



REGULATORY
GUIDE

Preparing Codes of Practice to Control Radiation Doses at Uranium Mines and Mills

G-218

October 2003

REGULATORY DOCUMENT

The legal framework within which the Canadian Nuclear Safety Commission (CNSC) operates includes the *Nuclear Safety and Control Act*, its Regulations and other legal instruments such as licences, certificates and orders. The legal framework is supported by regulatory documents issued by the CNSC, the main classes of which are:

Regulatory Policy (P): a document that describes the philosophy, principles or fundamental factors which underlie the CNSC's approach to its regulatory mission. It provides direction to CNSC staff and information to stakeholders.

Regulatory Standard (S): a document that describes CNSC requirements. It imposes obligations on the regulated party, once it is referenced in a licence or other legally enforceable instrument.

Regulatory Guide (G): a document that indicates acceptable ways of meeting CNSC requirements, as expressed in the Act, Regulations, regulatory standard or other legally-enforceable instrument. It provides guidance to licensees and other stakeholders.

Regulatory Notice (N): a document that provides licensees and other stakeholders with information about significant matters that warrant timely action.

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TABLE OF CONTENTS

1	PURPOSE.....	1
2	SCOPE.....	1
3	BACKGROUND	1
	3.1 Regulatory Framework	1
	3.2 Regulatory and licensing process	1
	3.3 Legislative Basis for this Guide	2
4	CONTROLLING RADIATION LEVELS	3
5	DEVELOPING CODES OF PRACTICE.....	4
	5.1 Action Levels	4
	5.2 Administrative Levels.....	5
6	NOTIFICATION AND REPORTING PROCEDURES	6

1 PURPOSE

This Regulatory Guide is intended to help applicants for Canadian Nuclear Safety Commission (CNSC) mining facility licences develop codes of practice in accordance with the *Uranium Mines and Mills Regulations* for the purpose of controlling radiation doses to workers.

2 SCOPE

This guide pertains to codes of practice that are intended to control radiation doses to workers at uranium mines and mills. It applies to all applicants for a licence to prepare a site, construct, operate or decommission a uranium mine or mill.

This document does not address environmental protection codes of practice. Guidance on environmental protection codes of practice will be provided by the CNSC upon request.

3 BACKGROUND

3.1 Regulatory Framework

The CNSC is the federal regulatory agency that regulates the use of nuclear energy and materials to prevent undue risk to health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy.

The *Nuclear Safety and Control Act* ("the Act") requires persons or organizations to be licensed by the CNSC for carrying out the activities referred to in Section 26 of the Act, unless otherwise exempted. The associated regulations stipulate prerequisites for CNSC licensing and the obligations of licensees and workers.

3.2 Regulatory and licensing process

The Act obliges the CNSC to determine, before granting or refusing to grant a licence, whether the applicant for the licence is qualified and has made adequate provision for the health and safety of person, national security and protection of the environment. To make these determinations, the CNSC needs credible and relevant information from applicants.

Upon receipt of a licence application, or formal notice of intent to file an application containing an adequate description of the project, the CNSC determines whether the application involves a project that requires an environmental assessment pursuant to the *Canadian Environmental Assessment Act* (CEA Act) and its regulations. If an environmental assessment is required under the CEA Act, the CNSC may not exercise any authority that would permit the project to be carried out in whole or part until the environmental assessment process is complete. When CEA Act legislation does not apply to the project, the CNSC may proceed with routine processing of the licence application.

The CNSC's licensing process for uranium mines and mills follows the stages laid out in the *Uranium Mines and Mills Regulations*, proceeding progressively through site preparation and construction, operating, decommissioning and abandonment phases. At each licensing stage, the CNSC determines whether the licence applicant is qualified and has made adequate provision for the protection of the environment, the health and safety of person, and the maintenance of national security and measures required to implement international obligations to which Canada has agreed. If satisfied, the CNSC may issue a licence that contains appropriate conditions. Typically, this licence will incorporate the applicant's commitments and any other conditions that the CNSC considers necessary, including a condition that incorporates or relates to action levels.

The information required by the CNSC at each licence application stage is influenced by case-specific circumstances. An application for a CNSC licence may include new information, or, in accordance with section 7 of the *General Nuclear Safety and Control Regulations*, it may incorporate by reference any information that is contained in another licence issued by the CNSC.

3.3 Legislative Basis for this Guide

Section 4 of the *Uranium Mines and Mills Regulations* stipulates that applications for licences to site, construct, operate or decommission a uranium mine or mill must contain a proposed code of practice that includes:

- any action level that the applicant considers appropriate;
- a description of any action that the applicant will take if an action level is reached; and
- the reporting procedures that will be followed if an action level is reached.

An action level is defined in section 4 as “a specific dose of radiation or other parameter that, if reached, may indicate a loss of control of part of a licensee’s radiation protection program or environmental protection program, and triggers a requirement for specific action to be taken.”

Codes of practice and therefore action levels pertaining to environmental protection programs are not included within the scope of this guide as they tend to be very site specific.

Other relevant legislation includes section 4 of the *Radiation Protection Regulations* which requires that all CNSC licensees implement a radiation protection program that keeps the amount of exposure to radon progeny and the effective dose and equivalent dose received and committed to persons as low as reasonably achievable, social and economic factors being taken into account.

In addition, sub-section 6(2) of the *Radiation Protection Regulations* states that when a licensee becomes aware that an action level referred to in the licence has been reached, the licensee must:

- conduct an investigation to establish the cause for reaching the action level;
- identify and take action to restore the effectiveness of the radiation protection program; and
- notify the CNSC within the period specified in the licence.

4 CONTROLLING RADIATION LEVELS

A natural variation in radiation levels is expected within a uranium mine, and to a lesser extent, a mill, due to the variability of concentrations of radionuclides in ore. Mine and mill facilities are designed to maintain radiation levels and radiation doses to workers as low as reasonably achievable, social and economic being taken into account (ALARA). This is achieved through the radiation protection program which consists of multiple safety systems including engineered radiation control features, procedural and operational controls, and monitoring programs. When a facility is operating as designed, radiation levels will fall within an expected range of values. Temporary or localized increases in radiation levels above this range are expected and should not be automatically considered an indicator of a possible loss of control of the radiation protection program. The dosimetric impact of increased radiation levels can be minimized by investigating and responding to increasing radiation levels in a prompt manner either by reducing them or implementing protective measures. The radiation dose

control code of practice defines control levels for measured parameters, the actions to be taken and the notification and reporting to be carried out when certain control levels are reached.

5 DEVELOPING CODES OF PRACTICE

The code of practice should provide multiple control levels by containing the following:

- action level(s), as the principle control level, which may indicate a loss of control of part of the radiation protection program, and
- administrative level(s), as an additional control level, which may indicate minor deviations from the radiation protection program.

These control levels are described below.

5.1 Action Levels

As defined in the *Radiation Protection Regulations* and *Uranium Mines and Mills Regulations*, an action level is a specific dose of radiation or other parameter that, if reached, may indicate a possible loss of control of part of a licensee's radiation protection program and triggers a requirement for specific action to be taken.

In establishing action levels, consideration should be given to the nature of possible loss of control situations. These situations could be either acute or chronic in nature. Typically, acute situations involve very high radiation levels for a short period of time (e.g. less than one week) and are often related to failure of critical safety systems. Alternatively, chronic situations involve only modest increases in radiation levels but persist for extended periods of time (e.g. weeks to months) and usually are caused by substandard performance of safety systems and some form of administrative failure. Individual radiation parameters measured over short periods of time may fail to detect these situations. Effective dose, which takes into account both the magnitude and duration of elevated radiation levels, may be a more useful indicator of loss of control situations.

The licence application should explain how any proposed action level has been derived and if no action level is proposed, an explanation should be provided as to why no action level is deemed appropriate.

In addition to setting action levels, the *Uranium Mines and Mills Regulations* require that the proposed code of practice contain a description of any action that the applicant will take and the reporting procedures to be followed, when the action level(s) is reached.

When describing the actions that will be taken, licence applicants should also consider sub-section 6(2) of the *Radiation Protection Regulations*, which imposes specific obligations on licensees when an action level is reached. These obligations pertain to investigation, corrective action, and reporting.

If an investigation confirms that a loss of control of any part of the associated radiation protection program has occurred, the licensee must identify and take corrective actions to restore the effectiveness of the program. The substance, rigor and immediacy of this response should depend upon the specific circumstances, such as the cause and nature of any loss of control and the actual and potential consequences of any loss of control. If the effectiveness of the radiation protection program cannot be restored forthwith, the licensee should propose appropriate interim measures for CNSC consideration.

Licensees may request the CNSC amend an action level referenced in the licence. To request an amendment, licensees should submit an application containing justification for the amendment to the CNSC Project Officer for the facility.

Applicants for uranium mines and mill licences should also consult CNSC regulatory guide G-228, *Developing and Using Action Levels* for further guidance on action levels.

5.2 Administrative Levels

In addition to action levels, the code of practice should contain an administrative framework designed to prevent loss of control situations and maintain radiation levels ALARA. This administrative framework should consist of administrative levels that identify increasing radiation levels in the mine or mill environment and monitor the inhalation or ingestion of radioactive materials. To be proactive these administrative levels should be based on short-

term indicators, as this allows prompt initiation of investigations and remedial actions. Accordingly, administrative levels should be expressed in terms of relevant parameters, such as:

- gamma radiation dose rate;
- radon progeny concentration;
- radon gas concentration;
- long-lived radioactive dust concentration; and
- concentration of uranium in urine.

This list should not be considered mandatory or exhaustive. Measurement of non-radiometric parameters such as ventilation rates should also be considered. In addition, administrative levels based on longer term exposures or doses may also be appropriate.

The rationale for choosing administrative levels for different parameters should be based on the difference between the radiation levels measured and the expected range of radiation levels during normal operating conditions. Each administrative level should have an associated set of administrative actions. Typically, the greater the actual or potential radiation hazards present when an administrative level is reached, the more immediate and rigorous the corresponding response should be. Accordingly, when an administrative level is reached, the appropriate responses could include:

- investigation to identify the reason for elevated measurements. This could involve measures such as confirming the measurement, increasing the frequency of monitoring and reviewing the existing control measures;
- implementation of increased protective measures for workers. The measures could include posting warning signs, requiring work permits, requiring daily dosimetry control, requiring the use of protective equipment and restricting access to work areas; and
- suspending all or some operations.

An explanation for why each administrative level has been chosen should be provided in the licence application.

6 NOTIFICATION AND REPORTING PROCEDURES

The *Radiation Protection Regulations* require that licensees notify the CNSC within the period which is specified in their licence, once they become aware that an action level has been reached. This reporting period should also be specified in the code of practice.

When an administrative level in a code of practice is reached, the associated reporting procedures should include appropriate protocols for:

- notifying the employees responsible for conducting investigations;
- implementing findings; and
- notifying the CNSC.

These protocols should specify who is to be notified and how they are to be notified (i.e. oral or written).

The urgency and level of internal reporting required in the proposed code of practice should be commensurate with the anticipated consequences of reaching the associated control level. The CNSC may also request notification by licensees when specific administration levels are reached. The administrative levels in question will be identified during the CNSC review of the licensee's Code of Practice.