Section 5.5. Laboratories

5.5.1. Scope

5.5.1.1. Application

1) This Section applies to laboratories where *dangerous goods*, including *flammable liquids* and *combustible liquids*, are used. (See Note A-5.5.1.1.(1).)

2) Except as otherwise specified in this Section, the use, handling and storage of *dangerous goods*, including *flammable liquids* and *combustible liquids*, shall conform to Parts 3, 4 and 5.

5.5.2. Construction

5.5.2.1. Interior Finish Materials

1) Interior finish materials, floors, fixed furniture and equipment shall be chemically resistant to *dangerous goods* being used in a laboratory to minimize their deterioration, in conformance with Articles 3.2.7.7. and 3.2.7.8.

5.5.2.2. Separation

1) A laboratory shall be separated from other parts of the *building* by *fire separations* conforming to this Code and the British Columbia Building Code, but having a *fire-resistance rating* of not less than 1 h.

5.5.3. Fire Prevention and Protection

5.5.3.1. Emergency Planning

1) Except as provided in Sentences (2) to (5), a laboratory shall conform to the requirements for emergency planning in Section 2.8. and for a fire safety plan in Subsection 5.1.5.

2) Personnel working in a laboratory shall be trained in the safe handling and use of *dangerous goods*, in conformance with Article 3.2.7.15.

3) *Dangerous goods* shall be identified in conformance with Article 3.2.7.13.

4) The laboratory shall be clearly designated as an area containing *dangerous goods* in conformance with Article 3.2.7.14.

5) Measures shall be taken to prevent access to the laboratory by unauthorized persons.

5.5.3.2. Combustible Materials

1) Where combustible materials, such as packaging materials, are used in a laboratory, their quantity shall not be greater than the supply for one day of normal operation.

2) Combustible materials in excess of those permitted in Sentence (1) shall be stored outside of the laboratory in conformance with Section 3.2.

5.5.3.3. Spill Control

1) Absorbent and neutralizing materials shall be provided in the laboratory and in the *dangerous goods* storage areas in conformance with Sentence 3.2.7.11.(2).

5.5.3.4. Electrical Equipment

1) Except as provided in Sentence 5.5.3.5.(3), electrical equipment located in areas where the concentration of flammable vapours is sufficient to create a hazard shall conform to the British Columbia Electrical Safety Regulation requirements for hazardous locations. (See Note A-5.5.3.4.(1).)

2) Electrical equipment located inside a power-ventilated enclosure required in Article 5.5.4.2. and its exhaust duct system shall

a) conform to Sentence (1), and

b) be designed and maintained to prevent the accumulation of combustible or reactive deposits.

5.5.3.5. Ignition Sources

1) Smoking shall not be permitted in a laboratory and signs shall be posted in conformance with Article 2.4.2.2.

2) Where overheating of unattended equipment using heat can cause a fire or an explosion, such equipment shall be equipped with a high temperature limit switch fitted to

a) sound an alarm, and

b) shut off the heat.

3) An ignition source that is an integral part of an operation involving flammable vapours shall be permitted provided

a) the supply of *flammable liquids* or *combustible liquids* for this operation is controlled and kept to a strict minimum,

b) flammable vapours and combustion fumes are exhausted in conformance with Article 5.5.4.2.,

c) there is no other source of ignition capable of igniting the flammable vapours in an uncontrolled manner, and

d) there is no combustible material in the immediate vicinity of this operation.

5.5.3.6. Inspection and Maintenance

1) Electrical equipment, mechanical systems, piping, valves, and automatic and manual control and safety devices shall be inspected, tested and maintained in good operating condition at all times.

2) The ventilation systems serving a laboratory shall be inspected and cleaned to prevent the accumulation of combustible or reactive deposits, and the intervals between inspections shall be not greater than

a) 12 months for the ventilation systems of the laboratory and *dangerous goods* storage areas, and

b) 6 months for the ventilation system of a power-ventilated enclosure required in Article 5.5.4.2.

5.5.4. Ventilation

5.5.4.1. General Ventilation

1) A laboratory shall be provided with continuous mechanical ventilation that is

a) designed in conformance with Article 6.3.4.2. of Division B of the British Columbia Building Code, and

b) maintained to ensure it fulfills the function for which it was designed.

5.5.4.2. Power-Ventilated Enclosure

1) The use of *dangerous goods* in a laboratory shall be confined inside a power-ventilated enclosure conforming to Articles 6.3.4.3. and 6.3.4.4. of Division B of the British Columbia Building Code when

a) their use releases flammable vapours or causes runaway or potentially explosive reactions,

b) liquids are heated to a temperature equal to or greater than their *flash point*, or

c) Class I liquids or *unstable liquids* are used.

2) A power-ventilated enclosure required in Sentence (1) shall not be used for the storage of *dangerous goods*, and any quantity in excess of the supply necessary for normal operations shall conform to Subsection 5.5.5.

5.5.4.3. Enclosure Exhaust Ventilation

1) Except as provided in Sentence (2), the ventilation system for a power-ventilated enclosure required in Article 5.5.4.2. shall conform to Article 6.3.4.3. of Division B of the British Columbia Building Code.

2) The ventilation system described in Sentence (1) shall not be interlocked with a fire detection, fire alarm or makeup air system.

3) Where combustible or reactive deposits can accumulate in the power-ventilated enclosure and its exhaust duct system and create a fire or explosion hazard,

a) provisions shall be made to remove such deposits so they do not create a fire or explosion hazard, or

b) an automatic fire suppression system shall be provided.

5.5.4.4. Enclosure Construction

1) The power-ventilated enclosure required in Article 5.5.4.2. and its exhaust duct system shall conform to Article 6.3.4.4. of Division B of the British Columbia Building Code and

a) be provided with instructions for its use and the operation of the ventilation system, and

b) be provided with means to control accidental spillage.

5.5.5. Dangerous Goods

5.5.5.1. Maximum Quantities

1) The quantity of *dangerous goods* kept in a laboratory shall be minimized and shall not exceed the lesser of

a) the supply necessary for normal operation, or

b) when located in

i) a Group A, Division 2 educational or a Group D *major occupancy*, 300 L of *flammable liquids* and *combustible liquids*, of which not more than 50 L shall be Class I liquids, or

ii) a Group B *major occupancy*, the quantities of *flammable liquids* and *combustible liquids* permitted in Sentence 4.2.6.3.(1).

(See Note A-5.5.5.1.(1).)

2) Quantities of *flammable liquids* and *combustible liquids* in excess of those permitted in Sentence (1) shall be stored in

a) cabinets conforming to Subsection 4.2.10. except that, in laboratories described in Clause (1)(b), the total quantity of *flammable liquids* and *combustible liquids* stored in such cabinets shall not exceed the quantity permitted for one cabinet, or

b) a room conforming to Subsection 4.2.9.

3) Quantities of *dangerous goods* other than *flammable liquids* and *combustible liquids* in excess of those permitted in Sentence (1) shall be stored outside of the laboratory in conformance with Part 3.

5.5.5.2. Containers for Flammable and Combustible Liquids

1) Except as provided in Sentences (2) and (4), containers used for the storage or dispensing of *flammable liquids* or *combustible liquids* in a laboratory shall conform to Subsection 4.2.3.

2) Where Class I liquids are required to be kept in individual storage or dispensing containers having a capacity greater than 5 L in a laboratory, such containers shall

a) be safety containers conforming to ULC/ORD-C30, “Safety Containers,” and

b) have a capacity of not more than 25 L.

3) Containers used for the preservation of animal, human or plant specimens that contain *flammable liquids* or *combustible liquids* shall

a) be properly sized for the specimens,

b) be stored in a room conforming to Subsection 4.2.9., and

c) be protected against breakage and spillage.

4) Containers of *flammable liquids* or *combustible liquids* shall be kept closed when not in use.

5.5.5.3. Compressed Gases

1) Cylinders of *dangerous goods* classified as compressed gases shall not be located in laboratories unless they are

a) in use and connected

i) to a regulator to deliver gas, or

ii) to a manifold being used to deliver gas, or

b) one is serving as a single reserve cylinder for a cylinder described in Subclause (a)(i) to which it is firmly secured with a noncombustible attachment.

2) Storage cylinders and piping systems for *dangerous goods* classified as compressed gases used in a laboratory shall be firmly secured with a noncombustible attachment and protected against mechanical damage.

3) Each point of supply and each point of use of cylinders or piping systems for *dangerous goods* classified as compressed gases shall be provided with

a) labels identifying the gas being supplied, and

b) a manual shut-off valve.

4) Valves on cylinders for *dangerous goods* classified as compressed gases shall be closed when not in use.

5) Except as provided in Sentence (7), where cylinders of *dangerous goods* classified as toxic gases are used in a laboratory,

a) they shall be located in a continuously mechanically ventilated gas storage cabinet,

b) all exhaust shall be directed to a treatment system designed to process the accidental release of gas (see Note A-5.5.5.3.(5)(b) and (7)(b)), and

c) the gas levels in the air shall be monitored by a gas detection system designed to emit an audible and visual signal within the laboratory and at a central station when gas levels exceed the exposure limit values established by provincial regulations or, in the absence of such regulations, when they exceed the exposure limit values stated in the Safety Data Sheet.

6) Except as permitted in Sentence (7), cylinders of *dangerous goods* classified as compressed gases of pyrophoric materials shall be located in a gas storage cabinet that is

a) continuously mechanically ventilated, and

b) *sprinklered*.

7) Where lecture bottles of *dangerous goods* classified as toxic gases or as compressed gases of pyrophoric materials are used in a laboratory,

a) they shall be kept in a dedicated continuously mechanically ventilated hood or other continuously mechanically ventilated enclosure, and

b) all exhaust shall be directed to a treatment system designed to process the accidental release of gas (see Note A-5.5.5.3.(5)(b) and (7)(b)).

5.5.5.4. Refrigerated Storage

1) Refrigerators described in Sentence 4.1.4.1.(2) shall be identified in conformance with Article 3.2.7.14.

2) Class I liquids that are stored in refrigerators shall be kept in *closed containers*.

5.5.5.5. Dangerously Reactive Materials

(See Note A-5.5.5.5.)

1) Except as provided in Article 5.5.5.6., the heating of dangerously reactive materials above normal ambient temperature or as specified in the Safety Data Sheet shall be carried out in a separate power-ventilated enclosure

a) conforming to Articles 5.5.4.2. to 5.5.4.4., and

b) displaying conspicuously posted instructions specifying that the enclosure is to be used for this application only.

2) The power-ventilated enclosure required by Sentence (1) as well as its exhaust duct system shall be washed after each use to prevent the possible accumulation of highly reactive or unstable deposits. (See Note A-5.5.5.5.(2).)

5.5.5.6. Perchloric Acid

(See Note A-5.5.5.6.)

1) Where perchloric acid is heated above normal ambient temperature, it shall be done in a separate power-ventilated enclosure

a) conforming to Articles 5.5.4.3. and 5.5.4.4., and

b) displaying conspicuously posted instructions specifying that the enclosure is to be used for this application only.

2) The power-ventilated enclosure required by Sentence (1) as well as its exhaust duct system shall be washed after each use to prevent the accumulation of highly unstable deposits. (See Note A-5.5.5.6.(2).)

3) Perchloric acid shall not be heated with an open flame or in a hot oil bath.

5.5.5.7. Chemical Wastes

1) Wastes from *dangerous goods* shall be

a) identified to prevent accidental mixing of incompatible chemicals, and

b) included in the quantities specified in Article 5.5.5.1.