Appendix A - Safety Standards Act, Regulations and Codes

This appendix describes the application of the Safety Standards Act (Act) to the equipment, work and people involved with the incident. The applicable sections of the Act, Regulations, Codes and Standards are listed following the analysis.

Refrigeration equipment

There were three ice making machines installed at the facility that used ammonia as the refrigerant. These were two Vogt P24A ice making machines and one P34A Vogt ice making machine that were manufactured in the late 1970s and early 1980s. The machines are comprised of numerous pressure vessels and interconnecting pressure piping. The P24A machines are documented to be charged with 800lbs of ammonia each and the P34A machine is charged with 1600lbs of ammonia during normal operation. The P24A machines each include a compressor (prime mover) rated at 45 kilowatts (kW) and the P34A machine includes a compressor (prime mover) rated at 93 kW.

Modifications were made to the original machines. The P34A machine was split from its original skid-package configuration, separating the machine into two parts, and installing modified piping and ball valves to reconnect the two parts as a system. The two P24A machines were joined to a single compressor and receiver with the addition of an external evaporative condenser to comprise one connected system. The compressor (prime mover) was a Vilter VMC 450 XL having a maximum rating of 290 kW.

The refrigeration equipment as installed constituted two refrigeration systems and are regulated products, subject to the Act and Regulations. Due to their prime mover ratings, refrigeration operating permits were required for these two refrigeration systems.

People and work

The refrigeration systems required a designated person-in-charge who held a refrigeration operator or fourth-class power engineer qualification while the plant was in operation. The dismantling work was an *alteration* of a *regulated product* and *regulated work* involved assessment of the refrigeration equipment, manipulation of valves, removal and purging of refrigerant (ammonia), and cutting of pressure piping.

Until demonstrated or declared by a licensed refrigeration contractor to be ready for disconnection and removal, the dismantling work being performed on the refrigeration system was *regulated work* and required a licensed refrigeration contractor to complete or supervise this work.

The operating permit holder is required to ensure that the work was completed or supervised by a licensed refrigeration contractor.

The owner was required to ensure that the portions of pressure piping being cut were safe for the dismantling activity being performed.

Technical standards

The CSA B-52 Mechanical Refrigeration Code is adopted in BC; however, it does not currently specify disassembly or decommissioning procedures. The International Institute of Ammonia Refrigeration (IIAR) 8-2020, Decommissioning of Closed-Circuit Ammonia Refrigeration Systems is an industry-recognized standard and contains useful procedures and information.

Safety Standards Act (SSA) – Applicable Sections

"alteration" includes adding to, replacement and removal

"regulated work" means
(b)the alteration of a regulated product;

"regulated product" means a product or thing referred to in section 2 (1) (b), and if specified in the regulations, a part of that product or thing;

SSA - Application of this Act
2 (1)This Act and the regulations apply to all of the following:
(b)all of the following regulated products as they are defined in the regulations:
(vii)pressure vessels;
(viii)pressure piping;
(ix)refrigeration systems and equipment;

SSA - Operating permits
28
(5)A person who holds an operating permit must ensure that individuals who do regulated work under the permit maintain current knowledge of this Act, relevant regulations, relevant directives, relevant safety orders and any other relevant material that the minister makes publicly available.
(6)A person who holds an operating permit must not allow regulated work to be undertaken by persons under the permit unless they are authorized under this Act.

SSA - General prohibitions
63 A person must not do any of the following:
(a)assemble, manufacture, construct, test, install, operate, use, dispose of, maintain, repair or alter a regulated product contrary to this Act and the regulations;
(b)if the regulations require a person to obtain a permit, certificate or other permission before starting regulated work, do, or continue to do, the regulated work without the required permit, certificate or permission;

SSA - Maintenance and repair of regulated products
66 A person must not maintain or repair a regulated product unless that person is

(a)a licensed contractor, or
(b)authorized to do so under this Act.

SSA - Alteration of regulated products

68 (1)A person must not alter a regulated product if the alteration would or is likely to
(a)result in the product ceasing to meet the requirements of the regulations, or
(2)If an alteration to a regulated product is permitted under subsection (1), a person must not do the alteration unless that person is
(a)a licensed contractor,
(b)authorized to do so under this Act, or
(c)approved by the appropriate safety manager if the safety manager is satisfied that the person is capable of safely doing the alteration.

SSA - Regulated work

71 A person must not do regulated work unless the person is
(a)a licensed contractor, or
(b)authorized to do so under this Act.

Safety Standards General Regulation (SSGR) – Applicable Sections

SSGR - Regulated work done under supervision

5 (1)Despite section 4, an individual may do regulated work for which specific qualifications would be required under the Act if the individual is supervised by a person who

(a)is specifically authorized under the Act to perform that type of work, and

(b)supervises the individual on site and provides guidance and assistance to the individual as the regulated work is performed.

SSGR - Operating permits

18 (1)A person must have an operating permit to do any of the following:

(a)operate a regulated product;

(b)maintain a regulated product.

SSGR - Responsibilities of operating permit holder

19 The holder of an operating permit must do all of the following:

(a)if required under the permit, maintain a log of work performed under the permit;

SSGR - Regulated work under a permit

19.1 (1)This section applies to a person who holds a permit, other than a homeowner.

(2)For the purposes of section 23 (1) (a) of the Act, a person who holds a permit is authorized to manage or direct individuals doing regulated work under the permit.

(3)For the purposes of section 23 (1) (b) of the Act, a person who is authorized under the Act to do regulated work may do the regulated work for a person who holds a permit.

Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation – Applicable Sections

"pressure piping" means a system of pipes, tubes, conduits, gaskets, bolts and other components, the sole purpose of which is the conveyance of

(a)an expansible fluid [ammonia], or

"pressure vessel" means a vessel and its fittings, other than a boiler, that is capable of being used to contain, store, distribute, transfer, distil, process or otherwise handle gas, vapour or liquids under pressure;

"refrigeration equipment" means machinery in which refrigerants are capable of being vaporized, compressed and liquefied;

"refrigeration system" means a refrigeration plant.

"person in charge" means the power engineer, operator or other individual present on the premises during a period of time, and designated by the owner or chief engineer to be responsible for and in control of the plant while it is in operation;

"plant" means a power plant, heating plant, low temperature, low pressure fluid plant, low pressure thermal fluid plant, high pressure thermal fluid plant, refrigeration plant, oil well plant, unfired plant or pressure plant;

"refrigeration plant" means an assembly of refrigeration equipment and includes a pressure plant connected to it;

Application of this regulation

3 (1)This regulation applies in respect of every boiler and boiler plant, every pressure plant, every pressure vessel, every pressure piping system, every fitting, every plant and all refrigeration equipment and refrigeration plants.

(2)Despite subsection (1), this regulation does not apply to any of the following:

(j)a refrigeration plant with a capacity of less than 5 kW prime mover nameplate rating;

Individuals who may perform regulated work

5 (1)An individual must not perform regulated work unless the individual

(a)holds a valid certificate of qualification issued under this regulation,

(b)performs regulated work in accordance with section 5 of the Safety Standards General Regulation,

(c)is specifically authorized in this regulation, or

(d)has been exempted from any specified authorization requirement under this regulation.

(2)An individual must not perform maintenance and repairs on a refrigeration plant unless the individual

(a)holds a fourth class power engineer's certificate of qualification or higher, or

(b)is a refrigeration mechanic.

What a refrigeration operator may do
26 A refrigeration operator's certificate of qualification entitles the holder to be a person in charge of any type and size of refrigeration plant.

Plant classifications
44 (2.1)A refrigeration plant requires a refrigeration operator or a power engineer with a fourth class or higher certification of qualification to be in charge of the plant.

Permits
62 (1)A person must have an installation permit to install, repair or alter any of the following:
(b)a refrigeration system or part of a refrigeration system.
(2)A person must hold an operating permit for each boiler, pressure vessel or refrigeration system.

General requirements for person in charge of a plant
67 (1)The person in charge of a plant must hold a certificate of qualification appropriate to the work to be performed in the plant.
(2)The person in charge of the plant must ensure that the plant is adequately supervised and has appropriately qualified persons working in it.

Person in charge to give permission before work can begin
69 A person must not perform any work on a boiler, pressure vessel or pressure piping system connected to it, instrumentation and control system, fuel system or fuel burning equipment or refrigeration plant equipment that may affect the operation and safety of the plant except with the prior approval of the chief engineer, assistant chief engineer or the person in charge of the plant.

Owner responsible for safety in a plant
74 (2)If regulated work is being performed on a pressure piping system in a plant, the owner of the plant must ensure that the portion of the pressure piping system where the regulated work is performed is safe for the activity being performed.

CSA B52 mechanical Refrigeration Code – Applicable Sections

CSA B52:18

Mechanical refrigeration code

1 Scope

1.1 Purpose

The purpose of this Standard is to minimize the risk of personal injury by providing minimum requirements for the design, construction, installation, inspection, and maintenance of the mechanical refrigeration systems and volatile direct refrigeration systems specified in Clauses 1.2.1 and 1.2.2.

Note: *This Standard does not directly address protection of property and preservation of the environment.*

TECHNICAL SAFETY BC

International Institute of Ammonia Refrigeration ANSI/IIAR-8-2020

Decommissioning of Closed-Circuit Ammonia Refrigeration Systems – Reference

2.2 **Defined Terms.** The following words and terms, which are used in this standard, shall be defined as specified in this chapter.

decommissioning: The permanent deactivation of a closed-circuit refrigeration system.

4.4 **Ammonia to Be Removed.** Estimate the approximate amount of ammonia that will be removed from the system.

4.8 **Supporting Documents.** Obtain the following supporting documents:

4.8.1 ***Physical** Properties.** Documents that describe the physical properties and potential hazards of anhydrous ammonia, lubricating oil and other chemicals involved in the decommissioning activities.

4.8.2 **System Diagrams.** Refrigeration system flow diagrams and/or piping and instrumentation diagrams (P&IDs) depicting the refrigeration system to be decommissioned.

4.8.3 **Facility Plan View.** A facility plan view showing the orientation of the facility and the general location of the ammonia refrigeration system to be decommissioned.

4.8.4 **Pressure Relief Valves.** Information describing the location and setpoint of any pressure relief valves installed on equipment, components, and piping to be decommissioned.

5.2.3.5 Do not physically disconnect and remove system components until the components have been isolated and residual ammonia and lubrication oil have been drained from the components.