Notes to Part 4

Flammable and Combustible Liquids

A-4.1.1.1.(1) The all-inclusive phrase "buildings, structures and open areas" includes, but is not limited to, tank farms, bulk plants, fuel-dispensing stations, industrial plants, refineries, process plants, distilleries, and to piers, wharves and airports that are not subject to overriding federal control.

Part 4 applies wherever flammable or combustible liquids are used or stored, except as specifically exempted in Sentences 4.1.1.1.(2) and (3). In addition, Section 4.6. applies to dangerous goods classified as flammable gases at fuel-dispensing stations.

Part 4 contains both general and occupancy-specific provisions. While general provisions apply to all occupancies or operations identified within the scope of Subsection 4.1.1., occupancy-specific provisions apply only to the specific occupancy or operation stated.

To determine the provisions that apply to a given situation, the first step is to confirm which Section or Subsection corresponds to the operation or occupancy: this will help identify the occupancy-specific provisions that apply. The next step is to ensure that all general requirements that apply to the operation or occupancy are also identified.

A-4.1.1.1.(2) Certain areas in refineries, chemical plants and distilleries will not meet all Code requirements because of extraordinary conditions. Design should be based on good engineering practice and on such factors as manual fire suppression equipment, daily inspections, automated transfer systems, location of processing units, and special containment systems, piping, controls and materials used. NFPA 30, "Flammable and Combustible Liquids Code," and NFPA 36, "Solvent Extraction Plants," are examples of good engineering practice and can be referred to by the designer and the authority having jurisdiction.

A-4.1.1.1.(3)(b) Ancillary equipment covered in CSA B139, "Installation Code for Oil-Burning Equipment," includes storage tanks and piping that supply oil-burning equipment, diesel-engine-driven emergency generators and fire pumps. Part 4 of the BCFC does not apply to such tanks and piping systems.

A-4.1.2.1. The classification system for flammable liquids used by TC SOR/2008-34, "Transportation of Dangerous Goods Regulations (TDGR)," differs from the NFPA classification system used in the BCFC. In the BCFC, only liquids with a flash point below 37.8°C are referred to as "flammable liquids," whereas liquids having a flash point at or above 37.8°C are "combustible liquids." The TDGR do not include Class IIIA liquids, which have a flash point above 60°C.

For the purpose of comparing the TDGR classification system with the BCFC system, the difference between 60.5°C (TDGR) and 60°C (BCFC) may be ignored. The results of closed-cup flash point tests may vary by as much as 1°C, so nothing is gained by unnecessary precision.

A-4.1.2.1.(3)(b) The NFPA classification system for flammable and combustible liquids includes Class IIIB liquids, which have flash points at or above 93.3°C. These liquids are not regulated by Part 4 of the BCFC because they are deemed to represent no greater fire hazard than other combustibles, such as wood or paper products. However, Article 4.1.2.2. clarifies that such liquids are effectively Class I liquids when heated to their flash point temperature.

A-4.1.2.3. Used automotive lubricating oil may contain both oil and more volatile Class I liquids, such as gasoline. Tests of representative samples have demonstrated that the flash point of such used oil consistently exceeds 60°C, with an average above 93.3°C. When Class I or II liquids are added to such used oil, the flash point of the resulting mixture will vary with the percentage and flammability of the contaminating liquid and shall be determined by tests.

A-4.1.3.1. The kinematic viscosity of a liquid influences the choice of test most appropriate for measuring its flash point. In the ASTM standards, kinematic viscosity is measured in stokes (St) or centistokes (cSt).

For purposes of comparison, the kinematic viscosity of water is 1.0038 cSt at 20°C; of glycerine (100%), approximately 648 cSt at 20°C; and of some common motor oils, near 1 295 cSt at –18°C. Some paints, lacquers and glues have much higher kinematic viscosities, as indicated by the upper limit of 150 St in ASTM D 3278, "Flash Point of Liquids by Small Scale Closed-Cup Apparatus."

A substance should be treated as a liquid if it has a fluidity greater than that of 300 penetration asphalt, when tested in accordance with ASTM D 5/D 5M, "Penetration of Bituminous Materials." A viscous substance for which a specific melting point cannot be determined but that is designated as a liquid in accordance with ASTM D 4359, "Determining Whether a Material Is a Liquid or a Solid," should also be considered as a liquid.

A-4.1.4.1.(1) Additional information on determining the extent of Division 1 or 2 zones in Class I locations can be found in CSA PLUS 2203, "Hazardous Locations: A Guide for the Design, Testing, Construction, and Installation of Equipment in Explosive Atmospheres," in NFPA 30, "Flammable and Combustible Liquids Code," and in NFPA 497, "Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas."

A-4.1.5.2.(1) Sources of ignition include, but are not limited to, open flames, smoking, cutting and welding, hot surfaces, frictional heat, static, electrical and mechanical sparks, spontaneous ignition, heat-producing chemical reactions, and radiant heat.

A-4.1.5.8. Limited quantities of Class I liquids are permitted to be stored or used in basements where it is clear they will not create a fire hazard. Such factors as the size of the basement, ventilation, wiring, and proximity to sources of ignition should be taken into account in determining whether an unsafe condition exists.

A-4.1.6.1.(1) A spill containment system is intended to capture the maximum credible spill of a flammable or combustible liquid. This can be achieved by safely containing the liquid or having it drain to a safe location. Water used for firefighting need not be taken into consideration when determining the capacity of the primary spill containment or drainage system required by Sentence 4.1.6.1.(1).

Once a fire is associated with a spill, water from hose streams, suppression systems, etc. used for firefighting becomes a concern. The quantity of water involved is highly variable as it will depend on the fire conditions and the duration of the fire. As a result, the fire safety plan must address spill management associated with the application of water during firefighting operations.

Estimating credible spill capacity

The capacity of a credible spill must be based on the maximum quantity that can be released from containers located in the storage area.

- Where the storage – inside and/or outside – is in drums or small containers (not large vessels, Intermediate Bulk Containers (IBC), tote bins or tanks), the capacity of a credible spill should be at least 1 000 L. This will accommodate a spill in the event that lift truck forks spear a single pallet load containing four drums or drop the load. Where drums are not handled on pallets and hand trucks or clamp-type lift trucks are used, the capacity of credible spill may be reduced, but not to less than the capacity of the largest container used.
- For storage in IBC, tote bins or other bulk containers inside or outside buildings, and in tanks inside buildings, the credible spill capacity must be at least equal to the capacity of the largest container in the storage area.
- Outside storage tanks must comply with the provisions of Subsection 4.3.7.

Consideration for the fire safety plan

The fire safety plan must ensure that all critical areas, such as buildings, means of egress, fire department access, control valves, fire alarm panels, etc., in the path of a potential overflow remain accessible during the fire emergency and that the flow of liquid is directed away from such areas. The plan must allow for reliable and immediate notification of an emergency, such as by providing an automatic notification system, which will facilitate early intervention by the fire department. The plan must incorporate measures, including design features, that will minimize the impact of effluent on adjoining property and the environment.

The owner of the building is responsible for developing the fire safety plan. The owner may require assistance from the fire department, which can provide some of the relevant information necessary to develop a workable plan. The owner is also responsible for having the plan approved by the chief fire official and for ensuring the approved plan is implemented. Periodic (e.g. annual) testing of the plan would help identify any limitations of the plan and familiarize staff who have been assigned duties in the plan. The fire safety plan must be modified when original assumptions and conditions change.

Where small quantities are present

- Where only small quantities (up to 5 000 L) of flammable or combustible liquids are present, acceptable measures to control a spill of the liquids and the water used for firefighting include the provision of manhole or catch-basin covers, sorbent materials and portable dikes. Such measures can prevent contaminated effluents from entering sewers or flowing to other areas.
- For additional information on controlling a spill, reference should be made to NFPA 30, NFPA 15, FM Global Data Sheet 7-83, the SFPE, "Handbook of Fire Protection Engineering" and other industry-specific publications on the subject.

Where large quantities are present

- Where a facility stores, handles or processes significant quantities (exceeding 5 000 L) of flammable or combustible liquids, a high level of expertise may be required to develop an appropriate fire safety plan. In such cases, the owner must ensure that professionals who have expertise in this area play a lead role in developing and implementing the fire safety plan.

- Where the application of a fire suppression medium, either manual or automatic, may result in significant adverse impact on the community and/or the environment, a controlled burn is an option to consider. Evaluating this option should involve key stakeholders such as the owner, fire department, provincial and/or federal department responsible for the environment, and insurers.

A-4.1.6.2.(2) Book II (Plumbing Services) of the BCBC defines a trap as a fitting or device that is designed to hold a liquid seal that will prevent the passage of gas but will not materially affect the flow of a liquid.

A-4.1.6.3.(3)(b) Information on the compatibility and reactivity of liquids can be found in the Safety Data Sheets for each liquid.

An absorbent material conforming to ULC/ORD-C410A, "Absorbents for Flammable and Combustible Liquids," is acceptable.

A-4.1.7.1.(1) Article 3.3.1.20. of Division B of the BCBC specifies that ventilation must be provided in conformance with Part 6 of that Code if flammable vapour, gas, or dust could create a fire or explosion hazard. However, Part 6 of Division B of the BCBC does not provide specific information on the design of ventilation systems to prevent an accumulation of dangerous concentrations of flammable vapours. It refers instead to "good engineering practice" and directs the user to a number of NFPA standards for examples of good practice, which varies according to the nature of the vapours or dusts. Subsection 4.1.7. of the BCFC represents a minimum level of good practice for preventing the accumulation of explosive concentrations of vapours from flammable or combustible liquids.

In the phrase "rooms or enclosed spaces," the word "rooms" does not only designate small and confined areas of a building. It includes large open areas of a building as well as smaller rooms.

A-4.1.7.2.(3) Natural ventilation is normally adequate for the storage of flammable liquids and combustible liquids, or the dispensing of Class II and IIIA liquids. Such ventilation should consist of permanent openings at ceiling and floor levels leading to the outside. At least 0.1 m^2 each of free inlet and outlet openings per 50 m^2 of floor area should be provided. A mechanical ventilation rate of at least 18 m^3/h per square metre of floor area, but not less than 250 m^3/h, is normally adequate for rooms with low floor to ceiling height or small enclosed spaces where Class I liquids are dispensed. Ventilation for process areas must be designed to suit the nature of the hazard in accordance with good engineering practice.

A-4.1.8.2.(1)(b) Build-up of static electric charges near the surface of liquids being poured into non-conducting containers can be controlled or eliminated by: limiting the filling rate to velocities less than 1 m/s, using a grounded lance or nozzle extension to the bottom of the container, limiting free fall, or using antistatic additives.

A-4.1.8.2.(3)(b) It is generally considered that liquids with a conductivity greater than 50 pS/m (pico Siemens per metre) will dissipate static charges so that they will not accumulate to a hazardous potential. Experience indicates that most water-miscible liquids, crude oils, residual oils and asphalts do not accumulate static charges.

A-4.1.8.3.(1) Products tested and listed by recognized agencies are considered to be designed in conformance with good engineering practice. Underwriters Laboratories Inc., ULC and FM Global are currently listing these products.

A-4.2.2.3.(2) Flammable and combustible liquids are classified as Class 3 flammable liquids in TC SOR/2008-34, "Transportation of Dangerous Goods Regulations (TDGR)." Class 3 flammable liquids include liquids with flash points up to 60°C using the closed-cup test method or 65.6°C using the open-cup test method. This means that Class IIIA liquids with a flash point above 60°C are not usually treated as dangerous goods.

Flammable and combustible liquids are classified as flammable liquids belonging to Categories 1 to 4 of HC SOR/2015-17, "Hazardous Products Regulations." A Category 1 flammable liquid is any liquid with a flash point less than 23°C and an initial boiling point less than or equal to 35°C; a Category 2 flammable liquid is any liquid with a flash point less than 23°C and an initial boiling point greater than 35°C; a Category 3 flammable liquid is any liquid with a flash point greater than or equal to 23°C and less than or equal to 60°C; a Category 4 flammable liquid is any liquid with a flash point greater than 60°C and less than or equal to 93°C when tested in accordance with the applicable method specified in Part 7 of HC SOR/2015-17.

For the purpose of Article 4.2.2.3., Class IIIA and B3 liquids are treated as dangerous goods classified as flammable liquids.

A-4.2.5.4.(1) Article 4.2.5.4. addresses the potential hazard where flammable vapours are released during transfer operations in an improperly ventilated area, and where sources of ignition may not be adequately controlled.

A-4.2.7.5.(2) Sentence 4.2.7.5.(2) sets no limit to the total quantity of flammable and combustible liquids in a separate or detached storage building. Although total quantity limits of Tables 4.2.7.5.-A and 4.2.7.5.-B do not apply, the quantity and height limitations specified for the individual storage areas must be complied with in order to take advantage of the exemption for total quantity limits. Requirements pertaining to the spatial separation of buildings are found in Subsection 3.2.3. of Division B of the BCBC.
The requirements in this Code for the storage of flammable and combustible liquids must be read in conjunction with applicable provisions in the BCBC that impose restrictions on the design of a storage building. For example, the size and height of a building, type of construction, automatic fire suppression and street access are governed in part by Subsection 3.2.2. of Division B of the BCBC. Environmental protection regulations may contain additional requirements that should be considered in the design of a storage building for flammable and combustible liquids.

A-4.2.7.6.(1) Options for fixed fire suppression systems for protection of flammable or combustible liquid storage areas include: automatic sprinkler, foam sprinkler, water spray, carbon dioxide, dry chemical or halon systems. Examples of good engineering practice for the design of sprinkler or foam water systems for flammable and combustible liquid storage areas can be found in NFPA 30, "Flammable and Combustible Liquids Code."

A-4.2.7.7.(3) Containers of flammable or combustible liquids could be punctured or deformed if pushed up against a protrusion from a wall. The required wall clearance is intended to prevent such damage, and to permit visual inspection of the sides of the individual storage area. The clearance need not be provided for narrow shelves along a wall, where the backs of the shelves can be inspected from the aisle.

A-4.2.8.1.(1) Subsection 4.2.8. applies to those portions of an industrial occupancy where the use, storage and handling of flammable and combustible liquids is only incidental, or secondary to the principal activity. The word "incidental" does not imply "small quantity" or "insignificant amount." Manufacturers of electronic equipment, furniture and reinforced plastic boats, and automobile assembly plants are typical examples of locations where the use of flammable and combustible liquids is secondary to the principal activity of manufacturing consumer products. In storage areas otherwise governed by Part 3 of this Code, Subsection 4.2.8. applies to the "incidental" storage of flammable and combustible liquids that is deemed to be secondary to the principal activity of storing commodities covered in Part 3. This includes the storage of used lubricating oil in the warehouse portion (industrial occupancy) of a retail outlet. Subsection 4.2.8. also applies to the storage of used lubricating oil at motor vehicle repair and service garages because such storage is secondary to the principal activity of repairing and servicing motor vehicles.

A-4.2.8.3.(1) The fire separation required by this Sentence should also prevent the passage of vapours.

A-4.3.1.2.(2)(b) The contents of a tank that is exposed to an external fire can be heated to the point of boiling. Under such circumstances, the normal vent for the tank may not be of sufficient size to release the vapours created by the boiling contents; emergency venting is therefore required to prevent damage to the tank's shell or roof resulting from an explosion within the tank.

Tanks conforming to API 12B, "Bolted Tanks for Storage of Production Liquids," API 12D, "Field Welded Tanks for Storage of Production Liquids," and API 12F, "Shop Welded Tanks for Storage of Production Liquids," are typically used by oil field companies involved in the exploration, production and transmission of natural gas and oil. These API specifications allow tanks that are used in remote locations to be constructed without emergency venting. However, these tanks are also installed in built-up areas to store production liquids, in which case, they must comply with Clause 4.3.1.2.(2)(b).

A-4.3.1.2.(3) Some flammable and combustible liquids are corrosive, which can cause steel tanks to prematurely corrode and leak. Storage tanks should therefore be specifically selected while taking into consideration the potential for aggressive internal corrosion. Storage solutions for corrosive materials include the following:

- a double-walled aboveground tank with an interstitial space that is continuously monitored
- a single-walled aboveground tank that is installed in a secondary containment system in accordance with Subsection 4.3.7. and has a protective coating or lining that is compatible with the liquid being stored

A-4.3.1.8.(1)(b) Examples of devices to prevent overfill include automatic sensing devices for interconnection with shut-off equipment at the supply vehicle, automatic overfill shut-off devices of a float valve or other mechanical type and overfill alarm devices of the audible or visual type.

A-4.3.1.8.(2) A tight-fill operation means that a mechanical, liquid-tight connection is used at the fill point.

A-4.3.1.10.(3) Storage tanks can also be refurbished for underground use in conformance with ULC/ORD-C58.4, "Double Containment Fibre Reinforced Plastic Linings for Flammable and Combustible Liquid Storage Tanks." The process outlined in this document is applicable in a limited number of cases such as when the storage tank is in a location that is hard to reach.

A-4.3.2.1.(4) Boil-over is an event in the burning of certain oils in an open top tank when, after a long period of quiescent burning, there is a sudden increase in fire intensity associated with expulsion of burning oil from the tank. Boil-over occurs when the residues from surface burning become more dense than the unburned oil and sink below the surface to form a hot layer, which progresses downward much faster than the regression of the liquid surface. When this hot layer, called a "heat wave," reaches water or water-in-oil emulsion in the bottom of the tank, the water is first superheated and subsequently boils almost explosively, overflowing the tank. Oils subject to boil-over consist of both light ends and viscous residues. These characteristics are present in most crude oils and can be produced in synthetic mixtures.

Note: A boil-over is an entirely different phenomenon from a slop-over or a froth-over. Slop-over involves a minor frothing that occurs when water is sprayed onto the hot surface of a burning oil. Froth-over is not associated with a fire but results when water is present or enters a tank containing hot viscous oil. Upon mixing, the sudden conversion of water to steam causes a portion of the tank contents to overflow.

A-4.3.2.5. Guidelines for the protection of storage tanks can also be found in standards published by the NFPA and FM Global. Such guidelines are considered as good engineering practice in assessing the protection necessary for tanks.

A-4.3.7.5.(1) When the height of a secondary containment wall exceeds 1.8 m, there is an increased potential for heavier-than-air vapour to accumulate at ground level within the contained area. Depending on the nature of such a vapour accumulation, it may be explosive or sufficiently toxic to seriously endanger personnel. Entry into such a contained area should always be preceded by testing for such a vapour accumulation.

A-4.3.7.5.(2) Vapours from Class I liquids may reach unsafe concentrations when confined in the small space between the tank and the secondary containment wall. Remotely operated valves or elevated walkways eliminate the need for personnel to enter the bottom of the contained area to operate a valve.

A-4.3.8.9.(1) The purpose of anchoring or providing overburden on top of underground storage tanks is to prevent them from lifting out of the ground in the event of a rise in the water table or a flood. Any proposed means of anchorage or overburden must be sufficient to resist the uplift forces on tanks when they are empty and completely submerged.

Means that have been successfully employed to protect tanks against uplift are

(a) anchor straps to concrete supports beneath them,

(b) ground anchors, and

(c) reinforced concrete slabs or planks on top of them.

A-4.3.12.3.(6) A fill pipe (i.e. remote fill piping) is considered offset if it has a non-vertical component.

Special care must be taken during remote fill operations because the fill pipe acts as a pressure line and a build-up of pressure in the fill piping system could result in an unexpected release of liquid if a check valve is provided in the fill piping system.

A-4.3.13.4.(1)(b) Table 4.3.13.4.-B deals with storage tanks that are outside the scope of CSA B139, "Installation Code for Oil-Burning Equipment" (which limits the capacity of individual storage tanks to 2 500 L and their aggregate capacity to 5 000 L) and harmonizes requirements for all occupancies using oil-burning equipment, emergency generators and fire pumps.

A-4.3.13.9.(1)(b) The area that should be considered for ventilation is the space occupied by the tanks and extending to a distance that is classified electrically as Class I, Zone 2, when no ventilation is provided.

A-4.3.13.10.(1) For the design of normal and emergency venting of indoor storage tanks, Sentence 4.3.13.10.(1) refers to Subsection 4.3.4., which in turn refers to API 2000, "Venting Atmospheric and Low-Pressure Storage Tanks." However, API 2000 is intended for outdoor tanks rather than indoor tanks. The venting rate reduction factors for water spray on the tank surface, or drainage rates for spilled liquids, should not be used to calculate the emergency venting rate of a storage tank installed inside a building. The effects of water spray cooling, and room drainage on the calculated emergency venting rate must be worked out according to good engineering practice. Increased emergency venting capacity may be required.

A-4.3.13.11.(2) Good engineering practice for the design of supports for suspended storage tanks should meet the intent of Subsection 4.3.3. as much as possible. Such factors as the provision of adequate fire resistance for supports, the need to prevent over-stressing of the tank shell or its supports, and resistance to earthquake forces in areas subject to such forces, should be taken into consideration.

A-4.3.14.4.(1) Small diameter hose stations are not intended for fighting a flammable or combustible liquid fire. Such fires should be fought using fog nozzles rather than solid water streams, because solid streams may spread the liquid fuel and worsen the situation. The small diameter hoses permitted in lieu of extinguishers are intended to be used for prompt suppression of a small fire in ordinary combustibles, and for prompt wash-down of spilled flammable or combustible liquids, before any fire occurs.

A-4.3.16.1.(1) The following documents are examples of good engineering practice for the activities listed in Sentence 4.3.16.1.(1):

- Annex C of NFPA 30, "Flammable and Combustible Liquids Code"
- API RP 1604, "Closure of Underground Petroleum Storage Tanks"
- CCME PN 1326, "Environmental Code of Practice for Aboveground and Underground Storage tank Systems Containing Petroleum and Allied Petroleum Products"

A-4.4.1.2.(1) In the context of Sentence 4.4.1.2.(1) and Table 4.4.1.2.-E, the annual inspection and testing of sumps involves gaining access to the sumps, inspecting them at regular intervals throughout the year, assessing whether any problems exist, and ensuring any problems are addressed. In general, the annual inspection of sumps should ensure that:

- the lids to the sumps are tight and correctly sealed,
- the walls of the sumps are intact and are not slumping or warping,
- the sumps are free of debris, liquid and ice,
- the sumps are free of cracks and holes,
- the piping, fittings, and connections are not leaking or dripping liquid,
- no new stains have developed since the last inspection,
- the sensors are correctly positioned,
- all penetrations into the sumps are in good condition,
- the test boots (if provided) are in good condition, not cracked or torn, correctly positioned in the sumps, and open so liquid can drain by gravity back into the sump, and
- the piping and other equipment in the sumps are in good condition.

A-4.4.1.2.(7) Owners and operators of systems can use a number of methodologies to meet or exceed the leak detection requirements in Section 4.4. A list of leak detection technologies is available from the National Work Group on Leak Detection Evaluations (NWGLDE). The United States Environmental Protection Agency (EPA) has delegated authority to the NWGLDE to determine which test methodologies meet the testing protocol of the EPA.

A-4.4.2.1.(2) Inventory reconciliation leak detection methods used for a storage tank should follow an established procedure in order to minimize errors and reveal any trend that indicates a loss of product from the tank. Several documents deal with inventory reconciliation such as the booklet entitled EPA 510-B-93-004, "Doing Inventory Control Right for Underground Storage Tanks," which also allows calculations for the inventory reconciliation procedure to be carried out using an electronic methodology referred to as automatic tank gauging.

A-4.4.2.1.(3) Vapour monitors sense and measure product vapour in the soil around the tank and piping to determine the presence of a leak. Groundwater monitoring devices sense the presence of liquid product floating on the groundwater. Both methods require the installation of carefully placed monitoring wells in the ground near the tank and along the piping runs. Examples of good engineering practice for the location and installation of monitoring wells can be found in CCME PN 1326, "Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products." In either case, a professionally conducted site assessment is critical for determining site-specific conditions such as groundwater level and flow direction, background contamination, stored product type, and soil type.

All equipment and devices used for automated or manually operated vapour or groundwater monitoring systems that are tested in conformance with EPA 530/UST-90/008, "Evaluating Leak Detection Methods: Vapor-Phase Out-of-Tank Product Detectors," or EPA 530/UST-90/009, "Evaluating Leak Detection Methods: Liquid-Phase Out-of-Tank Product Detectors," are deemed to meet the intent of Sentence 4.4.2.1.(3).

A-4.4.2.1.(4) The SIR leak detection method uses sophisticated computer software to determine whether a storage tank system is leaking. The software performs a statistical analysis of inventory, delivery, and dispensing data collected over a period of time and provided by the operator to a vendor. SIR can allow the owner or operator to meet leak detection requirements using only the equipment that most facilities have readily at hand (i.e. a tank stick and a tank chart used for inventory control). As an example, the booklet EPA 510-B-95-009, “Introduction to Statistical Inventory Reconciliation For Underground Storage Tanks,” provides basic information to determine if SIR is the appropriate leak detection method to be used for a particular installation.

Additionally, to ensure that the collection of data for SIR purposes meets the intent of the leak detection, the SIR method also needs to be evaluated following a protocol such as the one defined in EPA 530/UST-90/007, “Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods (SIR).”

A-4.4.2.1.(5) Automatic tank gauging systems use monitors that are permanently installed in the tank. These monitors are linked electronically to a nearby control device to provide information on product level and temperature. The gauging system can automatically calculate the changes in product volume, which can indicate a leaking tank. For inventory control, the automatic tank gauging system replaces the use of the gauge stick to measure product level. It records the activities of an in-service tank, including deliveries.

All equipment used for automatic tank gauging systems that meets the requirements of CAN/ULC-S675.1, “Volumetric Leak Detection Devices for Underground and Aboveground Storage Tanks for Flammable and Combustible Liquids,” is deemed to comply with this Sentence.

A-4.4.2.1.(6) A continuous in-tank leak detection system involves a combination of statistical inventory reconciliation (SIR) techniques and good quality liquid level and temperature data, which can be obtained from tank gauging systems or probes. It may involve monitoring only a storage tank, but when the piping system is part of the delivery system, it should include the entire system.

This system provides increased sensitivity and accuracy for the following reasons:

- it incorporates the temperature characteristic and an increased frequency of readings into the data, and
- inventory reconciliation may be conducted after each dispensing operation.

The system is designed to meet the monitoring performance standard of detecting a leak rate of 0.76 L/h with a 95% probability of detection and a maximum false positive of 5%.

A-4.4.2.1.(7) Low-tech secondary containment monitoring involves a visual examination of the containment area, including conventional open dyke areas or a contiguous interstitial space. Some designs may use visual examination of the liquid gauges, sumps and collection pits.

All equipment and devices used in conformance with CAN/ULC-S675.1, “Volumetric Leak Detection Devices for Underground and Aboveground Storage Tanks for Flammable and Combustible Liquids,” and CAN/ULC-S675.2, “Nonvolumetric Precision Leak Detection Devices for Underground and Aboveground Storage Tanks and Piping for Flammable and Combustible Liquids,” are deemed to comply with this Sentence.

A-4.4.2.1.(8)(b)(ii) The presence or location of leaks in aboveground tanks can be determined through various testing methods, including ultrasonic, magnetic particle and video graphic testing. The location of leaks in the bottom of a tank shell can also be determined by vacuum testing. All testing should be conducted by individuals or companies trained in the proper care and use of the testing equipment. The choice of test methodology should be appropriate for the application.

A-4.4.2.1.(10)(a) The performance requirements of CAN/ULC-S675.1, “Volumetric Leak Detection Devices for Underground and Aboveground Storage Tanks for Flammable and Combustible Liquids,” and CAN/ULC-S675.2, “Nonvolumetric Precision Leak Detection Devices for Underground and Aboveground Storage Tanks and Piping for Flammable and Combustible Liquids,” are deemed to meet the intent of Clause 4.4.2.1.(10)(a).

The location of leaks in underground storage tanks can be determined through non-volumetric testing, which includes acoustical, tracer and external product detection methods. The location of leaks in the bottom of a tank shell can also be determined by vacuum testing. All testing should be conducted by individuals or companies trained in the proper care and use of the testing equipment. The choice of test methodology shall be appropriate for the application.

A-4.4.2.1.(12) Locating the single check valve anywhere other than immediately under the pump will require an alternative method of line leak detection for the piping system.

In such cases, when the piping system is not operating, a positive pressure is created by trapping the flammable liquid or combustible liquid in the pipe. The piping system should therefore be considered as a pressure piping system and the applicable provisions of the BCFC should be applied.

A-4.4.4.1. Inventory reconciliation and liquid level measurements can only be conducted on storage tanks that have a metered pump, dispenser or some other type of measuring device that can determine the amount of product withdrawn over a specific period of time. Other leak detection methods must be used for piping systems and storage tanks without meters or measuring devices.

Inventory reconciliation leak detection methods used for a storage tank should follow an established procedure in order to minimize errors and determine any trend that indicates a loss of product from the tank.

The recording of pump meter readings, shipments, internal transfers, product delivery receipts or measurements of the level of contents of a storage tank shall not in and of itself constitute a record as required by Article 4.4.4.1. In addition, suppliers of flammable and combustible liquids should provide their customers with sufficient data to conduct proper inventory reconciliation. Inventories, which have been adjusted for volume through temperature compensation, must also be available to operators by volume according to meter measurements.

Inventory reconciliation is not to be confused with statistical inventory reconciliation (SIR), which is a third-party computerized analysis of tank operator inventory data.

Indications of a potential leak from inventory reconciliation practice include:

(a) any unexplained loss or gain of 0.5 percent or more of the throughput from an underground storage tank or a loss of 1.0 percent or more of the throughput from an aboveground storage tank noted for each stored product in a calendar month, as indicated by the recording and reconciliation of inventory records,

(b) inventory reconciliations showing five consecutive days of unexplained product losses,

(c) inventory reconciliations showing 18 days of unexplained losses in one calendar month, or

(d) the level of water at the bottom of an underground storage tank exceeding 50 mm.

A-4.5.5.6. Mechanical connections include flanged, bolted and threaded piping connections and compression fittings, but not welded, glued and fused connections.

A-4.5.5.7.(1) All penetrations into sumps, including those for electrical cables, should be minimized and, where possible, should be brought into the sump from the top.

A-4.5.6.12.(1) It is good practice to space hangers for pipe having a nominal diameter of 50 mm or less not more than 3.5 m apart.

A-4.5.9.2.(1) Sentence 4.5.9.2.(1) is not intended to apply to small-capacity pumps that operate at low pressures, such as those normally associated with waste oil tanks. Safety measures should nevertheless be taken to protect the pump from mechanical and collision damage, and to control any spillage of liquid resulting from pump damage or failure.

A-4.5.10.7.(6) The following documents contain examples of good engineering practice as regards the maintenance of pressurized piping systems:

- API 1104, "Welding of Pipelines and Related Facilities,"
- API RP 2200, "Repairing Crude Oil, Liquefied Petroleum Gas, and Product Pipelines," and
- API RP 2201, "Safe Hot Tapping Practices in the Petroleum and Petrochemical Industries."

A-4.6.1.1. Section 4.6. applies only to the portion of a property where fuel-dispensing operations are conducted. When a facility combines fuel-dispensing operations with other types of business (motor vehicle repair garage, convenience store, restaurant, etc.), Section 4.6. is intended to apply only to the fuel-dispensing operations and the adjacent business shall conform to other Sections of this Code based on its occupancy classification (assembly occupancy for a restaurant, mercantile occupancy for a convenience store, industrial occupancy for a repair garage, etc.).

A-4.6.8.4.(1) The authorized holder of a card or key, having received adequate training in the safe and responsible operation of the equipment, is not considered a member of the "general public." Such is not the case for coin-operated or preset dispensers, which can be operated by anyone.

A-4.6.8.6.(2) When gasoline vapour is allowed to enter into a diesel-fuelled engine through the air intake, there is a potential for the diesel engine to run away. In a runaway condition, a diesel engine would accelerate in an uncontrolled manner even if the ignition were switched off, resulting in damage to the engine and potentially causing a fire.

A-4.6.8.8.(2) Examples of signs to indicate that smoking is not permitted and that the engine ignition must be turned off while the vehicle is being refuelled:

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Figure A-4.6.8.8.(2)
Fuel-dispensing station signs

A-4.7.4. When used in this Subsection, the terms “loading” and “unloading” shall mean the loading and unloading of tank vehicles or tank cars.

A-4.7.4.4.(2) Loading racks using bottom loading often load at high flow rates. The thermal expansion capacity at the top of the compartment is often insufficient to prevent an overfill if the requested volume does not fit the compartment (operator error or retain in the compartment). Overfill sensors must be designed to allow adequate time for the control valves to close before the compartment overfills. Retain sensors and/or a well-established operator training program could achieve the same result.

A-4.7.4.5. API RP 2003, “Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents,” is an example of good engineering practice for the activities described in Article 4.7.4.5.

A-4.8.8.1.(1)(a) TC SOR/2012-69, “Vessel Pollution and Dangerous Chemicals Regulations,” may apply to flexible cargo hoses described in this Code. The following documents are considered good engineering practice for this application:

- OCIMF 2009, “Guide to Manufacturing and Purchasing Hoses for Offshore Moorings,” and
- ARPM IP-2, “Hose Handbook.”

A-4.9.3.4.(1) Examples of such equipment are dispensing stations, open centrifuges, plate and frame filters, open vacuum filters and surfaces of open equipment.

A-4.10.1.1.(1) Beer, wine, and spirits that contain less than 20% by volume alcohol are not considered to be flammable liquids and are not regulated by this Section. Section 4.10. does not apply to wineries where distilled beverage alcohol is used to fortify wine.

A-4.10.3.2. Exposed steel supports do not have a 2 h fire-resistance rating, and need protection as much as timber supports for tanks. Due to the water miscibility of beverage alcohols, automatic sprinklers provide an effective means of achieving the necessary protection, provided there is sufficient space under the tank to permit their installation.

A-4.10.3.3.(1) The use of “good engineering practice” in the design of normal and emergency venting is intended to prevent an accumulation of flammable vapours inside the building that may present an explosion hazard. For new tank installations, this can be achieved by directing breather vents and emergency vents, equipped with flame arrestors or pressure/vacuum valves, to the outside of the building. However, on existing tank installations, installation of such vents may be impractical. Venting into the interior space may not constitute an undue hazard where certain measures are taken to ensure an adequate degree of fire safety. Such measures include, but are not limited to:

- the installation of automatic sprinklers throughout the tank room and under any raised tanks greater than 1.2 m in diameter;
- the classification of electrical equipment and wiring according to the zone classifications of CSA C22.1, “Canadian Electrical Code, Part I”;
- the provision of adequate natural or mechanical ventilation meeting the objectives of Article 4.10.6.1.; and
- the training of personnel in safe operating procedures.

A-4.10.5.1.(1) Piping and pumping systems should be designed to recognized engineering standards and accepted industry practice.