



Regulatory Document

RD-353

Testing the Implementation of Emergency Measures

October 2008

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**TESTING THE IMPLEMENTATION OF EMERGENCY
MEASURES**

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PREFACE

The Canadian Nuclear Safety Commission (CNSC's) *Class I Nuclear Facilities Regulations* (SOR/2000-204) and *Uranium Mines and Mills Regulations* (SOR/2000-206) requires licensees to test the implementation of the measures concerning an accidental release of nuclear substances and hazardous substances.

This regulatory document provides guidance with respect to the adequacy of emergency exercises at Class I nuclear facilities and uranium mines and mills. This document addresses suggested emergency exercise objectives when testing the implementation of emergency measures to prevent, mitigate, or control the effects of an accidental release of nuclear substances and hazardous substances.

This regulatory document aligns with national and international published documents regarding this subject including: International Atomic Energy Agency (IAEA) document *Emergency Preparedness Exercises for Nuclear Facilities: Preparation, Conduct and Evaluation*; IAEA document *Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency*; and the U.S. Nuclear Regulatory Commission document titled *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*.

Nothing contained in this document is to be construed as relieving any licensee from pertinent requirements. It is the licensee's responsibility to identify and comply with all applicable regulations and licence conditions.

TABLE OF CONTENTS

1.0	PURPOSE	1
2.0	SCOPE	1
3.0	RELEVANT REGULATIONS	1
4.0	EMERGENCY EXERCISES AND EMERGENCY DRILLS	2
4.1	Emergency Exercises.....	2
4.2	Emergency Drills	2
4.3	Training of Personnel	2
4.4	Frequency of Emergency Drills and Emergency Exercises.....	3
5.0	EMERGENCY EXERCISE OBJECTIVES	3
5.1	Mitigation	3
5.1.1	Reduction of Consequences of Accidental Release.....	4
5.1.2	Command and Control.....	4
5.1.3	Emergency Facilities, Equipment, and Documentation	4
5.1.4	Extended Response.....	5
5.2	Protection of Facility Personnel	5
5.2.1	Detection and Classification of Emergency—On-Site	5
5.2.2	Notification and Mobilization—On-Site	6
5.2.3	Protection of Non-Emergency Personnel—On-Site.....	6
5.2.4	Protection of Emergency Response Personnel	6
5.3	Protection of the Public and the Environment	7
5.3.1	Emergency Classification and Notification—Off-Site.....	7
5.3.2	Assessment of Off-Site Threat from Accidental Release	8
5.3.3	Alignment with Off-Site Authorities and Agencies	8
5.4	Termination of Emergency	8
5.5	Adequacy and Conduct of Exercises.....	9
5.5.1	Exercise Objectives	9
5.5.2	Exercise Competency	9
5.5.3	Controllers and Evaluators.....	10
5.5.4	Safety	10
5.5.5	Feedback	10
5.5.6	Reporting.....	10
	GLOSSARY	11
	ADDITIONAL INFORMATION	13

TESTING THE IMPLEMENTATION OF EMERGENCY MEASURES

1.0 PURPOSE

The purpose of this regulatory document is to provide guidance with respect to the adequacy of emergency exercises at Class I nuclear facilities and uranium mines and mills.

2.0 SCOPE

This document addresses suggested emergency exercise objectives that licensees of Class I nuclear facilities and uranium mines and mills should consider when testing the implementation of emergency measures to prevent, mitigate, or control the adverse effects of an accidental release.

3.0 RELEVANT REGULATIONS

The provisions of the *Class I Nuclear Facilities Regulations* and the *Uranium Mines and Mills Regulations* relevant to this document are as follows:

1. Paragraph 6(k)(v) of the *Class I Nuclear Facilities Regulations* states that, “An application for a licence to operate a Class I nuclear facility shall contain the following information in addition to the information required by section 3: ... (k) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of national security, including measures to ... (v) test the implementation of the measures to prevent or mitigate the effects of an accidental release;” and
2. Subparagraph 3(c)(x)(E) of the *Uranium Mines and Mills Regulations* states that, “An application for a licence in respect of a uranium mine or mill, other than a licence to abandon, shall contain the following information in addition to the information required by section 3 of the *General Nuclear Safety and Control Regulations* ... (c) in relation to the environment and waste management, ... (x) the proposed measures to prevent or mitigate the effects of accidental releases of nuclear substances and hazardous substances on the environment, the health and safety of persons and the maintenance of security, including measures to ... (E) test the implementation of the measures to control the adverse effects of an accidental release.”

4.0 EMERGENCY EXERCISES AND EMERGENCY DRILLS

4.1 Emergency Exercises

Emergency exercises typically take place over several hours in order to test the integrated performance of the emergency response program. Typical attributes of an emergency exercise include: mobilization of apparatus and resources in a realistic environment over an extended period of time; demonstration of inter-agency cooperation; testing of communication systems and/or public information systems; and testing of emergency facilities and equipment readiness.

4.2 Emergency Drills

An emergency drill involves a coordinated and supervised activity. Typical attributes of an emergency drill include: a narrow focus; limited number of personnel; specific equipment; timely feedback; and a realistic environment.

4.3 Training of Personnel

Emergency drills and emergency exercises can be used to clarify roles and responsibilities, identify gaps in resources needed to implement the emergency plan, and improve individual and team performance. A full scale emergency exercise should primarily be used to test the integrated capability of the emergency response organization to identify weaknesses that could affect the response to an actual emergency. Coaching for training purposes should not be permitted during a full-scale emergency exercise.

A correctly designed full scale emergency exercise should include as many exercise objectives as practical to simultaneously measure and demonstrate:

1. The preparedness and competence of participants;
2. The quality of the associated procedures; and
3. The effectiveness of the emergency response capability of the licensee.

Full-scale emergency exercises normally involve a large number of on-site and off-site stakeholders, and could include regional, provincial, federal and, where appropriate, international authorities and agencies. However, emergency exercises do not always need to be full scale. For example, tabletop emergency exercises, such as on notification and communication, are intended to stimulate discussion of various issues regarding a hypothetical emergency situation. As in a drill, a tabletop emergency exercise can be used as a training tool to achieve limited or specific objectives.

Personnel, including alternates, assigned to emergency teams and positions, should regularly receive training and participate in emergency drills and emergency exercises.

4.4 Frequency of Emergency Drills and Emergency Exercises

Licensees are directly responsible for training and exercising their personnel, and for appointing qualified personnel to their emergency teams. A schedule for both emergency drills and emergency exercises should be established every year to ensure that all responders, including alternates, have the opportunity to practice the required skills on a regular basis.

All emergency exercise objectives contained in Section 5 of this document should be brought into play over a five-year period, with a full scale emergency exercise every three years.

5.0 EMERGENCY EXERCISE OBJECTIVES

Emergency exercise objectives set specific goals and provide a framework for scenario development.

The licensee should set their own exercise objectives. The type and number of objectives will depend on the size of the facility and the scope of the exercise. The majority of emergency exercise objectives relate to:

1. Mitigation;
2. Protection of facility personnel;
3. Protection of the public and the environment;
4. Termination of emergency; and
5. Adequacy and conduct of exercises.

The following sections describe these objectives in more detail, and give examples of indicators that may be used to determine whether performance and exercise objectives have been met.

5.1 Mitigation

Mitigation enables the reduction and prevention of further adverse effects. Exercise objectives relating to mitigation can be categorized as:

1. Reduction of consequences of accidental release;
2. Command and control;
3. Emergency facilities, equipment, and documentation; and
4. Extended response.

5.1.1 Reduction of Consequences of Accidental Release

Reduction of consequences refers to the actions the licensee takes to limit the consequences of an accidental release inside the facility and in the environment. Indicators that demonstrate the licensee's ability to reduce consequences include:

1. Facility personnel correctly recognize and classify an abnormal event;
2. Staff follow facility procedures for alerting on-site personnel and off-site authorities and agencies to the emergency;
3. Facility personnel use approved emergency operating procedures to respond to the emergency;
4. Staffing in control rooms is kept to a minimum to prevent unnecessary distractions to the responders trying to focus on control measures;
5. Possible release paths are identified; and
6. Mitigating actions are implemented in a timely and effective manner.

5.1.2 Command and Control

The command structure should be clearly defined and integrated. An indication of an effective emergency response organization is the demonstration of clear command and control over the emergency response. It should be clearly understood who is in charge and with whom final decisions and authorities lie. Some response actions that demonstrate effective command and control include:

1. Timely and adequate on-site and off-site communication and mitigation strategies;
2. Periodic update briefings;
3. Decisions documented in event logs; and
4. Access control to site facilities.

5.1.3 Emergency Facilities, Equipment, and Documentation

The emergency response framework includes emergency facilities, equipment, and documentation. Indicators that demonstrate the effectiveness of these elements include:

1. Design and layout of emergency facilities are adequate to support the emergency response and to minimize interference with emergency personnel;
2. Emergency equipment and supplies are appropriate, operational, and available in sufficient quantities for an extended response, and are readily accessible during emergency conditions;
3. Back-up equipment and facilities are operational and available;
4. Emergency operating procedures and associated documentation are current and are used by personnel performing emergency tasks; and
5. Suitable and compatible equipment exists for all intervening agencies.

5.1.4 Extended Response

The licensee's emergency response organization should be capable of maintaining a response for extended multi-shift durations. This objective can be measured by the:

1. Continuity of command and control, response, off-site support, and personnel accounting during shift turnover;
2. Qualifications of relief personnel;
3. Ability of relief personnel to safely access the facility;
4. Briefings given to relief personnel along with documented turnovers;
5. Equipment, facilities, and other resources made available to emergency response personnel on extended shifts; and
6. Periodic re-evaluation of the habitability of response centres.

5.2 Protection of Facility Personnel

Protection of facility personnel deals with the licensee's ability to minimize or prevent serious health effects to facility personnel, including its emergency response personnel. The exercise objectives relating to protection of facility personnel can be categorized as:

1. Detection and classification of emergency—on-site;
2. Notification and mobilization—on-site;
3. Protection of non-emergency personnel—on-site; and
4. Protection of emergency response personnel.

5.2.1 Detection and Classification of Emergency—On-Site

This objective refers to the licensee's ability to detect and correctly classify an emergency in order to initiate the appropriate response actions. Some response actions that demonstrate the licensee's ability to meet this objective include:

1. The operations centre is promptly informed of the emergency;
2. The emergency classification correctly reflects the on-site risk; and
3. The emergency classification is re-assessed if emergency parameters change.

5.2.2 Notification and Mobilization—On-Site

The purpose of notification and mobilization is to alert all on-site personnel in order to initiate immediate protective action and activate the emergency response organization and associated support facilities. The licensee's ability to meet this objective can be measured by:

1. The time for the emergency response groups to activate, report, and respond;
2. The qualifications of emergency personnel for their assigned emergency tasks; and
3. The adequacy of the number of responders to support the emergency response effort.

5.2.3 Protection of Non-Emergency Personnel—On-Site

The licensee should be able to quickly evaluate the consequences of the emergency and take appropriate measures to protect its on-site personnel. The protection of non-emergency personnel can be measured by:

1. Timely identification of the sources of hazard and unsafe areas;
2. Radiation safety practices followed during all personnel movement including transfer of casualties and release of non-essential personnel from the site as appropriate;
3. Continued verification of the habitability of assembly areas;
4. Accounting and identification of missing persons within a 30 minute timeframe;
5. Timeliness and efficiency of search and rescue operations; and
6. Availability of first aid and on-site medical treatment capabilities.

5.2.4 Protection of Emergency Response Personnel

This objective refers to the actions taken to protect emergency responders, including those from external organizations, providing on-site support. Some of the response actions that demonstrate the licensee's ability to protect emergency responders include:

1. Monitoring and tracking of radiation doses;
2. Implementing back-out dose limits and protective actions when emergency action levels are exceeded;
3. Briefing, tracking, and debriefing the dispatched teams on safety requirements, communication requirements, etc.;
4. Proper use of radiation survey, communication, and protective equipment;
5. Maintaining three-way communication with the dispatched teams;
6. Continued verification of the habitability of all emergency response centres, including monitoring for radiation fields and hazardous materials, where appropriate;

7. Using dose records to assign specific emergency response tasks;
8. Allowing off-site emergency responders access to radiation protection assistance from on-site personnel; and
9. Interfacing with off-site responders (e.g., ambulance attendants and hospital staff) to ensure that pertinent hazardous material and radiological information is provided to medical staff.

5.3 Protection of the Public and the Environment

The licensee should provide the appropriate off-site authorities and agencies, as well as the public, with accurate, appropriate, timely information and support to allow an effective off-site response in accordance with local, provincial, and federal emergency response plans. Exercise objectives related to protection of the public and the environment can be categorized as:

1. Emergency classification and notification—off-site;
2. Assessment of off-site threat from accidental release; and
3. Alignment with off-site authorities and agencies.

5.3.1 Emergency Classification and Notification—Off-Site

The licensee should promptly and correctly classify an emergency for off-site notification. The same classification system is used by on-site and off-site authorities and agencies. Many off-site plans require the licensee to notify off-site authorities and agencies within a timeframe that allows an effective response. Other response actions that may be used to determine whether this objective has been met are:

1. Communications are established and maintained between the on-site emergency response centre and off-site authorities and agencies according to approved protocols;
2. Off-site authorities and agencies are kept informed of any significant change in current or projected facility conditions or environmental release data;
3. Communication links are compatible, tested, and reliable; and
4. Back-up equipment is available in case of failure of primary communication links.

5.3.2 Assessment of Off-Site Threat from Accidental Release

This objective refers to the licensee's ability to assess and characterize the magnitude of an off-site radiological risk resulting from an accidental release. Indicators for this objective include the following:

1. For power reactors, the ability to monitor and sample the containment after a post-Loss Of Coolant Accident (LOCA);
2. The consequences of the emergency are assessed by taking into account: off-site survey/sample results; current and forecasted weather; off-site areas affected; the timing and expected duration of a release; and appropriate use of models or procedures to determine the source term and projected dose;
3. Off-site licensee survey teams performing monitoring and sampling are trained and qualified, and use appropriate and calibrated equipment. Monitoring and sampling efforts occur in a coordinated manner with off-site authorities and agencies. Sampling could include the collection of water, vegetation, soil, and foodstuff once the release has ended; and
4. Measurement of radiation levels and radioiodine contamination levels in the air may be addressed by fixed telemetric survey equipment in conjunction with the mobilization of survey teams. Alternatively, mobile teams may be sent out to take measurements.

5.3.3 Alignment with Off-Site Authorities and Agencies

This objective refers to the licensee's ability to provide expertise and resources to support off-site authorities and agencies, in a manner consistent with emergency response plans and agreements. The adequacy of licensee expertise and resources (personnel, equipment, and material) in support of off-site authorities and agencies provides an indication of alignment.

5.4 Termination of Emergency

The licensee should be able to:

1. Adequately assess the situation and conditions;
2. Notify personnel and off-site authorities and agencies; and
3. Assess hazards for return of personnel.

5.5 Adequacy and Conduct of Exercises

The execution of an exercise should meet all its stated objectives, demonstrate thorough planning, identify weaknesses and deficiencies so they can be prioritized and corrected, and provide an overall accurate indication of the licensee's emergency response capability. Categories relating to the adequacy and conduct of exercises are:

1. Exercise objectives;
2. Exercise competency;
3. Controllers and evaluators;
4. Safety;
5. Feedback; and
6. Reporting.

5.5.1 Exercise Objectives

Exercise objectives set specific goals and provide a framework for scenario development. The exercise scenario allows the observers and evaluators to judge the ability of the participants to meet the defined emergency response objectives. This can be assessed by:

1. Examining whether the exercise scenario is consistent with the stated objectives and challenging enough to truly test the capability of the participants; and
2. All stated objectives are covered by the exercise scenario.

5.5.2 Exercise Competency

The purpose of this objective is to demonstrate sound organizational and professional execution in the conduct of the exercise. Exercise competency is characterized by the following:

1. The exercise scenario remains unknown to emergency responders before the exercise;
2. Timely and realistic data, messages, and materials are provided; and
3. Participants demonstrate realistic and professional behaviour, with limited instances for simulated actions.

5.5.3 Controllers and Evaluators

Controllers and evaluators should be adequately staffed and trained to control and evaluate the exercise, and should be provided with a package of exercise materials that includes:

1. Minimum interference with the participants;
2. Exercise conduct instructions;
3. Exercise evaluation criteria; and
4. Direction pertaining to existing requirements for safety and security measures.

5.5.4 Safety

No decision made, nor activity carried out, during an emergency exercise relieves a licensee from the requirements set out in applicable regulations and licence conditions. Safety must not be jeopardized in an emergency exercise. All participants should be made aware of the actions and interventions that are not allowed during the exercise. Indicators that can be used to measure safety include the following:

1. All participants, including controllers, evaluators, and observers, follow appropriate safety practices when in the presence of real radiation or conventional hazards;
2. Facility security controls and access control continue to be followed during the emergency exercise; and
3. Criteria for halting, restarting, or terminating an exercise should be determined and thoroughly covered in the exercise pre-briefing.

5.5.5 Feedback

Feedback serves to improve the overall performance of the emergency response capability of the facility. Feedback considerations may include:

1. All participants receive timely feedback on the exercise;
2. Where practical and appropriate, all participants are debriefed immediately following the exercise, ideally in small groups to facilitate the exchange of meaningful information; and
3. Controllers and evaluators have their own debriefing session to discuss the exercise and identify opportunities for improvement.

5.5.6 Reporting

The licensee should prepare a self-assessment report regarding execution of the emergency exercise, including a list of any corrective actions. The report should be prepared and issued in a timely manner. An appropriate target date for completion of the report would be sixty days following conclusion of the exercise.

GLOSSARY

Back-out dose limits

The pre-determined dose limit that should prompt responders to physically retreat from an area and to then assess the situation.

Controller

During an emergency exercise, a controller provides, as appropriate, data and messages to the emergency responders.

Emergency Exercise

Simulation of emergency events in order to test the integrated performance of an emergency response scenario.

Emergency Drill

Testing of a procedure or other specific aspect of an emergency response.

Emergency Response

The integrated set of infrastructural elements necessary to provide the capability for performing a specified function or task required in order to prevent, mitigate or control the effects of an accidental release.

Emergency Response Organization

Group of inter-related responders whose function is to mitigate the consequences of an emergency. Involves pre-defined coordination of roles and responsibilities.

Evaluator

During an emergency exercise, an evaluator observes, evaluates, and critiques the emergency responders' actions.

Observer

A person who is authorized to witness but is neither a participant nor a controller/evaluator.

Participant

Individuals who are taking part in an exercise and respond to the simulated events.

Three-Way Communication

The initiator sends a message. The receiver of the message repeats the message back to the initiator. The initiator provides confirmation to the receiver that the repeated message is correct.

ADDITIONAL INFORMATION

- 1) *Emergency Preparedness Exercises for Nuclear Facilities: Preparation, Conduct and Evaluation*. International Atomic Energy Agency. 1992
- 2) *Preparation, Conduct and Evaluation of Exercises to Test Preparedness for a Nuclear or Radiological Emergency*. International Atomic Energy Agency. 2005
- 3) *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*. U.S. Nuclear Regulatory Commission. 2002.

