6 Identification of persons authorized to implement the various stages of the plan

10.1.7 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 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

- Identification of potential incidents during industrial radiography work, 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.

King Fahd National Library Cataloging-in-Publication Data

L.D. no. 1445/77
ISBN:978-603-92072-0-7

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