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2010 NATIONAL MODEL CONSTRUCTION CODES

Dangerous Goods/Flammable and Combustible Liquids/ Hazardous Activities

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This presentation will focus on changes introduced into Parts 3, 4 and 5 of the National Fire Code.

Introduction

- Presentation is part of a series on the 2010 National Model Construction Codes
- Model codes developed by Canadian Commission on Building and Fire Codes
- These codes must be adopted by provincial/territorial authorities to become law

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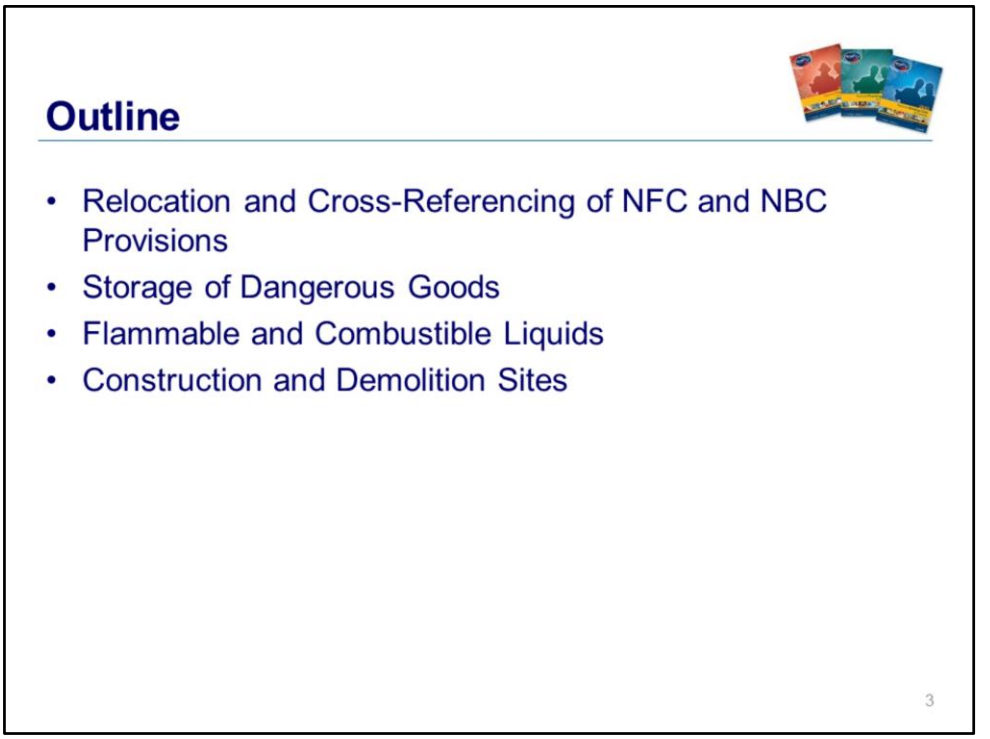
This presentation is part of a series of 13 on the 2010 National Model Construction Codes.

It is important to note that the Model Codes must be adopted by provincial/territorial authorities to become law.

This may mean that code requirements enacted by legislation within your province or territory might differ from what is presented here.

Please check with your local authority.



In this presentation, I will talk about the following specific changes to the fire code:

- Relocation and Cross-Referencing of fire code provisions into the National Building Code
  - Mainly moving building design requirements from the fire code into the building code
- Storage of dangerous goods inside buildings
- Storage and dispensing of flammable and combustible liquids, and more specifically about:
  - New underground storage tank and piping system construction requirements
  - New sump requirements: when, where and how
  - New aboveground storage tank requirements inside building for all occupancies
  - Revised leak detection and monitoring requirements for storage tanks and piping systems
  - Increased capacity of aboveground storage tank at fuel-dispensing stations
- Fire safety at construction and demolition sites
  - Clarification of requirements to provide safer protective measures to mitigate the hazards associated with this type of work in new and existing buildings

Outline

- Relocation and Cross-Referencing of NFC and NBC Provisions
- Storage of Dangerous Goods
- Flammable and Combustible Liquids
- Construction and Demolition Sites

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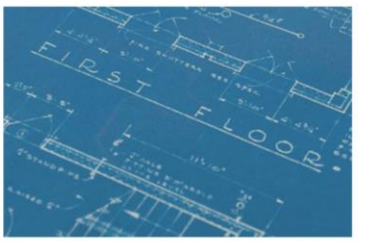
First, let's talk about relocation and cross-referencing of provisions from the fire code into the building code.

Relocation and Cross-Referencing of NFC and NBC Provisions

- All design and construction provisions in NFC
  - Relocated into NBC
  - Provided with cross-references



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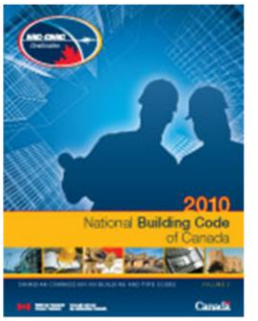
This exercice was completed based on the following principles:

- Relocation of all “building design” requirements currently located in the fire code into the building code, except spill control measures
- Introduction of cross-references in the fire code to the building code to maintain the application of “building design” requirements to existing buildings

Relocation and Cross-Referencing of NFC and NBC Provisions

- New subsection in Part 3 of the NBC (Design of Hazardous Areas)
- New definitions introduced into NBC
- No technical changes



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Provisions relocated into the building code dealt with storage, handling, use and processing of dangerous goods in quantities in excess of those identified in the fire code. They were mostly grouped in a new building code Subsection in Part 3 of Division B of the building code.

Relocating fire code provisions into the building code also required the addition of new defined terms associated with the fire code.

Fire code provisions that were deemed in conflict with current building code requirements and/or that required technical changes were kept in the fire code. They will be reviewed during this code cycle.

Outline

- Relocation and Cross-Referencing of NFC and NBC Provisions
- Storage of Dangerous Goods
- Flammable and Combustible Liquids
- Construction and Demolition Sites

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Changes to indoor and outdoor storage of dangerous goods, Part 3 of fire code, mainly come from the relocation and cross-referencing of fire code provisions into the building code.

Other minor technical changes include:

- Design clarification for automatic sprinkler system protecting loose combustible fibres storage in room
- New requirement for fire safety plan to include the maximum quantity of dangerous goods being stored inside buildings, when these products include:
  - Group A plastics
  - Rubber products
  - Level 2 or 3 aerosols

Outline

- Relocation and Cross-Referencing of NFC and NBC Provisions
- Storage of Dangerous Goods
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- Construction and Demolition Sites

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Now, let's talk about the main chunk of changes incorporated into the new edition of the fire code addressing flammable and combustible liquid hazards.

Flammable and Combustible Liquids

- Minor editorial changes
  - Clarification of intent (e.g. intermodal bulk containers replaced with intermediate bulk containers)
- Minor technical changes
  - Harmonization of requirements with recognized standards and/or common practice (e.g. ≤ 30 L of liquids can now be stored in each dwelling unit, up from 15 L)

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First, many changes include minor editorial changes clarifying the intent of the current code provisions such as:

- ❖ Clarification of intent with the addition of new or more commonly used terms
- ❖ Harmonization of requirements with recognized applicable standards

Outline

- Relocation and Cross-Referencing of NFC and NBC Provisions
- Storage of Dangerous Goods
- Flammable and Combustible Liquids
  - Tank storage
    - Underground storage tanks
    - Sumps
  - Tank storage inside building
  - Leak detection and monitoring
  - Piping and transfer systems
  - Fuel-dispensing stations
- Construction and Demolition Sites

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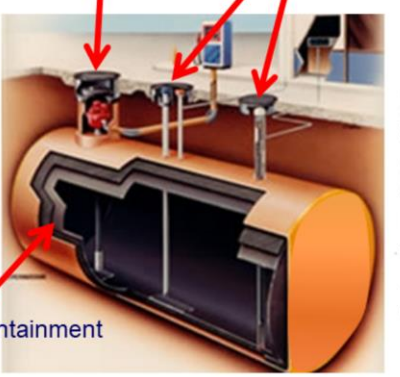
Important technical changes dealt with:

- ❖ Underground application for storage and dispensing of flammable and combustible liquids
- ❖ Inside storage of combustible liquids in buildings
- ❖ Leak detection monitoring and testing
- ❖ Aboveground application at fuel-dispensing stations

Flammable and Combustible Liquids

- Construction requirement for underground storage tanks and piping systems
- Spill containment measures for underground storage tanks and piping systems
- In line with environmental trends and applicable standards



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First, let's have an overview of the nature of the changes. Considerable efforts were made to update the 1995 edition of the fire code requirements for leak detection and monitoring of storage tanks and piping systems.

This led to the creation of a new Section in the 2005 edition of the fire code. Following that exercise, several areas were identified requiring further work.

While looking more specifically at leakage sources for both underground and aboveground storage tanks and piping systems, it was obvious that construction requirement of each component needed to be analyzed.

Changes were also provided to improve the likelihood of early detection of accidental leakage as well as to reduce the potential of accidental spill during filling operations.

Flammable and Combustible Liquids

- Size of aboveground storage tanks at fuel-dispensing stations
  - Capacity of single, aggregate and multi-compartment tanks

- Requirements for storage tanks inside building for all occupancies

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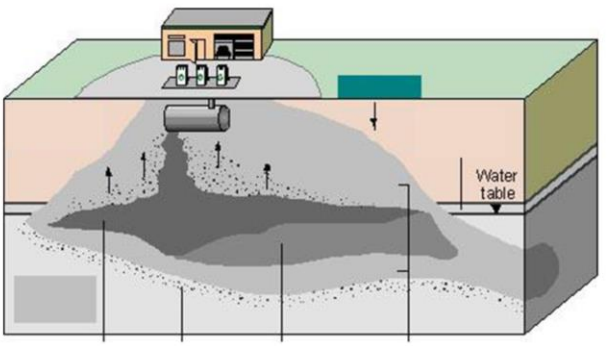
In order to reduce the incidence of accidental spills at fuel-dispensing stations, the capacity of aboveground storage tanks was revised based on current practices throughout Canada.

And finally, discrepancies created with the revision of the scope of the 2004 edition of the CSA-B139 standard were addressed.

Tank Storage

- Typical single-wall installation of underground storage tanks of flammable or combustible liquids



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So, let's dig in into those changes.

- First, underground application for storage and dispensing of flammable and combustible liquids

Historically, single-walled construction storage tanks were used to store flammable and combustible liquids underground. This led to tank leakage resulting in soil contamination.

In some cases, the water table got contaminated as well with the potential to impact people's health leaving nearby in urban and rural areas.

Many jurisdictions already restrict the installation of single-walled tanks and the petroleum industry mostly installs double-walled tanks as a means of limiting the risk of leakage.

Tank Storage

- Underground storage tanks now required to be double-walled construction

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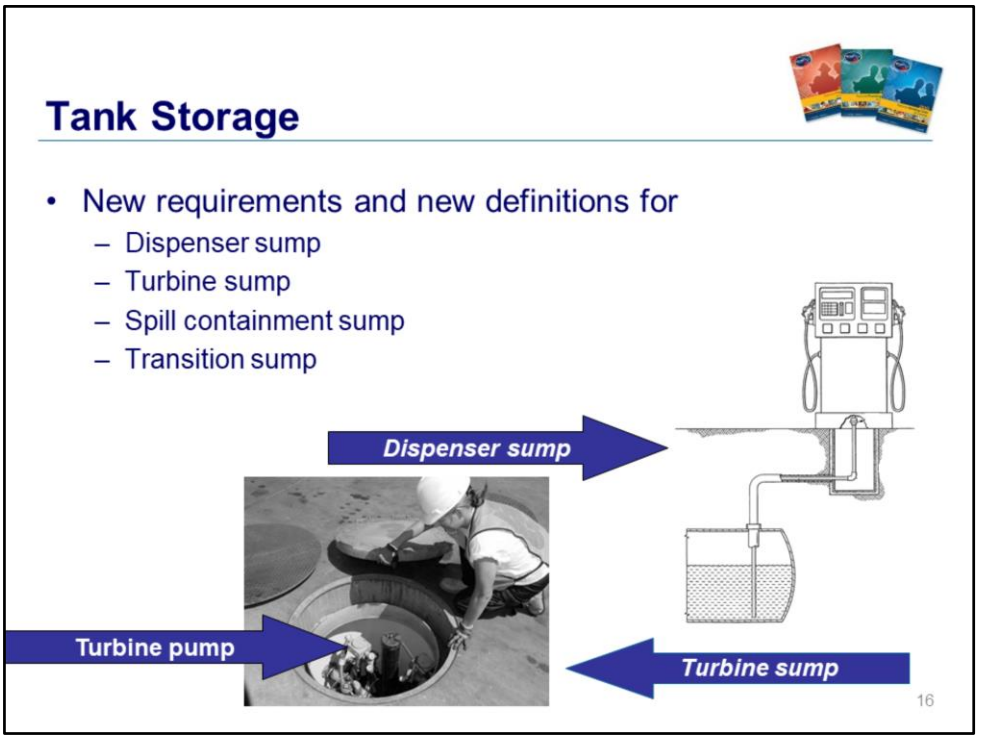
Therefore, all underground storage tanks of flammable and combustible liquids will need to be of double-walled construction.

This should significantly reduce incidents of tank leakage and potential impact to soil contamination and health hazard to people.

The new requirement should also reduce costs for leak detection monitoring required for single-walled versus double-walled tanks.

The 2005 edition of the fire code recognizes that it could be nearly impossible to replace single-walled underground storage tanks in remote areas.

As such, another option is provided to refurbish these tanks using double containment fibre reinforced plastic linings process in conformance with ULC/ORD-C58.4 document.

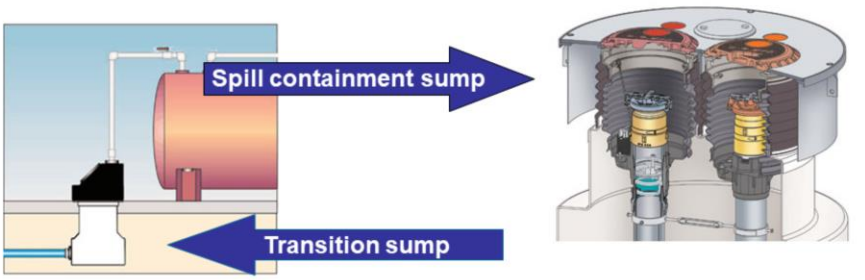


The fire code did not have requirements to indicate when and where sumps were required. In order to do so, the fire code needed to introduce four new definitions:

- Dispenser sump is required to collect incidental leaks from the fuel dispenser and any maintenance work as part of maintaining the dispensing equipment.
- Turbine sump is required to collect incidental leaks from the turbine pump and any maintenance work as part of maintaining the system.

Tank Storage

- Transition sump needs to be provided for all mechanical pipe connections located below grade
- Spill containment sump needs to be provided at every fill point



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❖ Transition sump collects incidental leakage where mechanical connection or transition occurs for the underground piping system involving any mechanical pipe connections.

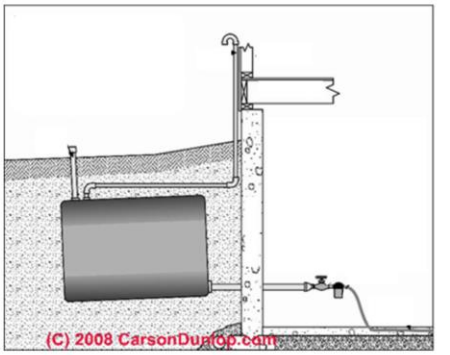
And finally,

❖ Spill containment sump collects incidental leakage during filling and other operation.

Each of these sumps are also part of the secondary containment for the underground piping system and allows access for maintenance, inspection and testing.

Tank Storage

- Specific application for underground *storage tank*
  - Vent piping to be tested for leaks at commissioning



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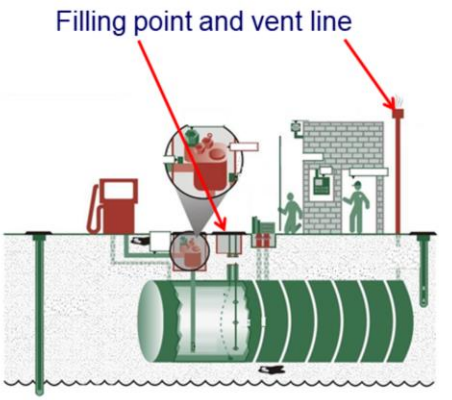
The fire code required clarification for vents and openings other than vents for underground storage tanks.

First, the requirement to test vents was not clearly stated. Risers, connections and vents are also subject to leakage and should be tested.

And since vents are normally open outlets, testing for leaks at commissioning is quite often eluded.

Tank Storage

- Fill piping system
  - Fill point height ≤ tank's vent height
- New provision
  - Where fill point is below normal liquid level in storage tank



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For underground storage tank, the remote fill outlet is often higher than other outlets, in particular at marinas where the tank is located above the water table and the dispenser is at the dock.

The important issue regarding the height of any fill outlets is in relation to the vent. The fill point should never be higher than the discharge point of the vent, which is generally the only open outlet in an underground storage system.

This change addresses the intent of the requirement to limit the probability that liquid will escape through tank openings during filling operations.

In situations where a tank is higher than the filling point (e.g. fuel-dispensing barge), liquid residue in the filling line could lead to spillage upon disconnection. Where the storage tank system is not equipped to pump the fill line dry, there will be liquid residue in the line.

The fire code now requires a device to prevent spillage at time of disconnect or the opening of the fill line and in the case where a leak occurs in the fill line, preventing siphoning of the storage tank.

Tank Storage Inside Building

- CSA-B139 standard
  - Storage tank size limited to 2 500 L or 5 000 L aggregate
- Storage tanks inside buildings now permitted in all occupancies where combustible liquids are stored and used as fuel for
  - Oil-burning equipment
  - Emergency generators
  - Fire pumps

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Now, let's talk about tank storage of flammable and combustible liquids inside buildings. But first, here is some background information.

The 2005 edition of the fire code does not apply to appliances and their equipment listed within the scope of the CSA-B139 standard (i.e. forced-air furnaces, boilers, domestic water heaters, vehicle heaters and emergency power supplies for buildings).

Previous editions of the standard provided minimum requirements for the installation of oil-burning equipment, including supply tanks for all occupancies. There was no limit in tank size.

The current edition of the standard limits the installation of storage tanks inside buildings to a maximum individual capacity of 2 500 L and a maximum aggregate capacity of 5 000 L and refers to the fire code for larger storage tanks.

Well, the 2005 fire code provisions addressed the installation of storage tanks of flammable and combustible liquids inside buildings for industrial occupancy only.

Since the fire code also applies to existing buildings (of all occupancies), current installation of storage tanks for oil-burning equipment inside buildings completed under the previous editions of the standard would no longer comply with the fire code.

Similarly, new building construction would require storage tanks to be located outside the building when such tanks are larger than 2 500 L in individual capacity.

Tank Storage Inside Building

- New Table 4.3.13.4.B. applicable to
  - All occupancies, including industrial occupancies
  - Combustible liquids (Class II and IIIA) only
  - Storage tank supplying
    - Oil-burning equipment
    - Emergency generators
    - Fire pumps

Table 4.3.13.4.B.
Indoor Tank Storage in Occupancies Using Oil-Burning Equipment, Emergency Generators and Fire Pumps

Class of Liquid	Storage Level	Quantity per Protected Storage Room, L	
		Individual Tank	Aggregate
Classes II and IIIA	*First storey*	> 2 500	200 000
		> 20 000	
	Basement and *storeys* above the *first storey*	> 2 500	20 000
		> 20 000	45 000

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To address this issue, the changes in the fire code introduce a new Table dealing with the storage tank of fuel for oil-burning equipment, emergency generators and fire pumps inside buildings for all occupancies. These new requirements include:

- Restrictions for the location of the storage tanks in the building (i.e. basement, first storey and storeys above)
- Storage tanks need to be in a storage room provided with a fire suppression system
- Volume limitation of combustible liquids for all occupancies

Tank Storage Inside Building

- Storage tank construction varies based on capacity
  - Double-walled construction (> 2 500 L and ≤ 20 000 L) or minimum 300° secondarily contained construction, or
  - Protected tank assembly in conformance with ULC-S655 standard (> 20 000 L)

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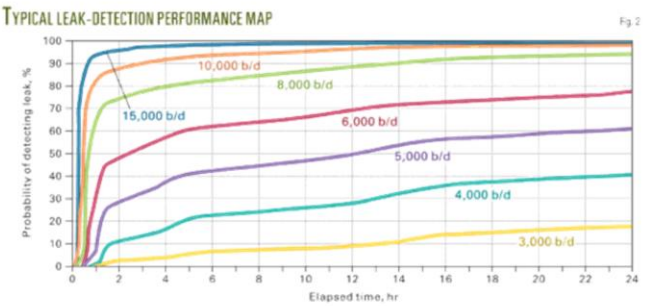
Additionally, storage tanks will now require to be provided with secondarily containment.

Stricter tank construction requirements are expected to reduce the hazard to occupants and building in the event of a fire involving leaking combustible liquids and/or a storage tank being exposed to a fire.

Tank Storage Inside Building

- In all cases, monitoring of secondary containment for leakage is required



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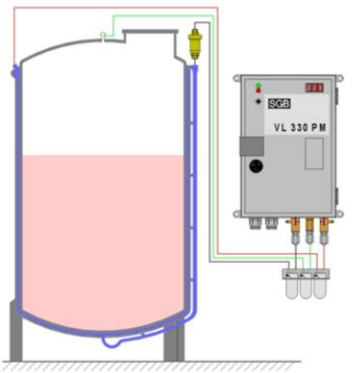
And finally, to ensure early detection and prompt corrective actions in the event of a leakage, those storage tanks will require monitoring of their secondary containment.

Leak Detection and Monitoring

- Interlock dispenser or pump to shut down upon detection of either product or high liquid level
- Pipe leak detection test results must qualify to a minimum value with probability of detection of 95% or greater and probability of false alarm of 5% or less



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The provisions for leak detection testing and monitoring for underground and aboveground storage tanks, piping systems and sumps were revised establishing the minimum requirements regarding the frequency and methods used for commissioning testing, in-service monitoring and testing when a leak is suspected.

Common industry practices and available technologies were also considered to reflect the changes for the new construction requirement outlined into the 2010 edition of the fire code.

- E.g. Since electronic monitoring was introduced for sumps, it was logical to shut off all flow in underground piping system to minimize any potential hazard due to spillage or overflow when monitoring device detects a leak in a sump.

Leak Detection and Monitoring

- New provisions for leak detection testing and monitoring need to be applied on forward basis

- Upon detection of leak for single-walled construction underground *storage tank* or piping system, leaking component should be replaced (double-walled construction) or taken out of service

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Since new installation of underground storage tanks and piping systems is now required to be of double-walled construction, I'll touch base later about underground piping system construction, it is important to note that commissioning testing for single-walled construction of such equipment is no longer required. However, for existing underground single-walled systems, in-service monitoring is still required.

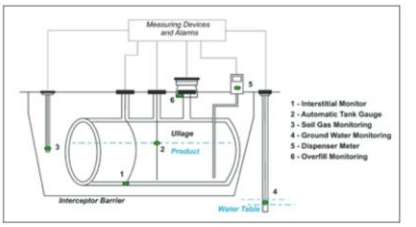
Some fire code requirements are most readily applied to new installations and their retroactive application to existing situations as prescribed by the new edition of this Code could result in some difficulty in achieving compliance.

It is the intent of the fire code that an equivalent level of safety be achieved rather than necessarily achieving strict conformance with the new provisions.

In all cases, the application of this Code to the upgrading of existing facilities is based on the judgment of the enforcement authority, who must deal with each case on its own merits.

Leak Detection and Monitoring

- Monitoring:
  - Inventory reconciliation
    - Mathematical reconciliation
    - Automatic tank gauging (electronic methodology)
  - Vapour or groundwater monitoring system
  - Statistical inventory reconciliation methodology
  - Continuous in-tank leak detection system
  - High-tech secondary containment monitoring
  - Visual inspection
  - Single vertical check valve
- Testing:
  - Static liquid media leak detection test
  - Pneumatic leak detection test
  - Precision leak detection test
    - Secondary containment test



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Several changes were provided in the Section dealing with leak detection of storage tanks and piping systems.

Performance criteria are now outlined into the body of the Code, when and where applicable, and clarification of methods to be used are provided to achieve better leak detection monitoring and testing for tank storage and piping system of flammable and combustible liquids.

Piping and Transfer Systems

- Underground piping system now required to be double-walled construction

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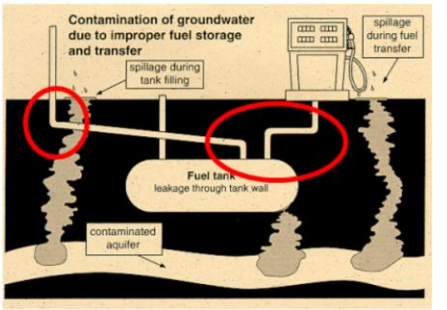
Piping and transfer systems are a well known major leak source, which could contaminate the soil and potentially reach the underground water source with impact on people's health.

Except for vents, risers and vertical fill piping systems, underground piping systems are now required to be of double-walled construction.

Double-walled construction of underground piping system will result in quicker identification of a potential leakage in the primary piping system.

Piping and Transfer Systems

- Fill piping system new provisions
  - When there is an offset component from the fill point
    - Double-walled construction
    - Sloped to the storage tank
    - Electronically monitored for leakage



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Additionally, there was a void in the fire code addressing fill piping systems with remote-fill operations and where portion of the fill pipes are not located directly vertical over the tank.

Both fill piping arrangements have been identified as sources of spillage. Therefore, special care needed to be taken to ensure any leakage is quickly identified and collected in the offset piping system.

A fill pipe is considered offset if it has a non-vertical component.

For fill piping system having offset components from the fill point to the underground storage tank, fill pipes are required to be:

- ❖ Double-walled construction
- ❖ Sloped to the storage tank
- ❖ Electronically monitored for leakage

Fuel-Dispensing Stations

- Outside aboveground *storage tanks* provided with tight-filled connection now required to be provided with positive shutoff device
  - Tight-filled connection (e.g. formula 1 racing car fuel filling operation)
  - Nozzle-filled connection (e.g. people filling up their car)

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The fire code now recognizes that storage tanks could be either nozzle-filled or tight-filled, each requiring specific overfill protection.

Nozzle-filled storage tanks would require overfill protection already outlined in the Code (i.e. continuous visual supervision of the filling operation or provision of an overfill protection device in conformance with ULC-S661 standard). (E.g. filling your car at a fuel station.)

Tight-fill operation means that a mechanical, liquid-tight connection is used at the fill point. In these cases, a positive shutoff device would be required in conformance with ULC-S661 standard. (E.g. filling gas to a racing car.)

Here, the difference resides in the type of overfill protection provided:

- A positive shutoff device means: *"*condition where at final shutoff, the flow rate shall be no greater than 2% of the maximum rated flow*"* (More stringent measure applicable to tight-fill connection.)
- An overfill protection device means *"*any device or combination of components that will significantly reduce the possibility of overfilling a storage tank*"*

Piping and Transfer Systems

- Mechanical connections would include
  - Flanged, bolted and threaded piping connections and compression fittings

  but exclude
  - Welded, glued and fused connections

Flanged connection

Compression fittings

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Other minor technical changes to piping and transfer systems include clarifications on:

- the characteristics of gaskets in flanged connections
- what is considered a mechanical connection
- where transition sump is required for mechanical connections of underground piping systems so that mechanical connections:
  - Are readily accessible for inspection and maintenance
  - not in direct contact with the soil.

Fuel-Dispensing Stations

- Increased capacity at fuel-dispensing stations for aboveground storage tanks
  - Individual from 50 000 to 80 000 L
  - Aggregate from 150 000 to 200 000 L

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The original aboveground storage tank size limit of 50 000 L at fuel-dispensing stations was introduced into the fire code based on availability of ULC listed tanks and the fuel tanker truck capacity at that time.

Present day demands, whether due to remoteness of area or high consumer demands, dictate a greater capacity at fuel-dispensing stations.

Many jurisdictions have already increased the capacity size limits as well as the aggregate capacity per site for aboveground storage tanks at fuel-dispensing stations.

The increased capacity for individual and aggregate aboveground storage tanks thus reflects the current practice by various jurisdictions.

Fuel-Dispensing Stations

- Compartmentalized storage tanks treated as one tank to evaluate their capacity

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The new requirement for aboveground compartmentalized storage tanks should clarify the confusion over how capacities of these tanks are treated.

Some concluded in the past that the individual capacity figure for this type of storage tank should be applied to each compartment. This could lead to a potential capacity for the compartmentalized storage tank larger than the permitted aggregate capacity for single storage tanks.

Therefore, an aboveground compartmentalized storage tank is considered as a single tank having the aggregate capacity of all its compartments.

Outline

- Relocation and Cross-Referencing of NFC and NBC Provisions
- Storage of Dangerous Goods
- Flammable and Combustible Liquids
- Construction and Demolition Sites

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Now, let's tackle the last section of this presentation.

Although occurrences of fires on construction sites are infrequent, fire losses resulting from such fire are up to six times greater than the average fire loss in buildings.

Because the nature of buildings undergoing construction, alteration and/or demolition operations exposes unprotected construction assembly for a period of time, a fire event involving these unprotected construction assemblies could rapidly spread the fire to adjacent suites, buildings and/or properties.

Several changes have been introduced to address those concerns.

Construction and Demolition Sites

- Expand scope of NFC to require protection of adjacent buildings or facilities from construction and demolition sites

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First, fire exposure to adjacent properties was identified as being a major issue on construction site fires.

Outcome of many fires on construction sites could have been different if the risk of an uncontrolled fire spreading to adjacent buildings could have been identified upfront.

As such, the scope of the fire code was expanded to include protection consideration for construction and demolition sites to adjacent buildings and/or properties.

Construction and Demolition Sites

- Active and/or passive fire protection systems required for adjacent buildings and facilities exposed to fire originating from construction and demolition sites
  - e.g. water curtains, gypsum sheathing, temporary fire barrier, fire watch, etc.

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A new requirement dealing with the protection of adjacent buildings or facilities from a fire originating at a construction or demolition site is introduced requesting protective measures to be put in place.

Construction and Demolition Sites

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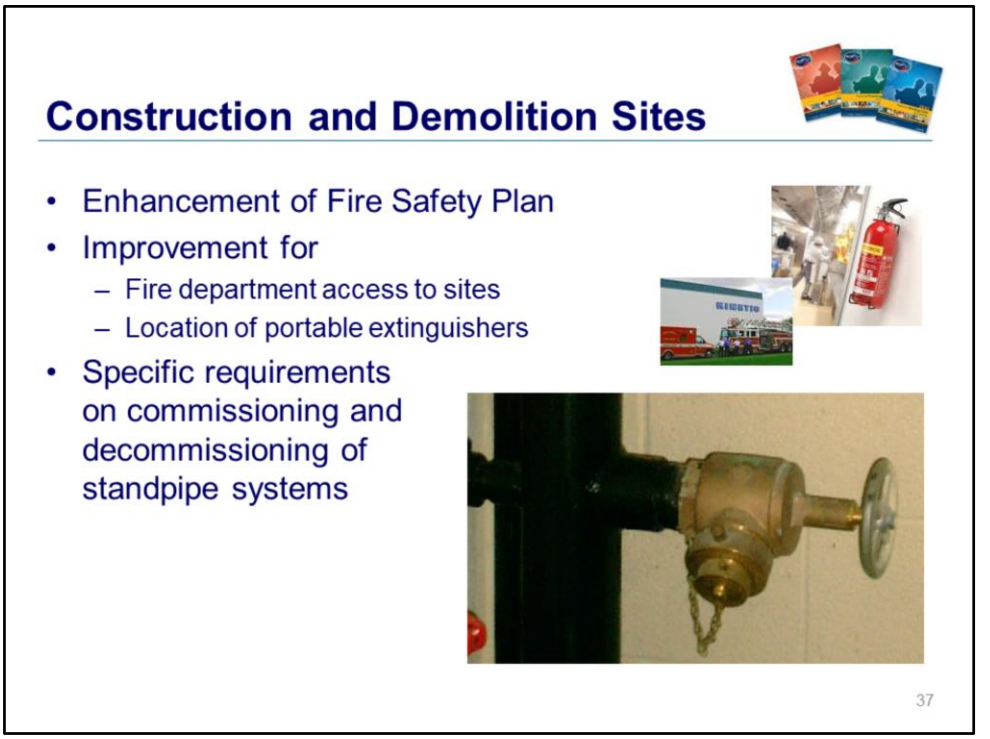
Protective measures could be either active (e.g. sprinkler protection, fire watch, etc.) or passive type (e.g. construction features, fire separation, no combustible storage including vegetation in the area, etc.), or a combination of both and are not restrictive.

This slide show examples where gypsum sheathing is used as a passive protective measure. On the picture to the right, the area around the house is kept cleared of any combustible materials.



Other changes include:

- Enhancement of the requirements related to fire safety plan (i.e. clarification for initiation of a fire warning rather than sounding a fire alarm, which usually is not functional at the time of construction, alteration or demolition operations; it also includes special measures to confine, control and potentially extinguish a fire)
- Maintenance of required access routes for fire department to construction and demolition sites
- Relocation of the Appendix note into the body of the fire code, allowing firefighters access to all levels of a building, including the use of existing elevators, hoists or lifts on site
- Provision of portable extinguishers in specific hazardous areas in unobstructed and easily accessible location
- Specific requirements on commissioning and decommissioning of standpipe systems for unoccupied building or part thereof under construction or alteration

Construction and Demolition Sites

- Roofing operations and other surface applications involving heat sources and hot processes considered to be hot works and need to conform to requirements of Section 5.2. Hot Works

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Roofing operations were given special attention.

Clarification was provided for roofing operations and other surface applications now considered as hot works.

Hot works involves open flames or any work producing heat or sparks, including, without being limited to, cutting, welding, soldering, brazing, grinding, adhesive bonding, thermal spraying and thawing pipes.

Construction and Demolition Sites

- Restrictions on placement of bitumen kettles for roofing applications

- Building services need to be terminated at a point located outside the building or part thereof being demolished

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New requirements for roofing operations also include restrictions on the location of bitumen kettles.

Better understanding of the hazards also led to:

- Clarification for building services shutoff procedures at demolition sites
- New requirements for storage and use of dangerous goods, other than flammable and combustible liquids

This end my presentation.


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Thank you!
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Thank you!