



Canadian Nuclear  
Safety Commission

Commission canadienne  
de sûreté nucléaire

REGULATORY  
GUIDE

# **A Guide to Ventilation Requirements for Uranium Mines and Mills**

G-221

June 2003

Canada

## REGULATORY DOCUMENTS

The Canadian Nuclear Safety Commission (CNSC) operates within a legal framework that includes law and supporting regulatory documents. Law includes such legally enforceable instruments as acts, regulations, licences and orders. Regulatory documents such as policies, standards, guides, notices, procedures and information documents support and provide further information on these legally enforceable instruments. Together, law and regulatory documents form the framework for the regulatory activities of the CNSC.

The main classes of regulatory documents developed by the CNSC are:

**Regulatory policy:** a document that describes the philosophy, principles and fundamental factors used by the CNSC in its regulatory program.

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**Regulatory guide:** a document that provides guidance or describes characteristics or practices that the CNSC recommends for meeting regulatory requirements or improving administrative effectiveness.

**Regulatory notice:** a document that provides case-specific guidance or information to alert licensees and others about significant health, safety or compliance issues that should be acted upon in a timely manner.

**Regulatory procedure:** a document that describes work processes that the CNSC follows to administer the regulatory requirements for which it is responsible.

Document types such as regulatory policies, standards, guides, notices and procedures do not create legally enforceable requirements. They support regulatory requirements found in regulations, licences and other legally enforceable instruments. However, where appropriate, a regulatory document may be made into a legally enforceable requirement by incorporation in a CNSC regulation, a licence or other legally enforceable instrument made pursuant to the *Nuclear Safety and Control Act*.

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## TABLE OF CONTENTS

1.0	PURPOSE.....	1
2.0	SCOPE .....	1
3.0	BACKGROUND .....	1
3.1	Regulatory framework .....	1
3.2	Regulatory and licensing process.....	1
4.0	OVERVIEW OF VENTILATION REQUIREMENTS IN LEGISLATION .....	2
5.0	INFORMATION REQUIREMENTS AT PRESCRIBED LICENSING STAGES .....	3
5.1	Introduction.....	3
5.2	All classes of licences except a licence to abandon .....	4
5.2.1	Summary of information requirements .....	4
5.2.2	Discussion of information requirements .....	4
5.3	Licence to prepare a site for and construct .....	5
5.3.1	Summary of information requirements .....	5
5.3.2	Discussion of information requirements .....	5
5.4	Licence to operate .....	6
5.4.1	Summary of information requirements .....	6
5.4.2	Discussion of information requirements .....	6
5.5	Licence to decommission.....	7
5.5.1	Summary of information requirements .....	7
5.5.2	Discussion of information requirements .....	7
6.0	OPERATIONAL AND MAINTENANCE RELATED REQUIREMENTS .....	8
6.1	Requirement to post codes of practice .....	8
6.2	Requirement for written procedures .....	8
6.3	Requirement for workers to be trained .....	8
6.4	Requirement to audit compliance with operating procedures.....	9
6.5	Requirement for design, designation and prevention measures.....	9
6.6	Requirement for operating and maintenance contingencies .....	9
6.7	Requirement to keep records.....	9
6.8	Requirement to make records available .....	10
	REFERENCES.....	11



## A GUIDE TO VENTILATION REQUIREMENTS FOR URANIUM MINES AND MILLS

### 1.0 PURPOSE

The purpose of C-221 is to help persons address the requirements for the submission of ventilation-related information when applying for a Canadian Nuclear Safety Commission (CNSC) licence to site and construct, operate or decommission a uranium mine or mill.

This guide is also intended to help applicants for a uranium mine or mill licence understand their operational and maintenance obligations with respect to ventilation systems, and to help CNSC staff evaluate the adequacy of applications for uranium mine and mill licences.

### 2.0 SCOPE

This guide is relevant to any application for a CNSC licence to prepare a site for and construct, operate or decommission a uranium mine or mill. In addition to summarizing the ventilation-related obligations of uranium mine and mill licensees, the guide describes and discusses the ventilation-related information that licence applicants should typically submit to meet regulatory requirements.

The guide pertains to any ventilation of uranium mines and mills for the purpose of assuring the radiation safety of workers and on-site personnel. This ventilation may be associated with any underground or surface area or premise that is licensable by the CNSC as part of a uranium mine or mill. These areas and premises typically include mine workings, mill buildings, and other areas or premises involving or potentially affected by radiation or radioactive materials. Some examples of the latter include offices, effluent treatment plants, cafeterias, lunch rooms and personnel change-rooms.

### 3.0 BACKGROUND

#### 3.1 Regulatory framework

The Canadian Nuclear Safety Commission (CNSC) is the federal agency that regulates nuclear energy and materials to protect 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 persons, 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 associated 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 persons, 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, a CNSC licence incorporates the applicant's commitments and any other conditions that the CNSC considers necessary in the interests of health and safety of persons, national security and protection of the environment.

The information required by the CNSC at each licence application stage is influenced by case-specific circumstances. Typically, the information supplied at one stage serves as a building block for the next. 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.

#### **4.0 OVERVIEW OF VENTILATION REQUIREMENTS IN LEGISLATION**

The *Uranium Mines and Mills Regulations* contain both direct and indirect references to the ventilation of uranium mines or mills. For example, section 3 of the Regulations is a comprehensive summary of the general types of information to be included in an application for a uranium mine or mill licence, except a licence to abandon. The section includes requirements that pertain exclusively to the ventilation of uranium mines or mills, as well as others that encompass, but are not limited to, ventilation-related matters.

Sections 4, 5, 6 and 7 of the *Uranium Mines and Mills Regulations* also address a range of topics that encompass or concern, but are not limited to, ventilation systems and related matters. These subjects include:

- codes of practice;
- the design of the mine or mill;
- the results of commissioning work;
- the design of equipment, systems and components;
- quality assurance;
- commissioning plans; and
- operating, maintenance and decommissioning policies, methods and procedures.

Section 10 of the Regulations pertains to both ventilation-related and non-ventilation-related matters. It requires uranium mine and mill licensees:

- to establish, implement and maintain written operating procedures for their licensed activities;
- to train their workers to perform work in accordance with operating procedures; and
- to audit their workers for the purpose of verifying compliance with operating procedures.

Sections 11 and 12 specify the actions to be taken by CNSC licensees with respect to the operation or malfunction of ventilation systems. Section 16 of the *Uranium Mines and Mills Regulations* requires licensees to keep certain records, including those for ventilation systems and activities, and to make these records available to workers and workers' representatives.

The documents listed in the References section of this guide provide information on developing and using action levels and codes of practice to control radiation doses to uranium mine and mill workers. This guidance may be relevant to the operation of ventilation systems, in order to keep radiation doses to workers and the public as low as reasonably achievable (ALARA), social and economic factors being taken into account.

## **5.0 INFORMATION REQUIREMENTS AT PRESCRIBED LICENSING STAGES**

### **5.1 Introduction**

The ventilation-related requirements discussed in this guide appear in the *Uranium Mines and Mills Regulations* because radiation safety in uranium mines and mills depends in part on the provision of adequate ventilation in the workplace. Historically, uranium mines and mills have used active or passive ventilation measures to limit concentrations of airborne radioactivity in workplaces. When properly designed, constructed, monitored and maintained, such systems have proven to be both practical and effective in reducing radiation hazards.

Under the *Uranium Mines and Mills Regulations*, applicants for all classes of uranium mine and mill licences, except a licence to abandon, will be responsible for submitting prescribed information pertaining to any proposed ventilation systems or activities. These information requirements will vary with the licensing stage. For example, although an application for a uranium mine or mill operating licence should typically include a description of the finalized proposal (i.e., the “policies, methods and procedures”) for operating and maintaining any proposed ventilation system and “as-built” design details, more preliminary information on operating and maintenance policies, methods and procedures might suffice at the siting and construction stage. Conversely, those proponents who plan to use unproven or nonconventional technologies or methods might need to provide more rigorous substantiations at an earlier licensing stage than might be required of the proponents of more conventional (i.e., proven) approaches.

At all stages of the uranium mines and mills licensing process, the ventilation-related measures and activities proposed by individual mines or mills under the *NSC Act* and regulations will depend in part upon unique combinations of legislated requirements and case-specific factors. These factors will reflect the options open to the applicants or proponents and their respective preferences, and include site, environmental and technological constraints, such as ore-body characteristics, mining and processing technologies, facility designs and operating methods.

In some situations, proponents of uranium mine or mill projects may need to submit detailed information on their proposed undertakings for reasons that are not directly linked to CNSC

licensing stages or requirements. For example, to obtain the necessary approvals for a proposed project, the proponent may need to address recommendations resulting from environmental assessments or hearings, or conditions set by government or other authorities.

At all licensing stages, the CNSC will review any proposed ventilation systems or activities against regulatory requirements, and will take into account relevant information that pertains both directly or indirectly to the systems or activities. The Act and regulations do not prescribe the form of applications for uranium mine or mill licences, only the type of information that is to be included. However, to aid regulatory review the information contained in licence applications should be organized and presented clearly and logically.

The following sections summarize and discuss information requirements for uranium mine and mill ventilation systems.

## **5.2 All classes of licences except a licence to abandon**

### **5.2.1 Summary of information requirements**

Subparagraphs 3(d)(vii) and 3(d)(viii) of the *Uranium Mines and Mills Regulations* require an application for any CNSC licence in respect of a uranium mine or mill, other than a licence to abandon, to contain descriptions of:

- the proposed ventilation and dust control methods;
- the proposed equipment for controlling air quality; and
- the proposed level of effectiveness of and inspection schedule for the ventilation and dust control systems.

### **5.2.2 Discussion of information requirements**

The description of the proposed level of effectiveness of the ventilation and dust control systems should explain how the system will be or has been optimized in accordance with the ALARA (as low as reasonably achievable) principle of dose limitation.

If, in an applicant's opinion, ventilation systems, either active or passive, are not necessary to meet regulatory requirements, this conclusion should be stated and substantiated in the licence application.

If alternative radiation protection measures are to be substituted for engineered ventilation measures, these measures should be described and justified within the context of the applicant's radiation protection program.

The licence application should demonstrate that the proposed ventilation designs are appropriate and that the related performance predictions are valid. This documentation could include descriptions of supporting assumptions, criteria, calculations, research, modeling results, drawings, plans or diagrams.

### 5.3 Licence to prepare a site for and construct

#### 5.3.1 Summary of information requirements

In addition to the information required by subparagraphs 3(d)(vii) and 3(d)(viii) of the *Uranium Mines and Mills Regulations*, an application for a licence to prepare a site for and construct a uranium mine or mill shall contain the following information, where it is relevant to the ventilation of the mine or mill:

- a proposed code of practice that includes:
  - (a) any action level that the applicant considers necessary for purposes of subsection 4(2) of the *Uranium Mines and Mills Regulations*,
  - (b) a description of any action that the applicant will take if an action level is reached, and
  - (c) the reporting procedures that will be followed if an action level is reached (subsection 4(2));
- a description of the proposed design of the mine or mill (paragraphs 5(1)(a), 5(2)(a));
- a description of the components, systems and equipment proposed to be installed at the mine or mill, including their design operating conditions (paragraphs 5(1)(c), 5(2)(c));
- the proposed quality assurance program for the mine or mill (paragraphs 5(1)(d), 5(2)(d));
- the results of a process-hazard analysis and a description of how those results have been taken into account (paragraphs 5(1)(e), 5(2)(e));
- the proposed commissioning plan for the ventilation components, systems, and equipment to be installed at the mine or mill (paragraphs 5(1)(j), 5(2)(i)).

#### 5.3.2 Discussion of information requirements

The information that is submitted to meet the information requirements listed in section 5.3.1 above for a licence to prepare a site for and construct a uranium mine or mill should typically include such supporting details as:

- a description of any alarm system or component, including a main fan warning device, that will be installed to ensure that the ventilation system operates safely (subsection 11(a)).
- a description of any design provisions to ensure effective separation of primary air intakes and exhausts;
- a description of any proposed auxiliary ventilation systems;
- the preliminary programs for monitoring air quality and quantity;
- a description of the quantity and quality of air that is to be supplied to each workplace area;
- a description of the expected rate of air exchange in the workplace after installation of any proposed ventilation systems;
- a description of the expected air quality in the workplace after installation of any proposed ventilation systems;
- a description of any administrative provisions to ensure effective operation of the ventilation system;

- proposed operating parameters for winter and summer; and
- any proposed measures to control the movement of radiation from unventilated to ventilated areas of underground mines.

## 5.4 Licence to operate

### 5.4.1 Summary of information requirements

In addition to the information required by subparagraphs 3(d)(vii) and 3(d)(viii) of the *Uranium Mines and Mills Regulations*, an application for a licence to operate a uranium mine or mill shall contain the following information, where it is relevant to the ventilation of the mine or mill:

- a proposed code of practice that includes:
  - (a) any action level that the applicant considers necessary for purposes of subsection 4(2) of the *Uranium Mines and Mills Regulations*,
  - (b) a description of any action that the applicant will take if an action level is reached, and
  - (c) the reporting procedures that will be followed if an action level is reached (subsection 4(2));
- the proposed policies, methods and procedures for operating and maintaining the ventilation systems (paragraphs 6(1)(c), 6(2)(c));
- a description of the structures, components, systems and equipment that have been constructed or installed at the mine or mill, and their design operating conditions as a result of commissioning (paragraphs 6(1)(b), 6(2)(b));
- the results of any commissioning work (paragraph 6(1)(a));

### 5.4.2 Discussion of information requirements

To meet the above requirements as they pertain to ventilation systems or related measures, an application for a licence to operate a uranium mine or mill should include or incorporate the relevant information, whether new or previously submitted.

Accordingly, an application to the CNSC for a uranium mine or mill operating licence should demonstrate that any engineered ventilation system will be operated, monitored and maintained in accordance with regulatory requirements. Typically, the application should describe:

- the dimensions, location and layout of ventilation ducts;
- the location, type and use of all ventilation system controls and regulators;
- the design, location and operation of any equipment or devices to measure air quality or air quantity;
- the location of system air intakes and exhausts;
- the measures to ensure that a person is designated to receive and respond to a warning signal provided by a main-fan warning device (subsection 11(b));
- the measures that are to be implemented to prevent any person or activity from interfering with the proper operation of the ventilation system (subsection 11(c));
- the measures that the applicant proposes to implement to protect the health and safety of workers if the ventilation system in the licensed workplace fails to function in accordance with the licence (paragraph 12(1)(a));

- the measures that the licence applicant proposes to implement to ensure, in the event of a ventilation system not functioning in accordance with a licence, that only the work that is immediately necessary to restore the system is performed in the affected workplace (paragraph 12(1)(b));
- how the licensee will inform a worker of the protective measures that have been taken and are to be taken in connection with any work necessary to restore a ventilation system (subsection 12(2));
- how the ventilation system has been constructed to meet any relevant conditions of the associated CNSC licence to prepare a site for and construct the facility;
- any available results from the monitoring of the performance of the ventilation system during commissioning;
- any planned changes with respect to the design, operation, monitoring, maintenance or performance of the engineered ventilation system;
- any proposed code of practice with respect to the ventilation system; and
- the policies, methods and procedures for operating, maintaining and controlling the ventilation system.

## 5.5 Licence to decommission

### 5.5.1 Summary of information requirements

In addition to the information required by subparagraphs 3(d)(vii) and 3(d)(viii) of the *Uranium Mines and Mills Regulations*, the regulations stipulate that an application for a licence to decommission a uranium mine or mill shall contain the following information where it is relevant to the ventilation of the mine or mill.

- a proposed code of practice that includes:
  - (a) any action level that the applicant considers necessary for purposes of subsection 4(2) of the *Uranium Mines and Mills Regulations*,
  - (b) a description of any action that the applicant will take if an action level is reached, and
  - (c) the reporting procedures that will be followed if an action level is reached (subsection 4(2));
- the proposed schedule for the decommissioning work, including the proposed starting date and the expected completion date of the decommissioning work and the rationale for the schedule (subsection 7(a));
- a description of the land, buildings, structures, components, systems, equipment, nuclear substances and hazardous substances that will be affected by the decommissioning (subsection 7(b));
- the proposed measures, methods and procedures for carrying on the decommissioning (subsection 7(c)); and
- a description of the planned state of the site upon completion of the decommissioning work (subsection 7(d)).

### 5.5.2 Discussion of information requirements

The information submitted in support of an application for a licence to decommission should address the requirements listed in 5.5.1 above to a level of detail and accuracy that demonstrates that the applicant has made adequate allowance for the health and

safety of persons, national security and protection of the environment during decommissioning.

One example of making adequate allowance might be to provide enhanced ventilation during some or all decommissioning activities. This could involve the continued use, with or without modifications, of a ventilation system that was used during the operating phase, or the use of new measures. Accordingly, a licence applicant's preferred measures will typically be influenced by case-specific circumstances, such as whether previously installed ventilation systems have become radioactively contaminated during use, or whether the proposed ventilation systems are likely to become similarly contaminated upon use. To expedite regulatory review and licensing, the application for a decommissioning licence should address any such possibilities.

The CNSC may need to know the details of an applicant's proposed decommissioning plans in order to evaluate the adequacy of any proposed use or decommissioning of ventilation systems and equipment.

To help control radiation doses to workers and the public during decommissioning activities, action levels that involve ventilation activities or results can be incorporated into codes of practice at uranium mines or mill.

## **6.0 OPERATIONAL AND MAINTENANCE RELATED REQUIREMENTS**

### **6.1 Requirement to post codes of practice**

If a code of practice is referred to in a uranium mine or mill licence, the licensee is required by section 9 of the *Uranium Mines and Mills Regulations* to post a copy of the code of practice at a location within the uranium mine or mill that is accessible to all workers and where it is most likely to come to their attention.

### **6.2 Requirement for written procedures**

Paragraph 10(a) of the *Uranium Mines and Mills Regulations* obliges every CNSC licensee to establish, implement and maintain written procedures for the conduct of licensed activities. Accordingly, uranium mine and mill licensees that use ventilation systems to help protect their workers and the public must establish, implement and maintain written procedures to ensure that these systems operate effectively. These operating procedures should include provisions, such as inspection, surveillance or sampling programs, for purposes of evaluating, controlling and demonstrating the effectiveness of the associated systems.

### **6.3 Requirement for workers to be trained**

Paragraph 10(b) of the *Uranium Mines and Mills Regulations* further obliges licensees to train their workers to perform work in accordance with operating procedures. To meet this obligation as it relates to a ventilation system at a uranium mine or mill, the licensee must ensure that the workers who are responsible for following the ventilation-related operating procedures receive training to perform their work.

#### 6.4 Requirement to audit compliance with operating procedures

Paragraph 10(c) of the *Uranium Mines and Mills Regulations* also obliges licensees to audit their workers for the purpose of verifying compliance with the relevant operating procedures for the conduct of licensed activities, including those for ventilation systems at uranium mines and mills.

#### 6.5 Requirement for design, designation and prevention measures

Section 11 of the *Uranium Mines and Mills Regulations* requires every licensee to:

- ensure that each main fan of the ventilation systems established in accordance with the licence is equipped with a device that provides a warning signal when the main fan is not functioning properly (paragraph 11(a));
- ensure that a person is designated to receive and respond to any warning signal provided by the main fan warning device (paragraph 11(b)); and
- implement measures to prevent any person or activity from interfering with the proper operation of the ventilation systems (paragraph 11(c)).

#### 6.6 Requirement for operating and maintenance contingencies

Where a ventilation system in a uranium mine or mill workplace is not functioning in accordance with the licence, section 12 of the *Uranium Mines and Mills Regulations* requires the licensee to:

- implement alternative measure to protect the health and safety of the workers (paragraph 12(1)(a)); and
- ensure that only the work necessary to restore the ventilation system is performed in the workplace (paragraph 12(1)(b)).

Subsection 12(2) of the *Uranium Mines and Mills Regulations* stipulates that before a worker performs any work that is necessary to restore a ventilation system at a uranium mine or mill, the uranium mine or mill licensee shall inform the worker of the protective measures that have been taken, and are to be taken in connection with the work.

#### 6.7 Requirement to keep records

Section 16 of the *Uranium Mines and Mills Regulations* requires every uranium mine or mill licensee to keep the following records that pertain to, or could pertain to, mine or mill ventilation systems:

- operating and maintenance procedures (paragraph 16(1)(a));
- the design of the components and systems installed at the mine or mill (paragraph 16(1)(e));
- the method and relevant data used to ascertain the doses of radiation received by workers at the uranium mine or mill and the intake of radioactive nuclear substances by those workers (paragraph 16(1)(f));
- any measurement made in accordance with the licence or the regulations made under the Act (paragraph 16(1)(g));
- the inspections and maintenance carried out in accordance with the licence or the regulations made under the *NSC Act* (paragraph 16(1)(h));
- the quantity of air delivered by each main fan identified in the licence (paragraph 16(1)(i));
- the performance of each dust control system (paragraph 16(1)(j)); and
- the training received by each worker (paragraph 16(1)(k)).

## 6.8 Requirement to make records available

Section 16 of the *Uranium Mines and Mills Regulations* also requires every uranium mine or mill licensee to:

- make the prescribed records available at the uranium mine or mill to the workers or workers' representative (subsection 16(2));
- retain a record of the training received by workers employed at the uranium mine and mill (subsection 16(3)); and

post at a location within the uranium mine or mill that is accessible to all workers, and where it is most likely to come to their attention, a record of the measurements made in respect of every workplace in accordance with the licence and the *Uranium Mines and Mills Regulations* (subsection 16(4)).

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**REFERENCES**

1. “Developing and Using Action Levels,” Regulatory Guide G-228, *Atomic Energy Control Board* (March 2001).
2. “Preparing Codes of Practice to Control Radiation Doses at Uranium Mines and Mills,” Draft Regulatory Guide C-218, *Atomic Energy Control Board* (November 1999).