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FIRE PROTECTION STUDY

CANADIAN CENTRE FOR INLAND WATERS
WTC BUILDING
867 LAKESHORE ROAD
BURLINGTON, ONTARIO

Prepared for:

Public Works and Government Services Canada
Professional and Technical Programs
Real Property Branch
4900 Yonge Street
Toronto, Ontario
M2N 6A6

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1.0 EXECUTIVE SUMMARY

This Fire Protection Study summarizes the fire protection and life safety building code requirements of the National Building Code of Canada 2010 (NBC) and the National Fire Code of Canada 2010 (NFC) relative to the overall condition of the existing Water Treatment Centre (WTC) building, which forms part of the Canada Centre for Inland Waters (CCIW) site located at 867 Lakeshore Road in Burlington, Ontario.

This report is based on existing documentation as summarized in Existing Documentation Section 2.4 of the Fire Protection Services — Contractor Statement of Work (SOW) dated October 8, 2014, subsequent space plans provided by Public Works and Government Services Canada (PWGSC), preliminary site reviews conducted by LMDG Building Code Consultants Ltd. (LMDG) in April 2015, and detailed site reviews in July 2015.

This report, prepared for PWGSC, is intended to:

- provide an outline of the condition of the building with respect to the current requirements of the NBC and NFC,
- identify deficiencies,
- recommend prescriptive upgrades and outline potential alternative solutions to address deficiencies where deemed necessary, and
- prioritize upgrades.

This report also includes a preliminary order of magnitude estimate for the recommended upgrades where sufficient information has been made available. Refer to **Appendix A** to this report.

This report summarizes the applicable building code requirements, existing conditions, and upgrading options for the existing non-complying conditions. Further, the priority that is associated with the upgrading of each deficiency is identified as either A, B, or C. These priority categories are subjectively defined, based on the life safety significance and the disparity between the existing condition and the requirements of the NBC and/or NFC.

Priority	Description
Priority A	Deficiencies that pose a significant fire or life safety hazard to the occupants or building and that should be immediately corrected
Priority B	Deficiencies that pose a minor fire or life safety hazard to the occupants or building and should be corrected to further enhance the level of fire protection and life safety of the building

Priority	Description
Priority C	Deficiencies that do not pose a fire or life safety threat and where upgrading should be considered (where practical) for purposes of enhancing property protection or improving convenience to the occupants

The recommendations to achieve a level of fire protection and life safety relative to conformance with the NBC, NFC, and associated standards are as follows.

PRIORITY A		
Section		**Recommendation**
4.1.1	Fire Department Access Route	Sprinkler the building throughout.
4.1.3	Fire Hydrant and Fire Department Connection	Provide additional directional signage and a hard surface to the Fire Department connection. Confirm with the Burlington Fire Department that the current arrangement of Fire Department response to the WTC is acceptable.
4.2.1	Proximity to Adjacent Buildings	Sprinkler the building throughout.
4.2.3	Underground Walkway	Restrict the walkway to service access only, unless major improvements can be made to the fire separation of the pedestrian portion of the walkway from the service portion of the walkway and provide an additional conforming exit where the exiting egress ladder is provided. Replace the doors at both ends of the walkway with conforming doors.
4.3.1	Floor and Roof Assemblies	Sprinkler the building throughout.
4.3.4	Building Service and Elevator Shafts	Perform an audit of the ventilation systems and how they pass through the floor fire separations. Provide any location where ducts pass though fire separations with fire dampers.
4.3.12	Rooms Containing Hazardous Processes and Operations	Provide a 1-hour fire separation between the group of laboratory rooms.
4.4.1	Closures — Fire Doors/Shutters	Replace any doors that do not have tags and are clearly unrated (wooden doors or old-style metal doors) with new doors with the required fire-protection rating.
4.4.2	Closure — Fire Dampers	Provide all supply and return air ducts that pass from the vertical shafts to floor areas should with fire dampers at the fire separation of the vertical shaft.
4.4.4	Firestopping	Retain a contractor to perform a thorough review of all service penetrations.
4.6.4	Egress Rooms from Rooms/Suites	Sprinkler the building throughout.

PRIORITY A		
Section		**Recommendation**
4.6.6	Separation of Corridors and Travel Distance to Exits	The recommendation to sprinkler the building throughout will address any non-conforming travel distances to the exits.
4.6.7	Travel Distance within Open Floor Areas	Although not required by the NBC, providing painted egress aisles will ensure that storage within open floor areas will not create a non-conforming condition with regard to egress aisle lengths and widths. Paint aisles used for egress that meet the requirements of the NFC within open floor areas.
4.6.10	Obstruction in a Means of Egress	Any obstruction that reduces the width of a means of egress to less than the required width should be moved.
4.6.15	Handrails and Guards	Modify any guard less than 1070 mm or any handrail less than 920 mm so that the top member is not less than this minimum height. Provide conforming handrails for all stairs.
4.6.16	Stair Treads and Risers	Provide contrasting nosings for all stairs.
4.6.21	Floor Numbering	Provide a consistent set of signs indicating floor numbers and exit stair designations for all exits within the building.
4.7.1	Automatic Sprinkler Protection	Sprinkler the building throughout.
4.8.1	Type and Continuity of Fire Alarm System	Retain the existing system and test and maintain it on an ongoing basis, as required by CAN/ULC-S537-02.
4.8.2	Electrical Supervision and Signals to Fire Department	Provide any new devices added to the sprinkler or standpipe systems with supervision, as required by the NBC.
4.8.3	Annunciator and Zone Indication	Maintain the zoning as provided. If a sprinkler system is provided for the building, add new zones as required.
4.8.4	Fire Detectors	The provision of a sprinkler system throughout the building will remove the requirement for the majority of detectors. Retain an electrical contractor to provide an audit of the fire alarm initiating devices within the building to determine if devices have been provided at all locations as required by the NBC.
4.8.5	Manual Stations	Retain an electrical contractor to provide an audit of the fire alarm initiating devices within the building to determine if devices have been provided at all locations as required by the NBC.
4.8.6	Audibility of Alert and Alarm Signals	Retain an electrical contractor to provide an audit of the fire alarm sounding devices within the building to determine if devices have been provided at all locations and levels as required by the NBC.
4.8.7	Visual Signals	Prepare a list of locations where the known or expected ambient sound level is above 87 dBA. Add visual signal devices in these areas.
4.8.8	Voice Communication	Retain the voice communication system and test it as required by the NFC.

PRIORITY A	
Section	**Recommendation**
4.9.1 Emergency Power	Retain an electrical contractor to verify that the fire pump has been connected to the emergency generator circuit. The electrical contractor should also confirm that any self-powered emergency lights provide the minimum 30-minute duration.
4.9.2 Emergency Lighting	Since testing of the emergency lighting systems would require a shutdown of the normal power systems, retain a contractor to perform testing that is coordinated with the tenants, so that power is not interrupted for other power sensitive operations within the building. The contractor should confirm that emergency lighting levels are as required by the NBC.
4.10 Elevators	Retain an elevator contractor to confirm that all elevators conform to CSA-B44-2007 and provide upgrades to the elevator systems if necessary.
4.11.1 Compressed Gases	Prepare and maintain a list of flammable and toxic gases stored throughout the building. Cross-reference this list to determine if the current volumes of gases meets the exemption requirements of Sentence 3.2.8.2.(2).
4.11.2 Rack Storage	Prepare and maintain a list of materials stored on the racks in the warehouse portion of the building that can be used to confirm that storage is in compliance with the NFC. Forward this list to a qualified sprinkler designer/inspector to confirm that the level of sprinkler protection meets the requirements of NFPA 13-2007.
4.11.3 Dangerous Goods	Prepare and maintain a list of dangerous goods as defined by Sentence 3.1.2.1.(1). Cross-reference the list against the requirements of Subsection 3.2.7. of the NFC.
4.13.1 Laboratories	Separate laboratories from the remainder of the building by a 1-hour fire separation. Review and incorporate the items noted in Articles 5.5.3.1. to 5.5.3.6. of the into the Fire Safety Plan. Retain a qualified electrical contractor to consult with the operators of each laboratory to identify materials and operations that could create flammable vapours and to confirm or upgrade any electrical equipment within these areas as required by Article 5.5.3.4. and CSA C22.1. Retain a specialty mechanical engineer to review the fume hoods and hood exhaust ducts from the hoods to the service cores throughout the building for their conformance with the NBC and NFC (particularly Subsection 5.4.4. of the NFC and Section 6.2. of the NBC) and to provide recommended upgrades.

PRIORITY A	
Section	**Recommendation**
4.13.1 Laboratories (Cont'd.)	Prepare a framework that permits the staff of each lab to know and comply with the various provisions regarding the storage and use of dangerous goods as described in Subsection 5.5.5. Incorporate this framework into the Fire Safety Plan. Provide this documentation in each laboratory.
4.14.1 Inspection Testing and Maintenance of Fire Protection Equipment	Consolidate all periodic testing requirements into a single document that identifies the applicable systems and required testing criteria. The results of testing should also be consolidated in to a matching filing system that permits convenient checking. The template provided by EC titled "Fire Protection Standards and Log Book" is a very comprehensive document that should be used for this purpose. Provide this logbook with a list of applicable and referenced standards at the start so that as the referenced standards are updated, the relevant portions of the document can also be updated.
4.15 Emergency Planning	Prepare a Fire Safety Plan for the WTC that incorporates the requirements of Subsection 2.8.2. of the NFC. Incorporated it into the Fire Safety Plan for the CCIW site. Replace emergency procedure signage with current and consistent information across the CCIW facility.

PRIORITY B	
Section	**Recommendation**
4.3.10 Garbage/Recycling Rooms	Determine if any rooms are specifically used for storage of combustible recycling or refuse and, if so, provide a 1-hour fire separation around those rooms.
4.3.11 Janitorial Rooms	By providing a sprinkler system throughout the building, the fire-resistance rating requirements for the janitorial rooms can be waived, and such rooms are only required to be provided with a door with self-closing device.
4.3.12 Rooms Containing Hazardous Processes and Operations	Confirm that no portions of the warehouse are being used for long-term storage of vehicles. If portions of the building are being used for this purpose, separate them from the remainder of the building by a fire separation with a fire-resistance rating not less than 1½-hour. If storage is generally transitory and limited to vehicles associated with the storage uses in the warehouse (and not just general vehicle storage), then this requirement may be waived. Separate repair garages from the remainder of the building by fire separations with not less than a 2-hour fire-resistance rating. Perform an audit of compressed gas tanks within the building to confirm that the volume of compressed flammable gases within each fire compartment (each floor area or fire separated compartment within a floor area) is less than the 170 m^3 permitted by the NFC.

PRIORITY B	
Section	**Recommendation**
4.3.12 Rooms Containing Hazardous Processes and Operations (Cont'd.)	Perform an audit of compressed gas tanks stored outside the building to confirm that, as based on the total volume of expanded gases, the storage is located sufficiently far enough away from openings within the building. For both cases noted above, once the maximum number of tanks has been determined for these specific areas, install permanent signage in these locations to permit ongoing verification of compliance with the NFC.
4.4.1 Closures — Fire Doors/Shutters	Upgrade any doors that do not have tags but appear to be modern pressed steel doors that have at least a ¾-hour fire-protection rating with new doors with the required fire-protection rating.
4.6.20 Exit Signs	Replace all exit signs with illuminated signs (with battery backup) complying with the current ISO standard.

PRIORITY C	
Section	**Recommendation**
4.6.21 Floor Numbering	Provide a consistent set of signs indicating floor numbers and exit stair designations for all exits within the building.

2.0 INTRODUCTION

2.1 Objectives

The objectives of this report, consistent with the SOW as prepared by PWGSC are as follows:

- outline the requirements of Division B, Part 3 of the NBC, the NFC, and referenced standards applicable to the existing WTC building;
- identify deficiencies relative to the above-noted documents;
- provide recommendations to address identified deficiencies and outline possible alternative solutions to prescriptive requirements;
- prioritize recommendations; and
- provide a preliminary order of magnitude estimate for the recommendations where sufficient information has been made available.

2.2 Project Description

The Project is a two-storey structure with a partial basement and mechanical penthouse. The building was originally constructed in 1971 and provided with an addition to the east side in 1995. The building has a building area of approximately 2,210 m².

The building primarily contains laboratories and related industrial occupancies used to study waste water treatment. Based on the occupancy classifications of the NBC, the major occupancy within the building is Group F, Division 2 medium hazard industrial. The building also contains subsidiary Group D office occupancies.

The building is not provided with a sprinkler system. However, a standpipe system with hose cabinets within floor areas has been provided. The building is provided with a fire alarm system. Emergency power is provided to the building from a feed from the emergency generator in the NWRI building via a tunnel.

Annotated drawings based on available space plan drawings are included in **Appendix B** to this report. These annotations are not intended to demonstrate requirements for complete code compliance. The dimensions, wall locations, room designations, etc. have not been confirmed by LMDG. These drawings and markups are included to facilitate location references in the report.

2.3 Applicable Building Code

The applicable building code for the WTC is the National Building Code of Canada 2010 (NBC). The NBC sets out the technical provisions for the design

and construction of new buildings and applies to the alteration and change of use of existing buildings.

This report is relative to fire protection. The requirements for fire and structural protection of buildings are established in Part 3 of the NBC. All references in this report refer to Part 3 of Division B of the NBC unless otherwise noted.

2.4 Applicable Fire Code

The applicable fire code for the WTC is the National Fire Code of Canada 2010 (NFC). The NFC establishes requirements for the operation and maintenance of the fire-related features of buildings in use.

The NFC contains provisions regarding fire safety and fire protection features that must be added to existing buildings when certain hazardous activities or processes are introduced in these buildings. Provisions of the NFC are not duplicated entirely within the NBC. For this reason, some NFC provisions will apply to original construction, alterations, or changes in use.

2.5 Treasury Board Fire Protection Standard

The NBC and NFC are the applicable codes as referenced in the Treasury Board of Canada Secretariat's Fire Protection Standard (FPS) effective April 1, 2010 (included as **Appendix C** to this report) for all Government of Canada real property. These codes are also referenced as applicable in Section 2.2.(1) of the Canada Occupational Safety and Health Regulations.

2.6 Additional Referenced Codes and Standards

Though not referenced by the NBC, NFC, or FPS, references have also been made in this report to the following standards and documents:

- NFPA 45-2015, "Standard on Fire Protection for Laboratories Using Chemicals";
- NFPA 75-2013, "Standard for The Fire Protection of Information Storage";
- NFPA 230-2003, "Standard for the Fire Protection of Storage" (since incorporated in to NFPA 1)
- MD15128-2008, "Laboratory Fume Hoods: Guidelines for owners, design professionals and maintenance personnel";
- MD15129, "Guidelines for Perchloric Acid fume hoods and their exhaust systems"; and
- *Standard for Fire Safety Planning and Fire Emergency Organization, Chapter 3-1* (SFSPFEO), of the Treasury Board Policy Suite.

2.7 Approach to Building Code Compliance

As outlined in Appendix Note A-1.1.1.2., "Application to Existing Buildings," it is not intended that the NBC be used to enforce the retrospective application of new requirements to existing buildings. Although the NBC does not give specific guidelines to determine which conditions are required to be upgraded, Appendix Note A-1.1.1.2. implies that the experienced judgment of both the designer and the AHJ should be used to determine if the cost of the upgrading is justified in relation to the improved safety for each respective deficiency. Accordingly, in developing an upgrading program, consideration has to be given to the difficulty of upgrading certain deficiencies due to the existing construction.

2.8 Approach to Fire Code Compliance

The NFC establishes the standard for fire prevention, firefighting, and life safety for buildings in use. It sets the standard of ongoing maintenance for fire detection, alarm, and extinguishing systems.

The existing maintenance standards for this building including the Fire Safety Plan (required to meet the additional provisions of the SFSPFEO) should be reviewed with EC, DFO, and PWGSC to confirm an acceptable level of maintenance is being provided.

The NFC includes provisions for the indoor and outdoor storage and handling, use, and processing of combustible products, dangerous goods, flammable and combustible liquids, hazardous processes and operations in addition to the requirements of the NBC. Several of these aspects, in particular with respect to flammable and combustible liquids, require further information from the above-noted parties before a comprehensive comment can be made.

2.9 Alternative Solutions to Building Code/Fire Code Compliance

The objective-based NBC and NFC are made up of two major divisions: Division A and Division B. Division A presents the objectives that the code addresses and the functional requirements (in qualitative terms) that solutions must satisfy. Division B presents the quantitative performance criteria with which solutions must comply (where these are available) and provides deemed-to-comply solutions drawn from the current version of the building code.

The NBC/NFC explain that compliance can be achieved by

- complying with the applicable acceptable solutions in Division B or
- using alternative solutions that will achieve at least the minimum level of performance required by Division B in the areas defined by the objectives and functional statement attributed to the applicable acceptable solutions.

The NBC/NFC includes an entire list of objective statements, categorized as

- OS — Safety,
- OH — Health,
- OA — Accessibility,
- OP — Fire and Structural Protection of Buildings, and
- the corresponding subobjectives.

The list of functional statements, which are measures such as those described in the acceptable solutions in Division B, are intended to direct the user of the NBC/NFC to the relevant building functions associated with the stated objectives.

The NBC/NFC also includes a list of the attributions to the acceptable solutions where the objective and functional statements attributed to each existing code requirement (from Division B) are listed against the code reference.

Systems involved with an alternative solution that form part of a base building sprinkler and fire alarm systems are subject to the ongoing inspection, testing, maintenance, and operational requirements specified in Part 6 of the NFC.

Where literal compliance with the NBC/NFC is not practical and where such an item is considered to compromise the minimum level of safety intended by the NBC, potential alternative solutions have been outlined in this report for consideration based on good fire protection engineering practice. Should any of these alternative solutions be pursued, a formal documented approach will be required to be developed with reference to the applicable objective and functional statements demonstrating the level of performance described in Appendix Note A-1.2.1.1.(1)(b) has been met or exceeded.

2.10 Authority Having Jurisdiction and the Acceptance of Approaches to Building Code and Fire Code Compliance

Government of Canada real property is self-insured with the Government of Canada acting as its own AHJ. With the closing in 2013 of Fire Protection Services (Office of the Federal Fire Commissioner previously under the Labour Program of HRSDC), which acted as the technical resource to the Government of Canada's self-insured AHJ position, the implementation of the FPS is now overseen by the respective Departmental Fire Protection Coordinator (DFPC).

Accordingly, it is understood that the acceptance of the approaches to building and fire code compliance, including the potential for alternative solutions outlined in this report are subject to acceptance by the DFPC.

2.11 Upgrading Priority System

In order to maximize any future investment in the building, particularly in the fire and life safety performance of the building, aspects of the building that do not conform to the various codes noted above will be assigned an upgrade priority.

These priority categories are subjectively defined, based on the life safety significance and disparity between the existing condition and the requirements of the building code.

Priority	Description
Priority A	Deficiencies that pose a significant fire or life safety hazard to the occupants or building and that should be immediately corrected
Priority B	Deficiencies that pose a minor fire or life safety hazard to the occupants or building and should be corrected to further enhance the level of fire protection and life safety of the building
Priority C	Deficiencies that do not pose a fire or life safety threat and where upgrading should be considered (where practical) for purposes of enhancing property protection or improving convenience to the occupants

2.12 Order of Magnitude Estimate

An order of magnitude estimate, where sufficient information has been provided for the priority-based upgrades, is included in **Appendix A** to this report.

2.13 Reference Materials

This report is based on existing documentation as summarized in the SOW, subsequent space plans provided by PWGSC, and site reviews conducted by LMDG in April and July of 2015.

2.14 Limitation of Liability

This report is prepared by LMDG Building Code Consultants Ltd. (LMDG) for Public Works and Government Services Canada. The material provided in this report is based on LMDG's best judgment in light of the information available to LMDG at the time of preparation. Any use of this report by third parties, or any reliance on or decisions to be made based on it are the responsibility of the third parties. LMDG accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

3.0 PROJECT CHARACTERISTICS

For the purposes of establishing the applicable requirements of the NBC, related requirements of the NFC, and other applicable referenced standards, the basic building code characteristics of the WTC are summarized in the following sections.

3.1 Number of Buildings

The WTC building consists of a single structure. The original structure was constructed in 1971 and added to in 1995. The structure has some attached exterior canopies. For the purposes of the NBC, the structure is considered as one building.

3.2 Building Area

Building area, as defined by the NBC, is "the greatest horizontal area of a building [footprint] above grade within the outside surface of exterior walls or within the outside surface of exterior walls and the centreline of firewalls."

Based on the considerations noted in **Section 3.1** of the report, the WTC building has a building area of approximately 2,210 m².

3.3 Grade

Grade as defined in the NBC and as applied to the determination of building height, means the "lowest of the average levels of finished ground adjoining each exterior wall of a building, except that localized depressions such as for vehicle or pedestrian entrances need not be considered in the determination of average levels of finished ground."

The average ground level around the building is at the same elevation as the 1st floor.

3.4 First Storey and Building Height

First storey, as defined in the NBC, means "the uppermost storey having its floor level not more than 2 m above grade." The 1st floor is considered the first storey.

Since the building area is defined by the perimeter of the exterior walls of the various structures noted above, and while large portions of the structures may only have one or two storeys, the building height is determined by the uppermost floor anywhere within the building. This does not include the mechanical penthouse, which is exempt from classification as a storey in building height, in accordance with Sentence 3.2.1.1.(1).

Based on the above considerations, the building has a building height of two storeys.

3.5 Number of Streets Facing

Further investigation is required to determine the number of streets that the building actually faces for the purposes of Fire Department access. The understanding and proposed resolution of this aspect is discussed in **Section 4.1** of this report. It should be noted that the building faces at least one street.

3.6 Major and Subsidiary Occupancies

In accordance with Article 3.1.2.1., every building or part thereof is required to be classified according to its major occupancy as belonging to one of the groups or divisions described in Table 3.1.2.1. A building intended for use by more than one major occupancy is required to be classified according to all its major occupancies. While not clearly defined by the NBC, a subsidiary occupancy is one in which a use or function within a building is secondary to that of the major occupancy.

The building contains several occupancies. The current and future laboratory uses may be classified as Group F, Division 3. However, in order to permit a wider variety of uses, the laboratories should be classified as Group F, Division 2. Similar industrial uses such as storage, machine shops, and repair areas are also considered to be Group F, Division 2 occupancies.

In areas of the building where Group D offices are closely associated with adjacent lab work, such offices may be considered subsidiary to the laboratory occupancy. Since some offices are remote from the labs or have unrelated work functions within them, these Group D offices should be considered a major occupancy.

3.7 Project Characteristics Summary

The above-noted existing Project characteristics are summarized as follows:

Applicable building code:	NBC, Division B, Part 3
Number of buildings:	1
Streets facing:	At least street
Building area:	Approximately 2,210 m²
Building height:	2 storeys (excluding rooftop service penthouse)
First storey:	1st floor

Major occupancies: Group D andGroup F, Division 2
High building: No

3.8 Project Construction/Structural Fire Protection

Based on the WTC characteristics outlined above, the following table summarizes the required construction/structural fire protection requirements for the WTC.

Occupancy	Article	Construction Type	Floor Assemblies /Occupied Roofs(1)	Unoccupied Roofs	Mezzanines	Supports	Sprinklers Required
Group D	3.2.2.58.	Comb.	¾-hour	¾-hour(2)	¾-hour(2)	(3)	No
Group F, Division 2	3.2.2.75.	Comb.	¾-hour	0-hour	¾-hour(2)	(3)	Yes

(1) Constructed as fire separations.
(2) If constructed using combustible construction.
(3) Same fire-resistance rating as for supported assembly.

The construction and structural fire protection requirements noted in the table above are summarized as follows:

- combustible construction is permitted throughout,
- floor assemblies are required to be constructed as fire separations having a ¾-hour fire-resistance rating,
- mezzanines are required to have a ¾-hour fire-resistance rating,
- loadbearing walls and columns supporting floor assemblies are required to have a ¾-hour fire-resistance rating,
- unoccupied roof assemblies are not required to provide a fire-resistance rating, and
- sprinklers are required throughout.

4.0 FIRE PROTECTION STUDY

The following section of this report outlines the current requirements of the NBC and NFC for the NWRI building, identifies areas of noncompliance, and provides corresponding recommendations, including potential alternative solutions.

Upgrade recommendations are provided throughout this report. A preliminary order of magnitude estimate is included in **Appendix A** to this report, where sufficient information has been made available.

Annotated drawings are included in **Appendix B** to this report.

As previously noted, all references in this report refer to the NBC, unless otherwise noted.

4.1 Firefighting Provisions

4.1.1 Fire Department Access Route

- **Applicable Requirements**

In accordance with Sentence 3.2.2.10.(1), every building is required to face a street located in conformance with the requirements of Articles 3.2.5.4. and 3.2.5.5. Depending on the size and sprinkler provisions within the building, a building may need to face more than one street. Based on the area and height of an unsprinklered building of this size, the relevant construction articles in Subsection 3.2.2. would normally require that the building face three streets (75% of the perimeter of the building is within 15 m of a street).

In accordance with Articles 3.2.5.4. to 3.2.5.6., the building is required to be provided with access routes for Fire Department vehicles. The access routes are required to be located so that the principal entrance and every access opening required by Articles 3.2.5.1. and 3.2.5.2. are located not less than 3 m and not more than 15 m from the closest portion of the access route required for Fire Department use, measured horizontally from the face of the building.

- **Assessment of Existing Conditions**

The building is located at the north end of the CCIW site. The site contains numerous other buildings, outdoor storage, piers and docks, parking lots, and private roadways.

The building faces a private roadway that meets the requirements of Articles 3.2.5.4. and 3.2.5.5., and thus faces at least one street. Large portions of the

exterior are within 15 m of paved areas on the site that would be suitable for exterior firefighting response.

The site is served by the Burlington Fire Department, and their response is to the principal entrance of the building via the private roadway accessed from Lakeshore Road. The Fire Department access route and fire truck parking location are generally as required by Articles 3.2.5.4. and 3.2.5.6.

The travel distance from the fire truck parking location to the doors of the principal entrance is approximately 20 m, which is greater than the 15 m permitted by Sentence 3.2.5.5.(1). This aspect is discussed further in **Section 4.1.2** of this report.

- **Recommendations—Priority A**

Large, unsprinklered buildings normally require roadways capable of Fire Department access around the perimeter of the building. However, this building is larger than permitted for an unsprinklered building of this type that relies on roadways capable of Fire Department access for firefighting response. Also, the perimeter of the building is partially obstructed by external parking areas, storage tanks, and other features that inhibit firefighting response.

In order to comply with the current construction articles and only require Fire Department access to the principal entrance, the building should be sprinklered throughout.

4.1.2 Fire Department Access to the Building

- **Applicable Requirements**

In addition to the Fire Department principal entrance, Article 3.2.5.1. requires that, except for storeys below the first storey, direct firefighting access be provided from the outdoors to every storey that is not sprinklered throughout and whose floor level is less than 25 m above grade, by at least one unobstructed window or access panel for each 15 m of wall in each wall required to face a street by Subsection 3.2.2.

Fire Department exterior access to above-grade storeys via openings in a building's facade is not required for a sprinklered building, in accordance with Sentence 3.2.5.1.(1).

In accordance with Sentence 3.2.5.3.(1), all main roof areas on a building more than three storeys in building height require direct access from the floor areas immediately below by a stairway or hatch with fixed ladder access.

- **Assessment of Existing Conditions**

The building is not sprinklered. The provision of windows or access panels at 15 m intervals for all storeys with a floor level less than 25 m above grade to address exterior Fire Department access to unsprinklered floor areas would not create a conforming condition in this respect. That is, the provision of additional street facings and properly sized and located window or panel access locations for a building of this size and height is not recognized by the NBC as being sufficient to address Fire Department access. The NBC requires a building of this size and height to be sprinklered.

The NBC requires that the building be provided with access via a main principal entrance and that this single access point, from which all floor areas are accessible, is sufficient (the building need only face one street with access via the principal entrance).This is premised on the understanding that the entire building is sprinklered.

The roof is provided with access via the mechanical penthouse.

- **Recommendations—Priority A**

The provision of sprinkler protection throughout the building will permit a single Fire Department access point to the building via the main entrance (Fire Department principal entrance) without the need for further action to mitigate non-conforming Fire Department access conditions with the provision of additional Fire Department access routes and window/access panel locations to floor levels less than 25 m above grade.

The increased travel distance of 20 m beyond the 15 m measured from the curb to the main entry doors, as noted in **Section 4.1.2** of this report, is not uncommon in older existing buildings and is not, in our view, considered to be a significant concern from a fire protection viewpoint. The provision of the recommended sprinkler protection throughout the building will further limit any potential concern with this increased travel distance. This item should be confirmed with the Burlington Fire Department.

4.1.3 Fire Hydrant and Fire Department Connection

- **Applicable Requirements**

The Fire Department access route, fire hydrant, and Fire Department connection are required to be coordinated such that the Fire Department pumper vehicle can be located adjacent to the hydrant with an unobstructed path of travel for firefighters from the vehicle to the building of not more than 45 m.

The Fire Department connection for a standpipe system is required to be located so that the distance from the Fire Department connection to a hydrant is not more than 45 m and is unobstructed.

- **Assessment of Existing Conditions**

The nearest hydrant is located near the fire tuck parking location, and the travel distance from the hydrant to the Fire Department connection is less than 45 m as required by Sentence 3.2.5.5.(2).

- **Recommendations—Priority A**

Additional directional signage and the provision of a hard surface to the Fire Department connection is recommended to facilitate Fire Department response.

4.1.4 Fire Department Access through Locked Doors

- **Applicable Requirements**

Where locking devices to prevent access to floor areas are installed on exit doors, a key to fit all such locking devices is required to be provided in an acceptable location accessible to firefighters (at the Fire Department response point).

- **Assessment of Existing Conditions**

The security desk in the entry lobby of the NWRI is provided with a set of keys for use by the Fire Department. Since the Fire Department responds to this location before the WTC building, it is assumed that they will arrive at the WTC building with the required keys to gain entry into the building.

- **Recommendations—Priority A**

Confirm with the Burlington Fire Department that current arrangement is acceptable.

4.2 Spatial Separation and Exposure Protection

4.2.1 Proximity to Adjacent Buildings

- **Applicable Requirements**

Subsection 3.2.3. provides requirements for the construction type and area of unprotected openings on exposing building faces. The limits on these facades are determined by the proximity of the building to property lines, streets, and adjacent buildings.

- **Assessment of Existing Conditions**

The building faces private roadways on all four exposing building faces.

No recommendations.

4.2.2 Canopy Protection for Vertically Separated Openings

- **Applicable Requirements**

Sentence 3.2.3.17.(1) requires that every opening in the exterior wall of a building classified as a Group F, Division 2 major occupancy that is located vertically below an opening in the storey above be separated from the storey above by a canopy projecting not less than 1 m from the face of the building at the intervening floor level. The canopy is required to have a fire-resistance rating not less than 1-hour.

The canopy required by Sentence 3.2.3.14.(1) is permitted to be omitted if the exterior wall of the upper storey is recessed not less than 1 m behind the exterior wall containing the opening in the lower storey or if the building is sprinklered throughout.

- **Assessment of Existing Conditions**

The building has numerous window openings around its perimeter that do not have the canopy protection required by Sentence 3.2.3.17.(1).

- **Recommendations—Priority A**

In lieu of providing the above-noted protection of exterior openings, the building should be sprinklered throughout.

4.2.3 Underground Walkway

- **Applicable Requirements**

In accordance with Article 3.2.3.20., an underground walkway between buildings is not permitted to be designed or used for any purpose other than pedestrian travel unless the purpose is acceptable to the Authority Having Jurisdiction and sprinklers are installed in any space in the walkway containing an occupancy.

Buildings connected by an underground walkway are required to be separated from the walkway by a fire separation with a fire-resistance rating of not less than 1-hour.

A walkway is required to have smoke barrier doors at intervals of not more than 100 m or be provided with exits located at a distance of not more than one and half times the allowable travel distance to an exit in the adjacent occupancies (one and half times 45 or 67.5 m, based on a sprinklered building at each end).

- **Assessment of Existing Conditions**

The NWRI and WTC buildings are connected via a below-grade walkway. The walkway is approximately 160 m in length.

The walkway is provided with two means of egress that are approximately equally spaced along it. The south means of egress is approximately 60 m from the NWRI building and leads to a ladder and ground-level hatch near the centre of the warehouse building. The north means of egress is approximately 120 m from the NWRI building and leads to a stairwell that discharges at the old guardhouse near the road between the NWRI and WTC buildings.

The walkway contains a combination of services including steam, water pipes, and electrical wiring. The walkway is unsprinklered and the clear width of the walkway varies, but is less than the 1100 mm required for corridors.

The walkway is separated from the basements of each building by doors. These doors are in disrepair and do not provide the 1-hour fire-protection rating required by the NBC.

- **Recommendations—Priority A**

Although it has been recommended that both the NWRI and WTC buildings should be sprinklered, and thus the walkway could also be sprinklered, the walkway would continue to contain the mechanical services noted above. It may be feasible to separate these services from the pedestrian portion of the walkway with a 1-hour fire separation; however, this would further reduce the clear with of the walkway, which is already less than 1100 mm wide.

Furthermore, the walkway is only provided with one conforming exit along its length. The emergency exit ladder is not considered an exit that meets the requirements of Sentence 3.2.3.20.(4).

Unless these improvements can be made to the walkway, or an alternative solution can be developed that provides an equivalent level of performance, the walkway should be restricted to service access only and not for general access.

4.2.4 Protection of Exit Facilities from Exposure

- **Applicable Requirements**

In accordance with Article 3.2.3.13., if an unenclosed exterior exit stair or ramp could be exposed to fire from an opening in the exterior wall of the building it serves, the opening in the exterior wall of the building is required to be protected with wired glass, glass block, or a closure where the opening in the exterior wall of the building is within 3 m horizontally and less than 10 m below the exit stair or ramp or less than 5 m above the exit stair or ramp.

- **Assessment of Existing Conditions**

Exits from the building are generally located directly at the exterior plane of the building (and not located within confined alcoves) where there is direct egress away from the building and away from adjacent openings within the building.

No recommendations.

4.3 Fire Separations

The following summarizes the applicable fire separation locations and associated fire-resistance ratings for the building.

4.3.1 Floor and Roof Assemblies

- **Applicable Requirements**

In accordance with Clauses 3.2.2.58.(2)(b) and 3.2.2.75.(2)(b), floor assemblies for the building are required to be constructed as fire separations having a fire-resistance rating of not less than ¾-hour.

Clause 3.2.2.75.(2)(b) does not require the roof to be provided with a fire-resistance rating where the building is sprinklered. Based on previous editions of the NBC, unsprinklered buildings of this size would require roofs to have a ¾-hour fire-resistance rating.

- **Assessment of Existing Conditions**

The 2nd floor slab of the original building uses concrete-filled steel pans/decks that may provide a fire-resistance rating of at least ¾-hour. The east end of the building, which appears to have been constructed at a later date, was being renovated and has open-web steel joists that are provided with spray-on fireproofing.

No additional information (e.g., as-built drawings) is available to provide the fire-resistance rating information.

- **Recommendations—Priority A**

To address the potential for insufficient floor fire-resistance ratings in the building, the building should be sprinklered throughout.

The potential deficiencies in the fire-resistance rating of the existing floor assemblies, as noted above, will be mitigated to an acceptable level based on the provision of sprinkler protection throughout the building.

If determined necessary, a supporting alternative solution may be developed to demonstrate that the provision of sprinkler protection will enhance the ability of the floor assemblies to perform as a fire separation, meeting or exceeding the required 2-hour fire-resistance rating. The approach would recognize the effect automatic sprinklers have on maintaining lower room temperatures, as demonstrated in a series of 12 full-scale fire tests sponsored by the National Fire and Sprinkler Association.

4.3.2 Mezzanine Assemblies

- **Applicable Requirements**

Articles 3.2.2.58. and 3.2.2.75. require that mezzanines, if of combustible construction, have a fire-resistance rating not less than ¾-hour.

- **Assessment of Existing Conditions**

The plant areas have mezzanines. These mezzanines are typical of industrial settings and use open-steel grate floors and stairs. The steel does not have a fire-resistance rating.

- **Recommendations**

Since the mezzanines are of noncombustible construction, no fire-resistance rating is required. As such, no upgrades are required.

4.3.3 Exits

- **Applicable Requirements**

In accordance with Sentence 3.4.4.1.(1), exits are required to be separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than ¾-hour.

In accordance with Table 3.1.8.15., a maximum wired glass area of 0.8 m² is permitted within an exit door and a maximum aggregate area of wired glass in sidelights/transoms is limited to 0.8 m². Refer to **Section 4.4.3** of this report for further information.

- **Assessment of Existing Conditions**

The concrete construction of the exit stair enclosures would be sufficient to provide a ¾-hour fire separation.

The exit stair doors are provided with a significant area of wired glass in fixed steel frames exceeding the limitations for a ¾-hour enclosure and those of Table 3.1.8.15.

Solid, unrated panels have been inserted into the steel frames.

- **Recommendations—Priority A**

Refer to **Section 4.4.3** of this report for further discussion and recommendations with respect to the existing area of wired glass.

The unrated panels should be replaced by wired glass.

4.3.4 Building Service and Elevator Shafts

- **Applicable Requirements**

In accordance with Sentences 3.5.3.1.(1) and Article 3.6.3.1., based on the floor assemblies requiring a ¾-hour fire-resistance rating, shafts/hoistways are required to be constructed as fire separations having the following fire-resistance ratings.

Shaft Type	Fire-Resistance Rating of Floor Above[(1)]	Shaft Fire-Resistance Rating
Elevator	¾-hour	¾-hour
Vertical service	¾-hour	¾-hour

(1) Where there is no floor assembly above, such as the top floor, the shaft fire-resistance rating will be based on the fire-resistance rating of the floor assembly below.

- **Assessment of Existing Conditions**

The building is provided with a single elevator near the centre of the building. The elevator is located in a concrete block shaft that appears to provide the required ¾-hour fire-resistance rating.

The building is also provided with air-handling units throughout the building and ducting on the roof. This ducting appears to supply air to the 1st and 2nd floors via shafts adjacent to the elevator shaft and along the main corridor. These shafts also use concrete block construction that provides the same rating as the elevator shaft.

It is not clear if the ducts that pass from the ventilation shaft are provided with fire dampers at the plane of the shaft fire separation.

- **Recommendations—Priority A**

An audit of the ventilation systems and how they pass through the floor fire separations should be performed. Any locations where ducts pass though fire separations should be provided with fire dampers.

4.3.5 Corridors

- **Applicable Requirements**

Sentence 3.3.1.3.(8) requires that each suite in a floor area that contains more than one suite is required to have either an exterior exit doorway or a doorway into a public corridor or to an exterior passageway.

In general, a public corridor is required to be separated from the remainder of the building by a fire separation.

- **Assessment of Existing Conditions**

The building is considered as a single suite operating under a single tenancy. As such, the corridors providing access to exit that serve these series of rooms of complementary use are not considered public corridors. Accordingly, the public corridor fire separation requirements of Article 3.3.1.4. are not applicable.

However, in accordance with Sentence 3.4.2.4.(2), corridors providing access to exit that are not considered public corridors may nonetheless be required to be constructed as fire separations to meet the travel distance limitations of Article 3.4.2.5. That is, in accordance with Clause 3.4.2.4.(2)(a)(ii), the travel distance to an exit is permitted to be measured from the egress door of a separated room to the exit, provided the corridor is separated from the remainder of the floor area by a fire separation equivalent to that of a public corridor.

Refer to **Section 4.6.7** of this report for further discussion relative to travel distance limitations and sprinkler protection.

- **Recommendations**

The recommendation to sprinkler the building throughout will also address this item. Refer to **Section 4.6.7** of this report.

4.3.6 Elevator Control Rooms

- **Applicable Requirements**

In accordance with Article 3.5.3.3., the elevator control room need not be separated from the elevator hoistway connected to it, though it is required to be separated from all other parts of the building by fire separations having a fire-resistance rating not less than that required for the shaft enclosing the elevator hoistway (¾-hour).

- **Assessment of Existing Conditions**

The elevator machine room appears to be on the roof above the elevator shaft.

No recommendations.

4.3.7 Service Rooms Containing Fuel-Fired Appliances

- **Applicable Requirements**

Except as noted below, fuel-fired appliances are required to be located in a service room separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than ¾-hour, in accordance with Sentence 3.6.2.1.(1).

The fire separation noted above is not required for:

- a fireplace and the room it serves,
- a rooftop appliance and the room it serves, or
- a fuel-fired appliance that does not utilize solid fuel or liquid with a flash point below 93.3°C and that serves not more than one room.

Except as permitted by Sentence 3.6.2.1.(8), in a storey that is not sprinklered throughout, a service room that contains service equipment other than that addressed by Sentences 3.6.2.1.(1) to (6) is required to be separated from the remainder of the building by a fire separation having a fire-resistance rating not less than 1-hour.

Sentence 3.6.2.8.(8) exempts service rooms with limited quantities of low hazard equipment that is not essential to the operation of fire and life safety systems from the 1-hour separation noted above.

- **Assessment of Existing Conditions**

The building is heated by a steam connection from the NWRI building. No additional boilers or gas-fired heating units appear to be provided in the WTC building.

- **Recommendations**

None. Any new fuel-fired appliance should be installed in a room separated from the remainder of the building by a ¾-hour fire separation, in accordance with Sentence 3.6.2.1.(1).

4.3.8 Service Rooms not Containing Fuel-Fired Appliances

- **Applicable Requirements**

For low hazard service rooms, except as noted below, Sentence 3.6.2.1.(8) permits a room containing a limited quantity of service equipment, where the service equipment that does not constitute a fire hazard nor is essential to the operation of fire safety systems in the building, to not be separated from the remainder of the building by a fire separation.

- **Assessment of Existing Conditions**

Some rooms with low hazard service equipment are noted throughout the building.

We have no recommendations

4.3.9 Fire Alarm Control Panel Room

- **Applicable Requirements**

Subsection 3.2.4. does not have any specific requirements for fire separations around fire alarm control panels or similar devices.

Clause 3.2.7.10.(1)(a) requires protection of electrical conductors serving fire alarm systems; however, this clause only applies to high buildings and, thus, does not apply to this building.

Emergency power for the fire alarm control panel may be provided by local batteries within the panel or from an emergency generator.

- **Assessment of Existing Conditions**

The fire alarm control panel is located in the main entrance lobby. Since the building is not classified as a high building that would be subject to the requirements of Subsection 3.2.6., there is no requirement for conductors from the fire alarm panel to be protected.

No recommendations.

4.3.10 Garbage/Recycling Rooms

- **Applicable Requirements**

In accordance with Article 3.6.2.5., rooms for the temporary storage of refuse, such as garbage rooms and recycling rooms, are required to be sprinklered and separated from the remainder of the building by fire separations having a fire-resistance rating of not less than 1-hour.

- **Assessment of Existing Conditions**

No garbage rooms are observed on site.

- **Recommendations—Priority B**

It should be confirmed if any rooms are specifically used for storage of combustible recycling or refuse and, if so, a 1-hour fire separation should be provided for those rooms.

4.3.11 Janitorial Rooms

- **Applicable Requirements**

In accordance with Article 3.3.1.21., a room for storage of janitorial supplies is required to be separated from the remainder of the building by a fire separation having a fire-resistance rating of not less than 1-hour. In accordance with Sentence 3.3.1.21.(3), the fire separation is not required to have a fire-resistance rating if the floor area is sprinklered throughout.

- **Assessment of Existing Conditions**

Room S126 is noted as a janitorial room.

- **Recommendations—Priority B**

By providing a sprinkler system throughout the building, the fire-resistance rating requirements for the janitorial rooms are waived and such rooms are only required to be provided with a door with a self-closing device and positive latching mechanism.

4.3.12 Rooms Containing Hazardous Processes and Operations

- **Applicable Requirements**

Laboratories

In accordance with Sentence 5.5.2.2.(1) of the NFC, a laboratory is required to be separated from other parts of the building by a fire separation having a fire-resistance rating of not less than 1-hour.

NBC and NFC requirements specific to laboratories are discussed in **Section 4.13.1** of this report.

Storage Garages

In accordance with Sentence 3.3.5.6.(1), a storage garage is required to be separated from other occupancies by a fire separation with a fire-resistance rating not less than 1½-hours.

Repair Garages

In accordance with Sentence 3.3.5.5.(1), a repair garage and any ancillary spaces serving it including waiting rooms, reception rooms, tool and parts storage areas, and supervisory office space are required to be separated from other occupancies by a fire separation having a fire-resistance rating not less than 2-hours.

Facilities for dispensing fuel within storage or repair garages that has a flash point below 37.8°C (e.g., gasoline) is not permitted to be installed within a building.

Flammable Liquid Storage

Article 3.3.6.4. of the NBC provides requirements for the storage and dispensing of flammable liquids.

The design and fire protection requirements for buildings or parts thereof used for the storage, handling, use, and processing of dangerous goods, including flammable liquids and combustible liquids in excess of those identified in Table

3.2.7.1. of Division B of the NFC, are required to conform to the requirements of Sentence 3.3.6.1.(1). Refer to **Section 4.12** of this report.

Compressed Gas Storage

Article 3.3.6.3. requires that indoor storage of Class 2.1 flammable gases be stored as required by the NFC. In some cases, this requires tanks to be stored in rooms at an exterior wall of the building and separated from the remainder of the building with a 2-hour fire-resistance rating.

Subsection 3.2.8. of the NFC regulates indoor storage of compressed gases.

In general, indoor storage of compressed flammable gases are required to be in rooms conforming to Article 3.2.8.2. This requires these rooms be located and accessed on the exterior wall of the building, be separated from the remainder of the building by a 2-hour fire separation, be provided with ventilation, and be designed in accordance with NFPA 68. These requirements are only typically applied to storage arrangements where there are large numbers of tanks located in close proximity. For typical uses within the building, each fire compartment is permitted to store tanks of flammable gases containing a total of up to 170 m^3 without additional protection.

- **Assessment of Existing Conditions**

Laboratories

The building contains extensive laboratories throughout. Refer to **Section 4.13.1** of this report.

Storage Garages

Almost all vehicular parking for the building is in exterior parking lots. The east and west ends of the main plant areas have overhead doors that can be used for the passage of vehicles so that they could temporarily park and unload goods within the building. These areas are not considered to be storage garages that are addressed by the NBC.

Repair Garages

There do not appear to be any areas of the building where vehicular or boat repair would take place.

Flammable Liquid Storage

There do not appear to be any specific rooms dedicated to the storage of flammable liquids. However, flammable liquids are noted throughout the building. Refer to **Section 4.12** of this report for further discussion.

Compressed Gas Storage

There are numerous rooms that have compressed gas cylinders. Most of these rooms have either a single or a number of tanks that are in use by laboratory equipment. The size and number of these tanks do not appear to present a significant hazard.

- **Recommendations**

Laboratories—Priority A

Based on the analysis detailed in **Section 4.13.1** of this report, a 1-hour fire separation is required between the group of laboratory rooms and each corridor and adjacent floors areas.

Storage Garages—Priority B

It should be confirmed that no portions of the warehouse are being used for long-term storage of vehicles. If portions of the building are being used for this purpose, these areas should be separated from the remainder of the building by a fire separation with a fire-resistance rating not less than 1½-hours. If storage is generally transitory and limited to vehicles associated with the storage uses in the warehouse (not for vehicle storage), then this requirement may be waived.

Repair Garages—Priority B

It should be confirmed that no portions of the WTC are being used for the maintenance and repair of vehicles. If portions of the building are being used for this purpose, these areas should be separated from the remainder of the building by a fire separation with a fire-resistance rating not less than 2-hours.

Flammable Liquid Storage

Refer to **Section 4.12** of this report.

Compressed Gas Storage—Priority B

An audit of compressed gas tanks within the building should be performed to confirm that the volume of compressed flammable gases within each fire

compartment (each floor area or fire separated compartment within a floor area) is less than the 170 m³ permitted by the NFC.

Once the maximum number of tanks has been determined for these specific areas, permanent signage should be installed in these locations to indicate these maximums to permit ongoing verification of compliance with the NFC.

4.3.13 Separation of Major Occupancies

The determination of major occupancies for this building are discussed in **Section 3.6** of this report.

- **Applicable Requirements**

In accordance with Table 3.1.3.1, a Group F, Division 2 major occupancy is not required to be separated from a Group D major occupancy.

- **Assessment of Existing Conditions**

Although it is not clear where the demarcation would be between the Group F, Division 2 industrial and Group D office major occupancies, there is no requirement to provide a fire separation between these two areas.

No recommendations.

4.4 Integrity of Fire Separations

4.4.1 Closures - Fire Doors/Shutters

- **Applicable Requirements**

Maximum Size

In accordance with Sentence 3.1.8.6.(1), the size of an opening in an interior fire separation required to be protected with a closure will not exceed 11 m² , with no dimension greater than 3.7 m, provided the fire compartments on both sides of the fire separation are not sprinklered.

In accordance with Sentence 3.1.8.6.(2), the size of an opening in an interior fire separation required to be protected with a closure will not exceed 22 m² (237 ft.²), with no dimension greater than 6 m (20 ft.), provided the fire compartments on both sides of the fire separation are sprinklered.

Fire-Protection Rating

Closures (doors and fire dampers) for openings in all fire separations are required to be provided with a fire-protection rating, in accordance with Table 3.1.8.4., as reproduced below.

Grade of Fire Separation	Required Fire-Protection Rating of Closure
¾-hour	¾-hour
1-hour	¾-hour
1½-hour	1-hour
2-hour	1½-hour

Doors in required fire separations are required to be provided with automatic closing devices (closers) and equipped with a positive latching mechanism designed to hold the door in the closed position after each use.

Hold-Open Devices

In accordance with Article 3.1.8.12., hold-open devices may be provided for any door of this building except exit stair doors. These hold-open devices (where provided) are required to be designed to release upon a signal from the fire alarm system.

Clearance at Door Sills

In accordance with NFPA 80-2007, doors required to provide a fire-protection rating of ¾- to 3-hours are permitted a maximum clearance below the bottom of the door of 9.5 mm where a noncombustible raised sill (threshold) is provided and 19 mm where there is no sill (and noncombustible floor).

- **Assessment of Existing Conditions**

Doors within fire separations are typically pressed steel and have labels indicating their fire-protection ratings and, in general, closures within exit fire separations meet the requirements noted above.

Door closures between labs and corridors are typically unrated.

- **Recommendations—Priority A**

Closures within fire separations should be upgraded so that the fire-protection rating of the door or closure is as required for the fire-resistance rating of that fire separation.

Any doors that do not have labels and are clearly unrated should be replaced with new doors with the required fire-protection rating.

4.4.2 Closure — Fire Dampers

- **Applicable Requirements**

In accordance with Article 3.1.8.7., a duct that penetrates an assembly required to be a fire separation is required to be equipped with a fire damper.

- **Assessment of Existing Conditions**

Fire dampers are not observed within ventilation ducts where they pass through either floor fire separations or vertical shaft fire separations.

- **Recommendations—Priority A**

All supply and return air ducts that pass from the vertical shafts to floor areas should be provided with fire dampers at the fire separation of the vertical shaft.

4.4.3 Glazing in Fire Separations

- **Applicable Requirements**

The maximum temperature rise and area of glazing for closures within exits is required to be in accordance with Table 3.1.8.15., as reproduced below.

Location	Min. Required Fire-Protection Rating of Door	Max. Temp. Rise on Unexposed Side of Door	Max. Area of Wired Glass in Door	Max. Aggregate Area of Wired Glass Panels and Glass Block not in Doors
Between an exit enclosure and the adjacent floor area in a building not more than 3 storeys in building height	All ratings	No limit	0.8 m²	0.8 m²

(1) In accordance with Sentence 3.1.8.17.(1), the temperature rise limits and glass area limits are waived for these types of closures where they open onto a vestibule or corridor
a) built as a fire separation having at least a ¾-hour fire-resistance rating,
b) not containing any wired glass or glass block within 3 m (10 ft.) of the closure, and
c) not containing an occupancy.

In accordance with Table 3.1.8.15., a maximum wired glass area in a ¾-hour exit enclosure is limited to 0.8 m² within an exit door and a maximum aggregate area

of wired glass not in a door is limited to 0.8 m². There is no temperature rise limit on doors within these fire separations.

- **Assessment of Existing Conditions**

The exit stairs are provided with a significant area of wired glass in fixed steel frames exceeding the limitations of Table 3.1.8.15.

In addition to maintaining the integrity of the ¾-hour fire separation while providing a degree of visual awareness, the wired glass area limitations, in combination with temperature rise limitations for the doors, are intended to limit exposure to occupants while they travel down the exit stairs and pass by a fire condition within a lower floor area, as well as providing protection for responding firefighters.

- **Recommendations**

It is recommended that the exit stairs be upgraded to meet the maximum permitted area of wired glazing.

A solution for consideration, on an alternative solution basis, would be to permit the existing area of wired glazing to remain with the provision of a water curtain system (e.g., a separate connection to the riser, located on the floor area side of the existing wired glass assemblies, sprinklers located 150 to 300 mm away from opening, 1.8 m on-centre). This provision, in combination with the recommendation to fully sprinkler the building, will address potential exposure conditions and associated temperature rise limitations and provide a level of protection that equals or exceeds that intended by the NBC.

4.4.4 Firestopping

- **Applicable Requirements**

Sentence 3.1.9.1.(1) requires that service penetrations of all required fire separations be sealed with a listed firestop system that provides an F-rating not less than the fire-protection rating required for closures, when tested in accordance with ULC-S115.

- **Assessment of Existing Conditions**

Firestopping of service penetrations through fire separation assemblies is evident and is in generally good condition. However, there are numerous locations where service penetrations, some abandoned, have not been sealed with a listed firestop system.

The level of nonconformity of firestopping is typical for buildings of this age. The most typical deficiency is where new penetrations have been provided as part of renovations and have not been correctly firestopped.

- **Recommendations—Priority A**

A firestopping contractor should be retained to perform a thorough review of all service penetrations for proper firestopping, as required.

4.5 Construction Type and Combustible Finishes/Materials

4.5.1 Base Building Construction

- **Applicable Requirements**

In accordance with Sentences 3.2.2.54.(2) and 3.2.2.72.(2), the building is permitted to be of combustible construction.

- **Assessment of Existing Conditions**

The base building structure is constructed largely of noncombustible construction.

No recommendations.

4.5.2 Combustible Finishes and Materials

- **Applicable Requirements**

Combustible materials are limited to those permitted by Subsection 3.1.4.

In general, all materials are permitted, provided that their flame-spread rating is less than 500 (typically only applies to foam plastics) as required by Sentence 3.1.4.1.(2).

- **Assessment of Existing Conditions**

The building uses a combination of exposed concrete and steel, as well as some conventional wood-/steel-stud framed partition walls.

Some ceilings have cedar slats on gypsum board (drywall). However, most ceilings are either T-bar ceiling with acoustic tiles or drywall.

No items are noted that do not confirm to Subsection 3.1.4.

No recommendations.

4.5.3 Roof Covering

- **Applicable Requirements**

Sentence 3.1.15.2.(1) requires that every roof covering have a Class A, B, or C classification as determined by CAN/ULC-S107, "Fire Tests of Roof Coverings."

- **Assessment of Existing Conditions**

Based on the condition report from September 2009, the roof consists of either SBS or conventional built up roofing using bituminous membranes. The roof coverings appear to be in general conformance with the applicable requirements of the NBC.

No recommendations.

4.6 Exit and Egress Systems

4.6.1 Minimum Number of Exits

- **Applicable Requirements**

In accordance with Sentence 3.4.2.1.(1), every floor area intended for occupancy is required to be served by at least two exits.

- **Assessment of Existing Conditions**

All floor levels areas within the building are served by at least two exits.

No recommendations.

4.6.2 Exiting through Lobby

- **Applicable Requirements**

In accordance with Article 3.4.4.2., one exit from a floor area is permitted to lead through a lobby provided:

- the lobby floor level is not more than 4.5 m above grade;
- the path of travel from the exit stair through the lobby to an approved open space does not exceed 15 m;
- rooms with residential occupancy and rooms with industrial occupancy do not open directly onto the lobby;

- the lobby is not located within an interconnected floor space, other than as described in Sentence 3.2.8.2.(6); and
- the lobby conforms to the requirements for exits, except that
  - washrooms and elevators are permitted to open into the lobby,
  - the fire separation between the lobby and a room used for the sole purpose of control and supervision of the building need not have a fire-resistance rating,
  - the fire separation between the lobby and its adjacent occupancies does not require a fire-resistance rating where the adjacent occupancies are permitted to open directly onto the lobby and the lobby and its adjacent occupancies are sprinklered, and
  - passenger elevators are permitted to open into an exit lobby where the doors are designed to remain closed except while loading or unloading passengers.

- **Assessment of Existing Conditions**

The south centre stair discharges through a lobby. While this area could be considered part of the exit, it has features typical of a lobby (reception desk, seating, etc.). Furthermore, the stair is not separated from the lobby, which is not in compliance with Clause 3.4.4.2.(2)(f).

- **Recommendations—Priority A**

Refer to **Section 4.3.3** of this report for fire separation requirements between exits the remainder of the building.

Since exits are not permitted to contain any fixtures or furnishings that do not serve the exit, the concierge desk and any furniture in this area should be removed.

4.6.3 Integrity of Exits

- **Applicable Requirements**

Sentence 3.4.4.1.(1) requires that exits (including exit stairs) be separated from the remainder of the building by a fire separation having a ¾-hour fire-resistance rating. The fire separation that separates an exit from the remainder of the building is not permitted any openings, except for

- standpipe and sprinkler piping;
- electrical wires and cables, totally enclosed noncombustible raceways, and noncombustible piping that serve only the exit;
- exit doorways; and
- wired glass and glass block permitted by Article 3.1.8.14.

In accordance with Sentences 3.4.4.4.(7), (8), and (9), service rooms, mechanical rooms, electrical rooms, and auxiliary rooms such as storage rooms, washrooms, and janitors' closets that are adjacent to exit shafts or exit corridors should be provided with vestibules such that these rooms do not open directly into the adjoining exit facility.

- **Assessment of Existing Conditions**

No nonconformities are noted except for the fixtures and furniture typical of lobbies in the central exit stair.

- **Recommendations**

Based on the relatively low hazard associated with this furniture and the similarity of this area to an exit lobby, no changes are necessary.

4.6.4 Egress Rooms from Rooms/Suites

- **Applicable Requirements**

NBC Requirements

In accordance with Sentence 3.3.1.5.(1), a minimum of two remotely separated egress doors will be provided from each room or suite that is anticipated to contain more than 60 persons or exceed the areas or travel distance limits in the tables below. For unsprinklered buildings, the maximum areas and travel distances are as follows:

Occupancy Type	Area	Egress Distance
Assembly (Group A, Division 2)	150 m²	15 m
Laboratories (Group F, Division 2)	150 m²	10 m
Offices (Group D)	200 m²	25 m
Service rooms (Group F, Division 2)	200 m²	15 m

For sprinklered buildings, the maximum areas and travel distances are as follows:

Occupancy Type	Area	Egress Distance
Assembly (Group A, Division 2)	200 m²	25 m
Laboratories (Group F, Division 2)	200 m²	25 m
Offices (Group D)	300 m²	25 m
Service rooms (Group F, Division 2)	200 m²	25 m

Egress distance is measured from the most remote location within the room or suite to a corridor or an exit, taking into account permanent fixtures that interfere with the most direct egress path.

NFPA 45 Requirements

Based on the assumption that the laboratory spaces will be Class B or Class C labs (as defined by NFPA 45), a room within a lab requires a second means of egress if that room is more than 93 m².

- **Assessment of Existing Conditions**

Travel distances are typically in the order of 30 m. However, depending on the floor layouts of the various labs, some travel distances may exceed this.

- **Recommendations—Priority A**

The area and distance limits are significantly more restrictive for unsprinklered buildings. Minor reconfiguration of permanent fixtures, particularly within Group F, Division 2 laboratories within rooms may create excessive travel distance. The provision of a sprinkler system within the building will increase the permitted travel distance to an exit up to 45 m and, thus, all floor areas will be within the permitted travel distances.

4.6.5 Remoteness of Floor Area Exits and Discharge Points

- **Applicable Requirements**

In accordance with Article 3.4.2.3., the least distance between two required exits in a floor area will be as follows:

- for floor areas containing public corridors, half the maximum diagonal dimension of the floor area, but need not be more than 9 m (29.5 ft.), and
- for floor areas other than those containing public corridors, half the maximum diagonal dimension of the floor area, but not less than 9 m (29.5 ft.).

- **Assessment of Existing Conditions**

The layout of the building is such that exits are well spaced around the perimeter of the building. Regardless of whether the floor areas are provided with fire-separated public corridors or whether they are open floor areas, the minimum distance between the multiple required exits meets the requirement of Article 3.4.2.3.

No recommendations.

4.6.6 Separation of Corridors and Travel Distance to Exits

- **Applicable Requirements**

In accordance with Clause 3.4.2.5.(1)(f), a maximum travel distance of 30 m to an exit is permitted for this building, based on an unsprinklered condition.

In accordance with Clause 3.4.2.5.(1)(c), a travel distance of 45 m is permitted within for this building if the building is sprinklered.

- **Assessment of Existing Conditions**

The floor areas have exits spaced such that all areas appear to be within 30 m of an exit. Door locations and partition configurations may cause some areas to have distances in excess of this limit. However, all floor areas are definitely within 45 m of an exit.

- **Recommendations—Priority A**

The recommendation to sprinkler the building throughout will also address any non-conforming travel distances to the exits.

4.6.7 Travel Distance within Open Floor Areas

- **Applicable Requirements**

In accordance with Sentence 3.3.1.10.(1) of the NBC and Article 2.7.1.2. of the NFC, aisles are required to be provided with minimum widths and maximum dead-end lengths, depending on the number of egress doors and occupancy served by the aisles.

- **Assessment of Existing Conditions**

The main plant area has a combination of storage, experimental areas, and aisles. Some of the areas within the plant have clearly demarcated aisles or fixed storage

locations, but in general, storage, experimental areas, and aisles are not clearly delineated.

- **Recommendations—Priority A**

In areas where there is general storage such that items could be placed on the floor that could render portions of the floor inaccessible, painted aisles not less than 1100 mm wide should be provided. These aisles should extend to either a public corridor, non-storage room, or exit from the building. These aisles should lead to means of egress in at least two directions; however, dead-end aisles up to 10 m are permitted to extend from these main aisles.

4.6.8 Dead-End Corridors

- **Applicable Requirements**

Sentence 3.3.1.9.(1) requires that except for a dead-end corridor that is entirely within a suite, a dead-end corridor is permitted, provided it is not more than 6 m long.

In general, the building is considered a single suite and, thus, Sentence 3.3.1.9.(1) does not apply.

- **Assessment of Existing Conditions**

The layout of exit stairs and exit doors is such that there are no dead ends within the building.

No recommendations.

4.6.9 Protection for Barrier-Free Path of Travel

- **Applicable Requirements**

In accordance with Clause 3.3.1.7.(1)(b), floor areas above grade that are not sprinklered are required to be divided into at least two zones such that persons with disabilities can be accommodated in each zone.

- **Assessment of Existing Conditions**

This provision may be provided via the existing wired glass door fire separations within the corridors of the unsprinklered floor areas.

- **Recommendations**

The recommendation to sprinkler the building throughout will also address the need to provide protection for barrier-free paths of travel.

4.6.10 Obstructions in a Means of Egress

- **Applicable Requirements**

Sentence 3.3.1.23.(1) requires that no obstruction is permitted in any occupancy that would restrict the width of a normal means of egress from any part of a floor area to less than 750 mm unless an alternative means of egress is provided adjacent to, accessible from, and plainly visible from the obstructed means of egress.

- **Assessment of Existing Conditions**

There are elements within the building that, due to their fixed nature, are subject to the requirements of the NBC and NFC. These elements typically include

- fire extinguisher cabinets,
- fixed shelving units,
- bollards/guards,
- fixed laboratory equipment (compressors/filtration units/etc.), and
- swinging doors.

- **Recommendations—Priority A**

Any obstruction that reduces the width of a means of egress to less than the required width should be moved.

4.6.11 Occupant Loads and Exit Capacities

- **Applicable Requirements**

Sentence 3.1.17.1.(1) requires that the occupant load of a floor area be based on the number of persons for which the area is designed, but not less than that determined from Table 3.1.17.1., unless it can be shown that the area will be occupied by fewer persons.

- **Assessment of Existing Conditions**

The building has a relatively low occupant load. In general, the exit capacities and washroom facilities throughout the building far exceed the expected occupant load.

No recommendations.

4.6.12 Minimum Exit/Egress Widths

- **Applicable Requirements**

In accordance with Sentences 3.3.1.9.(1), 3.3.1.13.(1) and 3.4.3.2.(8), the minimum widths for egress/exit facilities are required to be as follows:

Exit stairs/corridors/ramps:	1100 mm
Public corridors:	1100 mm
Stairs serving max. 3 storeys above grade or 1 storey below grade:	900 mm
Exit/egress doors:	865 mm[(1)]

(1) 800 mm clear width.

- **Assessment of Existing Conditions**

Exit stairs within the building are typically between 1050 and 1100 mm, which is less than required by the NBC.

Corridors and doors have widths that meet or exceed that required.

- **Recommendations**

Any deficiencies in width are not a significant concern given the limited occupant load and number of exits provided. Given the difficulty of changing the widths of existing exit stairs and the low occupant loads, no upgrades are recommended.

4.6.13 Direction of Door Swings

- **Applicable Requirements**

<u>NBC</u>

All exit doors are required to swing on a vertical axis in the direction of exit travel, in accordance with Sentence 3.4.6.11.(1).

In accordance with Article 3.3.1.11., egress doors are required to swing in the direction of exit travel when the occupant load of a room or space exceeds 60 persons.

Sentence 3.3.1.11.(4) requires that pairs of doors within corridors that divide floor areas and that are in a required means of egress swing in opposite directions, with the door on the right swinging in the direction of travel

NFPA 45

Article 3.4.3 of NFPA 45 requires that, in some cases, doors from laboratories to swing in the direction of travel.

- **Assessment of Existing Conditions**

The 2nd floor corridor is provided with a single door that swings in one direction.

- **Recommendations**

Although it is not a significant concern given the limited occupant load, the non-conforming swing door within the corridor is permitted to be deleted, based on the recommendation to sprinkler the building throughout.

The extent of the laboratory work areas need to be clearly established in order to determine the application of the requirements of NFPA 45.

4.6.14 Clearance beyond Door Swings

- **Applicable Requirements**

The length and width of a landing is required to be at least the width of the stairway in which it occurs, except that it need not be more than 1100 mm. Sentence 3.4.6.4.(1) requires that a where a door or stair empties on to a ramp, a level area extending across the full width of the ramp along its length extend not less than 900 mm.

Sentence 3.4.6.11.(1) requires that the distance between a stair riser and the leading edge of a door during its swing be not less than 300 mm. Similarly, Sentence 3.4.6.4.(2) requires a 300 mm level area on either side of a doorway where it opens on to a stair or ramp (the door is not permitted to open directly onto a landing directly adjacent to a step).

- **Assessment of Existing Conditions**

No non-conforming conditions are noted.

No recommendations.

4.6.15 Handrails and Guards

- **Applicable Requirements**

Stairs, ramps, handrails, and guards are required to be designed in accordance with the applicable requirements contained in Articles 3.4.6.1. to 3.4.6.8.

<u>Handrails</u>

Number	In accordance with Sentence 3.4.6.5.(1), every exit stairway is required to be provided with a handrail on at least one side, and where 1100 mm or more in width, provided with handrails on both sides. In accordance with Sentence 3.4.6.5.(10), every exit ramp is required to have handrails on both sides. In accordance with Sentence 3.4.6.5.(2), where the required width of a ramp or flight of stairs exceeds 2200 mm, one or more intermediate handrails continuous between landings is required, and the spacing of these intermediate handrails is not permitted to exceed 1650 mm.
Height	In accordance with Sentence 3.4.6.5.(4), handrails on stairs and ramps are required to be not less than 865 mm and not more than 965 mm high, measured vertically from a line drawn through the outside edges of the nosing or from the surface of ramp.
Graspability	In accordance with Sentence 3.4.6.5(8), at least one handrail is required to be continuous throughout the length of the stairway except where interrupted by doorways and newels at change of direction. In accordance with Sentence 3.4.6.5.(3), handrails are required to have a circular cross-section with a diameter between 30 and 43 mm or a non-circular cross-section with a graspable portion that has a perimeter not less than 100 mm and not more than 125 mm, and whose largest cross-section dimension is not more than 45 mm. In accordance with Sentence 3.4.6.4.(11), handrails are required to be located at least 50 mm from a smooth wall surface and 60 mm from a rough wall surface.

Extensions	In accordance with Sentence 3.4.6.5.(10), at least one stair handrail at the top of a flight is required to extend parallel to the floor or ground surface not less than 300 mm beyond the top riser, and at the bottom of a flight will continue to slope one tread depth beyond the bottom riser and then continue horizontally 300 mm. At the top and bottom of a ramp, handrails are required to extend parallel to the floor or ground surface not less than 300 mm.
Termination	In accordance with Sentence 3.4.6.5.(9), handrails are required to terminate in a manner that will not obstruct pedestrian travel or create a hazard.

Guards

Differences in floor elevations	In accordance with Clause 3.3.1.18.(1)(c), locations where the difference in floor elevations is more than 600 mm require a guard not less than 1070 mm high.
Stairs	In accordance with Sentence 3.4.6.6.(2), the height of guards on stairs used by the public and exit stairs is required to be not less than 920 mm measured vertically to the top of the guard from a line drawn through the outside edges of the stair nosings and not less than 1070 mm around landings.
Ramps	In accordance with Sentence 3.4.6.6.(3), the height of guards on ramps is required to be not less than 1070 mm measured vertically to the top of the guard from the ramp surface.
Maximum size of openings	In accordance with Sentences 3.3.1.18.(2) and 3.4.6.6.(5), the size of any openings through guards serving any space to which the public is admitted or serving an exterior balcony is required to be designed to prevent the passage of a spherical object having a diameter of 100 mm.
Climbability	In accordance with Sentence 3.3.1.18.(3), no horizontal members that facilitate climbing are permitted between 140 and 900 mm above the floor.

- **Assessment of Existing Conditions**

Stairs typically have handrails on both sides. Handrails are typically located between 865 and 965 mm, as required, although some handrails are up to 1000 mm high. Handrails are typically continuous along the length of stairs, although many handrails do not have extensions as required by the NBC. Furthermore, some handrails have diameters larger than permitted by the NBC.

Almost all guards meet the minimum height requirement of 1070 mm; however, a few guards in some exit stairs have heights less than this. Guards for stairs and elevated walkways typically consist of a top rail with well-spaced supporting pickets. These pickets are spaced in excess of the 100 mm maximum permitted by Sentences 3.3.1.18.(2) and 3.4.6.5.(5). Most guards have horizontal members at mid-height that could facilitate climbing.

- **Recommendations—Priority A**

The requirements of the NBC are intended to apply to all buildings of all occupancies that may include children, very large numbers of people unfamiliar with the building, or other persons who would require a higher level of safety than that provided by the conditions present in this building with regard to the above-noted items.

Any guard less than 1070 mm should be modified so that the top member is no less than this height.

4.6.16 Stair Treads and Risers

- **Applicable Requirements**

In accordance with Sentence 3.4.6.7.(1), stairs are required to have a run of not less than 280 mm and a rise between 125 and 180 mm.

In accordance with Sentence 3.4.6.7.(4), stair treads are required to be at right angles to the direction of exit travel.

In accordance with Sentence 3.4.6.7.(2), treads and risers are required to have a uniform rise and run, which will not alter significantly from flight to flight.

In accordance with Sentence 3.4.6.1.(1), stair treads are required to be slip-resistant and have contrasting nosings.

- **Assessment of Existing Conditions**

The original stairs within the building have rises and runs that do not meet the requirements of the NBC. A rise and run of 240 and 190 mm is noted throughout the existing stairs. Some stairs are industrial (expanded steel mesh with open risers), which also do not conform to the NBC.

Stairs do not have contrasting nosings as required by the NBC.

- **Recommendations—Priority A**

Based on the impracticality of replacing existing stairs and the low hazard associated with this condition, the only upgrades recommended are the provision of contrasting nosings within stairs.

4.6.17 Headroom Clearances

- **Applicable Requirements**

Floor areas/exits	Except as noted below, the minimum headroom clearances in every access to exit and exits, including stairways, within this building is required to be 2100 mm, in accordance with Sentence 3.4.3.4.(1).
Doorways	In accordance with Sentence 3.4.3.4.(3), the headroom clearance for doorways is required to be not less than 2030 mm.
Closers	In accordance with Sentence 3.4.3.4.(4), no device such as a door closer is required to be installed so as to reduce the headroom clearance of a doorway to less than 1980 mm.

- **Assessment of Existing Conditions**

No areas of low headroom are noted.

No recommendations.

4.6.18 Door Release Operation

- **Applicable Requirements**

In accordance with Sentences 3.3.1.13.(2) and (3) and Sentence 3.4.6.16.(1), a door in a required access to exit or exit door is required to be provided with manual door-opening hardware providing single operation release that is available at all times in the direction of exit travel.

In accordance with Sentences 3.3.2.7.(1) and 3.4.6.15.(2), the following doors are required to be equipped with panic hardware:

- every exit door from a floor area containing an assembly occupancy with an occupant load greater than 100 persons,
- every egress door with a mechanism in an access to exit from a room or group of rooms of assembly occupancy with an occupant load greater than 100 persons,

- every exterior door leading from an exit stair shaft, and
- every door leading to an exit lobby from an exit stair shaft.

- **Assessment of Existing Conditions**

All exit doors requiring panic hardware are provided with the required devices.

No recommendations.

4.6.19 Electromagnetic Locks

- **Applicable Requirements**

Under certain circumstances, Sentence 3.4.6.16.(4) permits electromagnetic locks on exit doors.

- **Assessment of Existing Conditions**

No electromagnetic locks are noted.

No recommendations.

4.6.20 Exit Signs

- **Applicable Requirements**

In accordance with Sentence 3.4.5.1.(1), every exit door, including the main entrance to the building, is required to have an illuminated exit sign placed over or adjacent to it.

In accordance with Sentence 3.4.5.1.(6), where an exit is not visible from a public corridor, from a corridor used by the public in a Group A or B major occupancy, or from principal routes serving an open floor area having an occupant load of more than 150 persons, directional exit signs are required to indicate the direction of egress.

In accordance with Sentence 3.4.5.1.(2), every exit sign is required to conform to the requirements of ISO 7010 “Graphical symbols — Safety colours and safety signs” (the green pictogram).

Exit signs shall be continuously illuminated by either internal or external means as permitted by Sentence 3.4.5.1.(3) and (4).

- **Assessment of Existing Conditions**

The building has a wide assortment of exit signs that have been installed since the original construction of the building.

- **Recommendations—Priority B**

Based on the inconsistency of exit signage throughout the building and that some exit signs are not properly illuminated, all exit signs should be replaced with self-illuminated signs with battery backup and complying with the current ISO standard.

4.6.21 Floor Numbering

- **Applicable Requirements**

Sentence 3.4.6.19.(1) requires that signs with Arabic numerals indicating the assigned floor numbers be provided with the following:

- be mounted permanently on the stair side of the wall at the latch side of doors to exit stair shafts;
- be not less than 60 mm high, raised approximately 0.7 mm above the surface;
- be located 1500 mm from the finished floor and not more than 300 mm from the door; and
- be contrasting in colour with the surface to which they are applied.

- **Assessment of Existing Conditions**

Floor numbering signs are noted throughout the building although their locations and designs are inconsistent.

- **Recommendations—Priority C**

Provide a consistent set of signs indicating floor numbers and exit stair designations for all exits within the building.

4.7 Automatic Sprinkler and Fire Suppression Systems

There are many requirements within the NBC that are waived when a sprinkler system is provided within a building. Furthermore, sprinkler systems are frequently incorporated in alternative solutions to address non-conforming conditions that may not be practically addressed by other methods. Automatic sprinkler protection is considered to be an important fire and life safety feature required by the current NBC for a building of this size.

4.7.1 Automatic Sprinkler Protection

- **Applicable Requirements**

NBC

In accordance with Clause 3.2.2.72.(2)(a), the building is required to be sprinklered throughout.

Sentence 3.2.5.12.(1) requires that the automatic sprinkler system be designed, constructed, installed, and tested in conformance with NFPA 13-2007.

NFC

The NFC defers to the NBC for sprinkler protection unless there is a specific hazard that necessitates sprinkler protection.

Sprinkler protection within a building increases the area, height, and quantity limits for storage of both general materials and flammable liquids.

Section 5.5. of the NFC does not specifically require sprinkler protection for laboratories.

NFPA 45

Depending on the classification of laboratory units within the building, NFPA 45 may require sprinkler protection within those areas, Class A and B units require sprinkler protection while Class C and D units do not. Sprinkler protection, where provided, is required to be in conformance with NFPA 13.

- **Assessment of Existing Conditions**

The building is not sprinklered.

- **Recommendations—Priority A**

The provision of sprinkler protection installed in accordance with NFPA 13-2007 throughout the WTC is strongly recommended.

In addition to bringing the WTC into conformance with the sprinkler requirement of Subsection 3.2.2., the provision of sprinkler protection throughout will address or significantly decrease other existing non-conforming conditions, as detailed throughout this report.

Automatic sprinkler protection has been found to be one of the most beneficial forms of fire protection. By controlling or suppressing a fire its incipient stages, a

properly maintained automatic sprinkler system reduces or eliminates the potential for fire spread. This fact, in combination with the reliability of floor area automatic sprinkler systems to be in excess of 96% significantly reduces any potential concern with fire spread.

4.7.2 Standpipe and Hose Systems

- **Applicable Requirements**

In accordance with Sentence 3.2.5.8.(1), a standpipe is required in a building more than three storeys in building height. Sentence 3.2.5.9.(1) requires that the standpipe system be designed and installed in conformance with NFPA 14-2007.

- **Assessment of Existing Conditions**

The building is provided with a standpipe system throughout.

The standpipe system is provided with 38 mm hose stations (Class II connections) within floor areas. However, 64 mm (Class I) hose connections are not provided within exit stairs.

- **Recommendations—Priority A**

The recommendation to sprinkler the entire building will exempt the requirement for a standpipe system. Hose cabinets could be removed to save on maintenance costs.

4.7.3 Fire Pumps

- **Applicable Requirements**

Article 3.2.5.7. requires that buildings be provided with an adequate water supply for firefighting. Where the building is provided with a sprinkler or standpipe system, the building is required to comply with the relevant NFPA standards, which require that any fire pump within those systems conform to NFPA 20.

- **Assessment of Existing Conditions**

No fire pump is provided. The existing municipal water pressure is assumed to be sufficient to supply a building sprinkler system without a fire pump.

- **Recommendations**

As part of providing a sprinkler system for the building, the sprinkler engineer should determine if a fire pump is required.

4.7.4 Commercial Kitchen Suppression System

- **Applicable Requirements**

Sentence 6.2.2.7.(1) requires that systems for the ventilation of commercial cooking equipment are required to be designed, constructed, and installed to conform to NFPA 96-2008.

- **Assessment of Existing Conditions**

There are no commercial cooking operations within this building.

No recommendations.

4.7.5 Specialty Fire Suppression Systems

- **Applicable Requirements**

Although not explicitly addressed in the NBC, Clean Agent Fire Extinguishing systems are required to conform to NFPA 2001.

- **Assessment of Existing Conditions**

No specialty systems are noted. Where provided, any specialty systems should be reviewed by a qualified fire protection engineer.

No recommendations.

4.7.6 Portable Fire Extinguishers

- **Applicable Requirements**

Sentence 2.1.5.1.(1) of the NFC requires that portable fire extinguishers be selected and installed in accordance with NFPA 10-2007.

- **Assessment of Existing Conditions**

Fire extinguishers have been provided throughout the building. Based on random checks, the extinguishers appear to have been recently serviced.

- **Recommendations—Priority A**

Fire extinguishers should continue to be maintained in accordance with NFPA 10.

4.8 Fire Alarm and Detection Systems

4.8.1 Type and Continuity of Fire Alarm System

- **Applicable Requirements**

In accordance with Sentences 3.2.4.1.(1) and (4), the building requires a fire alarm system.

Based on Sentence 3.2.4.3.(1), the fire alarm system is permitted to be either a single or two-stage system.

The fire alarm system is required to be installed throughout the building and in accordance with CAN/ULC-S524-06

- **Assessment of Existing Conditions**

The fire alarm annunciator control panel is located in the main entrance lobby. The fire alarm is a single-stage system and has devices located throughout the building. When the system goes in to alarm, a signal is sent to the fire alarm annunciator control panel in the NWRI building.

- **Recommendations—Priority B**

The existing system should be retained and tested and maintained on an ongoing basis, as required by CAN/ULC-S537-02.

4.8.2 Electrical Supervision and Signals to Fire Department

- **Applicable Requirements**

In accordance with Article 3.2.4.16., the fire alarm system is required to be electrically supervised and monitored.

In accordance with Sentence 3.2.4.10.(3), the fire alarm system is required to be electrically supervised and indicate a supervisory signal on the fire alarm annunciator for each of the following:

- movement of a valve handle that controls the supply of water to sprinklers,
- loss of excess water pressure required to prevent false alarms in a wet-pipe system,
- loss of air pressure in a dry-pipe system,
- loss of air pressure in a pressure tank,
- a significant change in water level in any water storage container used for firefighting purposes,

- loss of power to any automatically starting fire pump, and
- temperature approaching the freezing point in any dry-pipe valve enclosure or water storage container used for firefighting purposes.

- **Assessment of Existing Conditions**

The fire alarm system is not directly monitored, but sends a signal to the fire alarm system in the NWRI building, which is monitored.

- **Recommendations—Priority A**

Any new devices that are added should be provided with supervision as required by the NBC.

4.8.3 Annunciator and Zone Indication

- **Applicable Requirements**

In accordance with Sentence 3.2.4.9.(1), the fire alarm system is required to be provided with an annunciator installed in close proximity to the principal entrance of the building.

Sentence 3.2.4.9.(2) requires that the annunciator required by Sentence 3.2.4.9.(1) be provided with separate zone indication of the actuation of alarm initiating device in each

- floor area, so that the area of coverage for each zone in a building that is not sprinklered is not more than 2,000 m²;
- floor area, so that the area of coverage for each zone is neither
  - more than one storey nor
  - more than the system area limits specified in NFPA 13, "Installation of Sprinkler Systems";
- shaft required to be equipped with smoke detectors;
- air-handling system required to be equipped with smoke detectors;
- fire extinguishing system required by NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations";
- contained use area;
- impeded egress zone; and
- fire compartment required by Sentence 3.3.3.5.(2).

- **Assessment of Existing Conditions**

Zoning of initiation devices exceeds the number of zones as required by the NBC.

- **Recommendations—Priority A**

The zoning should be maintained as provided. If a sprinkler system is provided for the building, new zones should be added as required.

4.8.4 Fire Detectors

- **Applicable Requirements**

Sentence 3.2.4.11.(2) requires that fire detectors be provided in the following locations:

- storage rooms not within dwelling units,
- service rooms not within dwelling units,
- janitors' rooms,
- rooms in which hazardous substances are to be used or stored (see A-3.3.1.2.(1) in Appendix A),
- elevator hoistways and dumbwaiter shafts, and
- laundry rooms in buildings of residential occupancy, but not those within dwelling units.

Sentence 3.2.4.12.(1) requires that smoke detectors be provided in the following locations:

- each exit stair shaft other than those serving only a Group A, Division 4 occupancy or an open storage garage and
- elevator machine rooms.

Sentence 3.2.4.13.(1) requires that if a fire alarm system is installed, an air-handling system shall be designed to prevent the circulation of smoke upon a signal from a duct-type smoke detector if the air-handling system serves more than one storey.

- **Assessment of Existing Conditions**

Fire detectors are noted throughout the building.

- **Recommendations—Priority A**

The provision of a sprinkler system throughout the building will address the requirement for the majority of detectors noted above.

An audit of the fire alarm initiating devices within the building should be conducted to determine if devices have been provided at all locations as required by the NBC.

4.8.5 Manual Stations

- **Applicable Requirements**

Sentence 3.2.4.17 requires that manual stations be installed in every floor area near

- every principal entrance to the building,
- every required exit, and
- every other egress facility that has been designed and identified as an exit and has all the features of a required exit.

- **Assessment of Exiting Conditions**

Manual stations are noted throughout the building at exits and in other locations of the floor areas.

- **Recommendations—Priority A**

An audit of the fire alarm initiating devices within the building should be conducted to determine if devices have been provided at all locations as required by the NBC.

4.8.6 Audibility of Alert and Alarm Signals

- **Applicable Requirements**

Articles 3.2.4.19. and 3.2.4.20. provide the requirements for audibility and visibility of fire alarm signal devices. In general, the sound pressure level is required to be between 65 and 110 dBA in all floor areas. Areas with high ambient noise levels are required to have an audio signal 10 dBA higher than average, and if the average noise level is above 87 dBA, visual signal devices are also required to be provided.

- **Assessment of Existing Conditions**

Fire alarm bells are noted throughout the building.

- **Recommendations—Priority A**

An audit of the fire alarm sounding devices within the building should be conducted to determine if adequate devices have been provided and sound pressure levels are as required by the NBC.

4.8.7 Visual Signals

- **Applicable Requirements**

In accordance with Clauses 3.2.4.20.(1)(c) and (d), visual signal devices are required in addition to audible signal devices in any floor area in which the ambient noise level is more than 87 dBA and in any floor area in which occupants use ear protection devices.

- **Assessment of Existing Conditions**

Portions of the main plant area have pumps and other equipment capable of generating high sound levels.

- **Recommendations—Priority C**

A list of locations where the known or expected ambient sound level is above 87 dBA should be prepared and visual signal devices added in these areas.

4.8.8 Voice Communication

- **Applicable Requirements**

Sentence 3.2.6.8.(1) requires that a building more than 36 m in height, as measured from grade to the floor level of the top storey (a high building), be provided with a voice communication system conforming to Article 3.2.4.22.

Sentence 3.2.4.22.(7) requires a voice communication system in a building where the occupant load is greater than 1,000 persons and a two-stage fire alarm system is provided.

- **Assessment of Existing Conditions**

Since the WTC is not a high building, nor is a two-stage fire alarm system provided, a voice communication system is not required.

Firefighters' telephones have been provided throughout the building.

- **Recommendations—Priority A**

The voice communication system provides an increased level of safety within the building and should be retained and tested as required by the NFC.

4.9 Emergency Power and Lighting Systems

4.9.1 Emergency Power

- **Applicable Requirements**

Sentence 3.2.7.8.(1) requires that fire alarm systems be provided with emergency power for a duration not less than 30 minutes.

- **Assessment of Existing Conditions**

The emergency power supply for the fire alarm system is not confirmed, but based on its age, it is assumed to be provided with the required battery backup.

Wall mounted emergency lights with integrated battery packs are observed in some locations.

Based on the building condition report from September 2009, the WTC is provided with emergency power from the NWRI building.

- **Recommendations—Priority A**

It should be verified that the fire pump is connected to the emergency generator and that any self-powered emergency lights provide the minimum 30-minute duration.

4.9.2 Emergency Lighting

- **Applicable Requirements**

The building is required to be provided with emergency lighting and power in conformance with Subsection 3.2.7.

Exits and public corridors are required to be equipped with lighting to provide illumination to an average level not less than 50 lx at the floor level.

Exits, public corridors, access to exits in open floor areas and service rooms, underground walkways, and commercial kitchen areas are required to be provided with emergency lighting to provide illumination to an average level not less than 10 lx at the floor level.

In accordance with Sentence 3.2.7.3.(1), emergency lighting is required to be provided for a duration not less than 30 minutes and at an average level not less than 10 lx for all exits; principal routes providing access to exit; corridors used by

the public; underground walkways; Group A, Division 2 occupancies with more than 60 persons; and commercial kitchen areas.

- **Assessment of Existing Conditions**

Battery pack emergency lights are noted in exits and throughout the building, and should be sufficient to meet the minimum illumination levels.

- **Recommendations—Priority A**

It should be confirmed that ongoing testing and maintenance of the emergency lighting is being provided in accordance with the requirements of Section 6.5 of the NFC.

4.10 Elevators

- **Applicable Requirements**

In accordance with Article 3.5.4.1., at least one elevator is required to accommodate a stretcher 2010 mm long and 610 mm wide. This can be achieved by a 1134 kg, 2032 mm by 1295 mm elevator car with door openings in accordance with A-3.5.4.1.(1).

In accordance with the requirements outlined in the ASME/CSA B44-2007, "Safety Code for Elevators and Escalators," all elevators are required to comply with the following:

- fire recall operation (firefighters' emergency operation);
- automatic initiation of fire emergency operation;
- recall to an alternate level;
- initiation of elevator recall by only fire alarm initiating devices (smoke or heat detectors) located in elevator lobbies, machine rooms, control rooms, hoistways and/or pit;
- smoke detectors installed in elevator lobby at each floor level served by the elevator; and
- pit drain to have a flow rate of 50 gpm.

- **Assessment of Existing Conditions**

The building is provided with an elevator that appears to meet the minimum dimensions required above. We are not able to verify the operation of the elevator as required by CSA B44-207.

- **Recommendations—Priority A**

An elevator contractor should be retained to confirm that all elevators conform to CSA-B44-2007 and provide upgrades to the elevator systems if necessary.

4.11 Indoor and Outdoor Storage

4.11.1 Compressed Gases

- **Applicable Requirements**

Part 3 of the NFC primarily addresses Class 2 gases. Appendix A-3.1.1.1.(1) of the NFC notes that where gases not addressed by Part 3 of the NFC are stored or used within a building, NFPA 55, "Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks," should be applied.

Indoor Storage

Indoor storage of compressed cylinders of Class 2 gases is regulated by Subsection 3.2.8. of the NFC.

Unless the criteria of Sentences 3.2.8.2.(2) or (3) of the NFC are met, cylinders of Class 2.1 flammable gases stored indoors are required to be in rooms that are fire separated from the remainder of the building and conform to the other requirements of Sentence 3.2.8.2.(1).

Sentence 3.2.8.2.(2) permits compressed gas cylinders with an aggregate unexpanded gas capacity of up to 60 or 170 m^3 to be stored within a single fire compartment for an unsprinklered building or sprinklered building, respectively.

Outdoor Storage

Subsection 3.3.5. of the NFC addresses the requirements for outdoor storage of compressed gases.

In general, tanks are required to be stored on a raised concrete platform and in a locked, chain-link fenced area. Depending on the total volume of flammable gases, these tanks are required to be stored at a minimum distance from openings to the building.

- **Assessment of Existing Conditions**

Indoor Storage

Some labs have single or multiple gas tanks attached to experimental apparatus.

Outdoor Storage

No gas tanks are stored outside the building.

- **Recommendations—Priority A**

A list of flammable and toxic gases stored throughout the building should be prepared and maintained. This list should be cross-referenced against the requirements noted above to determine if the volumes of gases being stored meets the exemption requirements of Sentence 3.2.8.2.(2).

4.11.2 Rack Storage

- **Applicable Requirements**

Subsection 3.2.3. of the NFC provides the requirements for indoor storage. In general, storage heights are permitted to be up to 6.5 m in unsprinklered areas and 9.0 m in sprinklered areas, except that Class III and IV commodities and certain plastics have lower limits.

NFPA 13-2007 has specific sprinkler criteria for sprinkler system design in areas with rack storage.

- **Assessment of Existing Conditions**

The rack storage area of the main plant area has storage up to approximately 4 m. The racks contain a variety of materials, some of which are stored in closed cardboard containers.

- **Recommendations—Priority A**

A list of materials stored on the racks in the warehouse portion of the building should be prepared and maintained that can be used to confirm that storage is in compliance with the NFC.

This list should also be forwarded to a qualified sprinkler designer/inspector to confirm that the provided level of sprinkler protection meets the requirements of NFPA 13-2007.

4.11.3 Dangerous Goods Storage

- **Applicable Requirements**

Dangerous goods are defined by Sentence 3.1.2.1.(1) of the NFC. Subsection 3.2.7. of the NFC addresses indoor storage of dangerous goods and provides requirements for maximum quantities, storage arrangements, ambient conditions, restrictions on ignition sources, fire suppression systems, and other hazard mitigating requirements.

- **Assessment of Existing Conditions**

It can be expected that the building contains storage of dangerous goods, including Class 4 flammable solids, Class 5 oxidizing substances and organic peroxides, Class 6 poisonous substances, and Class 8 corrosive substances.

- **Recommendations—Priority A**

Further to the list noted in **Section 4.11.1** of this report, a list of dangerous goods, as defined by Sentence 3.1.2.1.(1) stored throughout the building should be prepared and maintained. This list should be cross-referenced against the requirements noted above.

4.12 Flammable and Combustible Liquids

- **Applicable Requirements**

Flammable and combustible liquids are governed by Part 4 of the NFC.

Based on the typical use of flammable liquids within the laboratories, the use may be considered incidental and, thus, the storage and handling of such liquids are required to conform to Subsection 4.2.8. of the NFC.

Subsection 4.2.8. applies to industrial occupancies where the use, storage and handling of flammable liquids or combustible liquids is secondary to the principal activity. The word incidental does not imply “small quantity” or “insignificant amount.”

Referencing the NFC, except as provided in Sentences 4.2.8.2.(2) and 4.2.8.2.(3) and in Article 4.2.8.4., the quantity of flammable liquids and combustible liquids permitted to be located outside of storage rooms conforming to Subsections 4.2.7., 4.2.9., or 4.3.14. or storage cabinets conforming to Subsection 4.2.10. in any one fire compartment of a building shall not be more than

- 600 L of flammable liquids and combustible liquids in closed containers, of which not more than 100 L shall be Class IA liquids, and
- 5,000 L of Class IB, IC, II, and IIIA liquids in storage tanks or portable tanks.

If it is not possible to conform to the quantity requirements in Subsection 4.2.8., flammable liquids should be stored in rooms conforming to Subsection 4.2.9. or cabinets conforming to Subsection 4.2.10.

In general, storage rooms are required to be separated from the remainder of the building with fire separations having a fire-resistance rating not less than 1-hour, as well as other additional features for spill control, dispensing equipment, and explosion venting systems.

Storage within cabinets is required to conform to Subsection 4.2.10. In general, each cabinet may contain up to 500 L each, and each fire compartment may have up to 1,500 L total within cabinets.

- **Assessment of Existing Conditions**

Based on the principal activity of the building being laboratory use, which is not a use that deals primarily with the production or handling of flammable liquids, the classification of these liquids under Subsection 4.2.8. is considered appropriate.

A complete list of flammable liquids throughout the facility has not been provided.

Flammable liquids in nominal 4 L containers are noted throughout the laboratories.

- **Recommendations—Priority A**

A list of flammable and combustible liquids within the building should be prepared and maintained. This list should be cross-referenced with the requirements noted above with regard to the maximum permitted quantities within rooms and fire compartments.

If it is determined by the review above that quantities of stored materials require fire separations between these storage rooms and the remainder of the building, the fire separations around these rooms should be upgraded as required.

4.13 Hazardous Processes and Operations

4.13.1 Laboratories

- **Applicable Requirements**

The NBC does not have any specific requirement for laboratories in Subsection 3.3.6., which applies to the design of hazardous areas.

Section 5.5. of the NFC provides the requirements for laboratories within buildings. A laboratory is not a defined term in the NFC, but Sentence 5.5.1.1.(1) does note that this section applies to areas where dangerous goods, including flammable and combustible liquids, are used.

In accordance with Sentence 5.5.2.2.(1) of the NFC, a laboratory is required to be separated from other parts of the building by a fire separation having a fire-resistance rating of not less than 1-hour.

Subsection 5.5.3. of the NFC provides requirements for emergency planning, inspection, maintenance, and other operational details within laboratories.

Subsection 5.5.4. of the NFC provides requirements for mechanical ventilation within laboratories. This subsection addresses the design and configuration of power-ventilated enclosures (fume hoods). Under certain conditions, these enclosures are required to be designed in conformance with Articles 6.2.12.3. and 6.2.12.4. of the NBC.

Subsection 5.5.5. of the NFC provides requirements for the storage and use of dangerous goods within laboratories. This subsection applies to the storage, use, and disposal of flammable liquids, compressed gases, and other unstable substances (such as perchloric acid).

While not directly referenced the NBC or the NFC, NFPA 45, “Standard on Fire Protection for Laboratories Using Chemicals,” also provides requirements for the design and operation of these spaces within the building.

- **Assessment of Existing Conditions**

The building contains extensive laboratories throughout. These are located throughout the 1st floor and on the north sides of the corridor on the 2nd floor.

The main plant area contains a variety of research equipment, although this equipment is typically large scale hydraulic testing equipment and does not contain the hazards associated with the laboratories. This equipment is located off the corridors on the 1st and 2nd floors.

It is not entirely clear which areas within the floor areas are laboratories and which areas are the associated offices. Additionally, it is not clear which rooms with laboratory equipment are under the same staff control as adjacent labs or offices.

The laboratories are separated from the corridors with concrete block walls that provide a 1-hour fire-resistance rating. However, doors and ducts that pass through the block wall do not appear to have the required ¾-hour fire-protection rating.

Some laboratories are provided with hazardous material lists posted outside the labs. Some aspects of the various requirements in Subsection 5.5.3. of the NFC are provided (doors are locked to prevent unauthorized entry, dangerous goods are frequently stored in cabinets when not in use, laboratories have signage indicating dangerous goods storage, absorbent and neutralizing materials are typically provided). Inspection or maintenance logs for equipment and ventilation systems, as required by Article 5.5.3.6. of the NFC, are not provided. It is not clear if electrical equipment and ignition sources conformed to the various requirements of Articles 5.5.3.4. and 5.5.3.5. of the NFC.

Based on our general observations of the various laboratories within the building, it is not clear which laboratories have chemicals or procedures which would necessitate power-ventilated enclosures. Based on the potential for various uses within these labs, a safe assumption would be that all labs should be provided with at least one power-ventilated enclosure designed in conformance with Subsection 6.2.12. of the NBC.

Most labs have fume hoods of varying design and age. Some hoods appeared to be relatively new and likely in conformance with the requirements of Subsection 6.2.12. However, many hoods are in disrepair and have features that do not appear to comply with the current requirements (combustible materials within hoods, non-conforming electrical outlets and ventilation switch locations, supervision to notify of ventilation system malfunction, etc.).

The operations within the various laboratories is not confirmed and, as such, the storage of the various dangerous goods within them is not reviewed.

- **Recommendations—Priority A**

In general, a laboratory should be separated from the remainder of the building by a 1-hour fire separation. Since the demarcation of the various laboratories and offices is not clear, we recommend that each group of laboratories on the 1st and 2nd floors be separated from the corridor by a 1-hour fire separation. Other rooms that are identified as functioning primarily as a laboratory, which contain any of

the hazardous materials or processed noted in Section 5.5. of the NFC, should also be separated from the remained of the building by 1-hour fire separations.

The items noted in Articles 5.5.3.1. to 5.5.3.6. of the NFC should be reviewed and incorporated in to the Fire Safety Plan.

A review should be conducted in consultation with the operators of each laboratory to identify materials and operations that could create flammable vapours and to confirm or upgrade any electrical equipment within these areas, as required by Article 5.5.3.4. of the NFC and CSA C22.1.

A review of the fume hoods and hood exhaust ducts from the hoods to the service cores throughout the building should be conducted for their conformance with the NBC and NFC (particularly Subsection 5.4.4. of the NFC and Section 6.2. of the NBC) and to provide recommended upgrades.

A framework that permits the staff of each lab to know and comply with the various provisions regarding the storage and use of dangerous goods, as described in Subsection 5.5.5. of the NFC, should be prepared and incorporated in to the Fire Safety Plan. This documentation should also be provided in each laboratory.

4.13.2 Storage Garages

- **Applicable Requirements**

In accordance with Sentence 3.3.5.6.(1), a storage garage is required to be separated from other occupancies by a fire separation with a fire-resistance rating not less than 1½-hours.

- **Assessment of Existing Conditions**

Almost all vehicular parking for the building is in exterior parking lots. The main plant area has several overhead doors that can be used for the passage of vehicles so that they could temporarily park and unload goods within the building. These areas are not those specifically addressed by the NBC with regard to storage garages.

- **Recommendations—Priority B**

It should be confirmed that no portions of the warehouse are being used for long-term storage of vehicles. If portions of the building are being used for this purpose, they should be separated from the remainder of the building by a fire separation with a fire-resistance rating not less than 1½-hours. If storage is generally transitory and limited to vehicles associated with the storage uses in the

warehouse (and not just general vehicle storage), then this requirement may be waived.

4.13.3 Repair Garages

- **Applicable Requirements**

In accordance with Sentence 3.3.5.5.(1), a repair garage and any ancillary spaces serving it, including waiting rooms, reception rooms, tool and parts storage areas, and supervisory office space, are required to be separated from other occupancies by a fire separation having a fire-resistance rating not less than 2-hours.

Facilities for dispensing fuel within storage or repair garages that has a flash point below 37.8°C (e.g., gasoline) is not permitted to be installed within a building.

- **Assessment of Existing Conditions**

It does not appear than any portions of the building are used for this purpose.

- **Recommendations—Priority B**

It should be determined if any portions of the building are being used as repair garages. If so, repair garages should be separated from the remainder of the building by fire separations with not less than a 2-hour fire-resistance rating.

4.14 General Building Operations

The NFC provides the basic operational requirements for fire safety within a building. The NFC does not necessarily provide all requirements itself and does refer to external codes and standards for these requirements.

4.14.1 Inspection Testing and Maintenance of Fire Protection Equipment

- **Applicable Requirements**

The following is the list of relevant standards for inspection, testing, repair, or modification of life safety systems within the building:

- NFPA 10-2007 for the inspection and maintenance of portable fire extinguishers;
- NFPA 13-2007 for repairs or modifications to water-based sprinkler system;
- NFPA 14-2007 for repairs or modification to the standpipe systems;
- NFPA 20-2007 for the installation and maintenance of stationary fire pump systems;

- NFPA 25-2008 for the inspection, testing, and maintenance of water-based fire protection systems;
- NFPA 80-2007 for the installation and maintenance of fire doors and other opening protectives;
- ULC-S524-06 for the repair and modification of fire alarm systems; and
- ULC-S536-04 for the inspection and testing of fire alarm systems,

- **Assessment of Existing Conditions**

As part of our site visits, we have received a number of inspection reports, including

- fire alarm subpanel inspection reports for pre-action systems,
- various inspection reports for wet systems throughout the building,
- fire hydrant test reports,
- fire pump test reports,
- backflow preventer inspection reports,
- standpipe test reports,
- fire extinguisher reports, and
- Treasury Board fire protection compliance monitoring reports.

- **Recommendations—Priority A**

All periodic testing requirements should be consolidated in to a single document that identifies the applicable systems and required testing criteria. The results of testing should also be consolidated in to a coordinated filing system that permits convenient checking.

The template provided by EC titled "Fire Protection Standards and Log Book" is a comprehensive document that should be used for this purpose. This logbook should also include a list of applicable and referenced standards at the beginning of the document so that when referenced standards are updated, the relevant portions of the document can also be updated.

4.15 Emergency Planning

- **Applicable Requirements**

The SFSPFEO, is a comprehensive document applicable to the entire CCIW site and all buildings within it.

The SFSPFEO is to be read and implemented in conjunction with Part II of the *Canada Labour Code*, Part XVII of the *Canada Occupational Safety and Health Regulations*, and the requirements of the NFC regarding emergency planning.

Section 2.8 of the NFC outlines the various requirements for emergency planning within the building. The fire safety plan requirements of the NFC are included with the SFSPFEO.

- **Assessment of Existing Conditions**

The SFSPFEO requires an approved copy of the Fire Safety Plan to be distributed in manual form to each member of the fire emergency organization. A copy of this document is required to be kept at the main fire alarm and control facility of the NWRI building.

Further, the fire emergency procedures are required to be prominently posted on each floor and all government employees are expected to be familiar with the instructions contained therein.

- **Recommendations—Priority A**

A Fire Safety Plan for the WTC that incorporates the requirements of Subsection 2.8.2. of the NFC and the SFSPFEO should be prepared and incorporated in to the Fire Safety Plan for the CCIW site.

Emergency procedure signage should be replaced with current information and be posted consistently across the CCIW facility.

End of report.

Prepared by:

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2016-03-31

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Appendices

APPENDIX A
ORDER OF MAGNITUDE COST ESTIMATE

Canadian Centre for Inland Waters (CCIW)

Order of Magnitude Estimate #1

MARCH 31, 2016

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1.0 EXECUTIVE SUMMARY

1.1. Instructions Received

1.1.1. This report has been prepared by BTY Group ("BTY") at the request of LMDG Building Code Consultants Ltd. (the "Client").

1.1.2. The Client has appointed BTY to provide an Order of Magnitude Estimate for Canadian Centre for Inland Waters Buildings Fire Protection Study, (the "Project"). It is not known whether the Project will be delivered using a Stipulated Price Contract construction model and, therefore, BTY strongly recommends that estimates are prepared at each of the key design milestones.

1.1.3. Information related to the Project for the purposes of this report was received by BTY on March 22, 2016. Please refer to Section 12.0 for confirmation of information has been reviewed in producing this report.

1.2. Report Findings

1.2.1. The current estimated costs of construction are as follows: -

1) NWRI Building $3,842,700
2) WTC Building $615,700
3) Annex Building $55,400

1.3. The above costs do not include any allowance for hazardous material removal.

2.0 Report Purpose

2.1.1. The purpose of this report is to provide a realistic assessment of the Project cost based on the information available at the time of writing this report. This will assist Canadian Centre for Inland Waters (CCIW) and the Client in assessing the project viability from a financial perspective.

2.1.2. The opinion contained within this report has been prepared without the benefit of reviewing any detailed architectural, mechanical, electrical or processing system drawings and, therefore, should be considered an Order of Magnitude estimate. Based on the information reviewed, our opinion on cost would be correct to a magnitude of approximately +/- 15% to 20%.

2.1.3. In order to provide an accurate cost estimate for the Project, BTY Group strongly recommends that a professional Quantity Surveying organization, such as BTY Group, is retained to provide a detailed analysis on any design information produced on behalf of the Client during the design development and construction phases. Should you have any queries regarding the content of this report, please do not hesitate to contact either of the following:

Ping Pang, PQS
pingpang@bty.com
604 734 3126

Connor Falls, PQS/MRICS
connorfalls@bty.com
604 734 3126

3.0 PROJECT DESCRIPTION

3.1. The proposed project is to provide cost estimates to all the repairs recommended in the fire protection study prepared by LMDG in November 2015 which are listed in Section 12 of this report.

3.2. The scope of work provided includes repairs related to fire separations, fire alarm systems, sprinkler systems, exit signage and the building elements.

3.3. Following are the list of buildings being assessed: -

- National Water Research Institute Building (NWRI);
- Water Treatment Centre Building (WTC;)
- Annex Building.

4.0 DEVELOPMENT COST SUMMARY

4.1. The current estimated cost of the project may be summarized as follows:

Item		Estimated Cost			Total Estimated Cost
		NWRI Building	WTC Building	Annex Building	
A.	Land Cost (Excluded)	0	0	0	0
B.	Construction	3,842,700	615,700	55,400	4,513,800
C.	Professional Fees	0	0	0	0
D.	Connection Fees & Permits	0	0	0	0
E.	Management & Overhead	0	0	0	0
F.	Project Contingency	0	0	0	0
G.	Furnishings, Fittings & Equipment	0	0	0	0
H.	Payable Goods & Services Tax	0	0	0	0
Sub-Total Project Cost		***3,842,700***	***615,700***	***55,400***	**$ 4,513,800**
I.	Escalation	0	0	0	0
Total Project Cost (2016 Dollars)		***3,842,700***	***615,700***	***55,400***	**$ 4,513,800**

Please note that, where zero dollar values are stated, BTY has excluded these costs and the values should be carried in a separate budget (if applicable).

5.0 BASIS & ASSUMPTIONS

5.1. Refer to our cost plans for detailed basic scope of work for each building.

5.2. The construction estimate is based on the following list of assumptions.

- Existing building structure will not be affected during the renovation work except for services penetrations unless otherwise noted in the cost plans;
- Access to occupied units and affected areas would be limited; however, all similar scope of work within a particular unit would be carried out in single phase;
- Building finishes will be reinstated to match existing conditions unless specified otherwise;
- Existing finishes are available in the market for replacement;
- Patching to penetration and hole assumed not larger than 25mm unless noted otherwise;
- Our GFA measurements in our cost plans are based on our order of magnitude estimate;
- Renovation would be carried out under normal working hours;
- Staging spaces and temporary utilities will be provided to the contractor free of charge.

5.3. Please note that BTY are not qualified to act as engineering and architectural consultants. Where assumptions have been made these assumptions cannot be relied upon as accurate assessments and should be reviewed by the design team.

6.0 EXCLUSIONS

6.1. The construction estimate includes all direct and indirect construction costs identified in the drawings and other information provided by the Client.

6.2. The estimate specifically excludes the following:

- Professional fees and disbursements unless stated otherwise;
- Planning, administrative and financing costs;
- Legal fees and agreement costs / conditions;
- Building permits and development cost charges;
- Temporary facilities for user groups during construction;
- Loose furnishings and equipment;
- Unforeseen ground conditions and associated extras;
- Other renovation to the existing buildings;
- Hazardous material removal;
- Off-site works;
- Accelerated schedule;
- Decanting and moving;
- Project commissioning;
- Erratic market conditions, such as lack of bidders, proprietary specifications;
- Unforeseen building conditions;
- Code upgrades unless specified in the Fire Protection Study;
- Seismic upgrades;
- Cost escalation past March 2016.

7.0 TAXES

The estimate **includes** the Provincial Sales Tax (P.S.T.) where applicable.

The estimate **excludes** the Goods & Services Tax (G.S.T.).

8.0 PRICING

8.1. The estimate has been priced at current rates taking into account the size, location and nature of the project. The unit rates utilized consider a construction management form of contract with competitively bid sub-trade pricing.

8.2. The estimate allows for labour, material, equipment and other input costs at current rates and levels of productivity. It does not take into account extraordinary market conditions, where bidders may be few and may include in their tenders disproportionate contingencies and profit margins.

9.0 RISK MITIGATION

9.1. BTY Group recommends that the Owner, Project Manager and Design Team carefully review this document, including exclusions, inclusions, contingencies, escalation and mark-ups. If the project is over budget, or if there are unresolved budgeting issues, alternative systems/schemes should be evaluated before proceeding into the next design phase.

9.2. Requests for modifications of any apparent errors or omissions to this document must be made to BTY Group within ten (10) days of receipt of this estimate. Otherwise, it will be understood that the contents have been concurred with and accepted.

9.3. It is recommended that BTY Group design and propose a cost management framework for implementation. This framework would require that a series of further estimates be undertaken at key design stage milestones and a final update estimate produced which is representative of the completed tender documents, project delivery model and schedule. The final updated estimate will address changes and additions to the documents, as well as addenda issued during the bidding process. BTY Group is unable to reconcile bid results to any estimate not produced from bid documents including all addenda.

10.0 CONTINGENCIES

10.1. Design Allowance

A design contingency of **Fifteen Percent (15%)** has been included in the estimate to cover modifications to the program, drawings and specifications during the further development of the design.

10.2. Construction Allowance

An allowance of **Ten Percent (10%)** has been included in the estimate for changes occurring during the construction of the project. This amount may be expended due to site conditions or if there are modifications to the drawings and specifications.

11.0 QUALIFICATIONS

11.1. Reliance Upon the Report

11.1.1. This report has been prepared in accordance with the scope of our Fee Proposal dated March 21, 2016 and is subject to the terms of that appointment. This report is for the sole and confidential use and reliance of the Client. BTY Group, its Directors, staff or agents do not make any representation or warranty as to the factual accuracy of the information provided to us on behalf of the Client or other third party consultants or agents, upon which this report is based. BTY Group will not be liable for the result of any information not received which, if produced, could have materially changed the opinions or conclusions stated in this report.

11.1.2. This report shall not be reproduced or distributed to any party without the express permission of BTY Group.

11.1.3. Any advice, opinions, or recommendations within this document should be read and relied upon only in the context of this report as a whole. The contents of this report do not provide legal, insurance or tax advice or opinion.

11.1.4. Opinions in this report are not an advocate for any party and if called upon to give oral or written testimony it will be given on the same assumption.

12.0 DOCUMENTATION REVIEWED

The list below confirms the information that we have reviewed in order to prepare our opinion contained within this report:

	Description	Date
Drawings		
	NWRI Building Floor Plans (17 sheets)	May 22, 2015
	WTC Floor Plans (3 sheets)	May 22, 2015
	Annex Building Floor Plans (1 sheet)	August 12, 2014
Reports		
	Fire Protection Study for NWRI Building	November 10, 2015
	Fire Protection Study for WTC Building	November 10, 2015
	Fire Protection Study for Annex Building	November 10, 2015

13.0 APPENDICES

APPENDIX II
WTC Building

Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority A						
4.1.1 — Fire Department Access Route	The building should be sprinklered throughout.	*Fire protection to building including making good ceiling and wall finishes; no allowance for new fire main*	4,200	m2	60	$252,000
4.1.3 — Fire Hydrant and Fire Department Connection	Additional directional signage and the provision of a hard surface to the Fire Department connection should be provided.	*Allowance for directional signage and fire department connection; no allowance for new fire main*	1	sum	8,700	$8,700
	Confirm with the Burlington Fire Department that current arrangement of Fire Department response to the NWRI is acceptable.	*Noted; no construction cost impact*				$0
4.2.1 — Proximity to Adjacent Buildings	The building should be sprinklered throughout.	*included in item 4.1.1*				$0
4.2.3 — Underground Walkway	Unless these improvements can be made to the walkway, or an alternative solution can be developed to provide an equivalent level of performance, the walkway should be restricted to service access only and not for general access.	*Noted; no construction cost impact*				$0
	The doors at both ends of the walkway that separate it from the adjoining buildings should be replaced with doors with a ¾-hour fire-protection rating.	*included in NWRI building*				$0
4.3.1 — Floor and Roof Assemblies	The building should be sprinklered throughout.	*included in item 4.1.1*				$0
4.3.4 — Building Service and Elevator Shafts	An audit of the ventilation systems, including how they pass through the floor fire separations, should be performed. Any locations where ducts pass though fire separations should be provided with fire dampers.	*Allowance for fire dampers (5 nos)*	1	sum	4,900	$4,900
4.3.12 — Rooms Containing Hazardous Processes and Operations	Provide a 1-hour fire separation between the group of laboratory rooms.	*Allowance for new fire rated doors and fire stopping to services penetration (assume all existing fire separation wall meet code requirement.*	1	sum	48,800	$48,800
4.4.1 — Closures — Fire Doors/Shutters	Any doors that do not have tags and are clearly unrated (wooden doors or old-style metal doors) should be replaced with new doors with the required fire-protection rating.	*Allowance for new doors (20 nos)*	1	sum	45,000	$45,000

Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority A						
4.4.2 — Closure — Fire Dampers	All supply and return air ducts that pass from the vertical shafts to floor areas should be provided with fire dampers at the fire separation of the vertical shaft.	*Allowance for fire dampers (20nos)*	1	sum	19,500	$19,500
4.4.4 — Firestopping	A contractor should be retained to perform a thorough review of all service penetrations.	*Allowance for 50 nos of firestopping*	1	sum	3,800	$3,800
4.6.4 — Egress Rooms from Rooms/Suites	The building should be sprinklered throughout.	*included in item 4.1.1*				$0
4.6.6 — Separation of Corridors and Travel Distance to Exits	The recommendation to sprinkler the building throughout will address any nonconforming travel distances to the exits.	*Noted; no construction cost impact*				$0
4.6.7 — Travel Distance within Open Floor Areas	Although not required by the NBC, the provision of painted egress aisles will ensure that storage within open floor areas does not create a nonconforming condition with regard to egress aisle lengths and widths. Aisles that meet the requirements of the NFC should be painted within open floor areas.	*Further information required; no construction cost impact*				$0
4.6.15 — Handrails and Guards	Any guard less than 1070 mm high or any handrail less than 920 mm high should be modified so that the top member is not less than this minimum height.	*Add metal pipe rails to existing 950mm ht. guardrails/handrails -Flr to roof, repaint all railing (4 stairs)*	1	sum	66,000	$66,000
	Conforming handrails should be provided for all stairs.	*Included in item 4.6.15*				$0
4.6.16 — Stair Treads and Risers	Contrasting nosings should be provided for all stairs.	*Contrasting nosings to stairs*	1	sum	11,300	$11,300
4.6.21 — Floor Numbering	Provide a consistent set of signs indicating floor numbers and exit stair designations for all exits within the building.	*Allowance for consistent signage indicating floor numbers in exit stairs*	1	sum	3,800	$3,800
4.7.1 — Automatic Sprinkler Protection	The building should be sprinklered throughout.	*included in item 4.1.1*				$0
4.8.1 — Type and Continuity of Fire Alarm System	The existing system should be retained and tested and maintained on an ongoing basis as required by CAN/ULC-S537-02.	*Maintenance cost; no construction cost impact*				$0
4.8.2 — Electrical Supervision and Signals to Fire Department	Any new devices added to the sprinkler or standpipe systems should be provided with supervision as required by the NBC.	*Allowance for new devices*	1	sum	2,300	$2,300

Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority A						
4.8.3 — Annunciator and Zone Indication	The zoning should be maintained as provided. If a sprinkler system is provided for the building, new zones should be added as required.	*Allowance for 2 new zones*	1	sum	30,000	$30,000
4.8.4 — Fire Detectors	The provision of a sprinkler system throughout the building will remove the requirement for the majority of detectors noted above.	*Noted; no construction cost impact*				$0
	An electrical contractor should be retained to provide an audit of the fire alarm initiating devices within the building to determine if devices have been provided at all locations as required by the NBC.	*Further information required from an electrical contractor*				$0
4.8.5 — Manual Stations	An electrical contractor should be retained to provide an audit of the fire alarm initiating devices within the building to determine if devices have been provided at all locations as required by the NBC.	*Auditing; no construction cost impact*				$0
4.8.6 — Audibility of Alert and Alarm Signals	An electrical contractor should be retained to provide an audit of the fire alarm sounding devices within the building to determine if devices have been provided at all locations and levels as required by the NBC.	*Auditing; no construction cost impact*				$0
4.8.7 — Visual Signals	A list of locations where the known or expected ambient sound level is above 87 dBA should be prepared and visual signal devices added in these areas.	*Allowance for signage*	5	no	220	$1,100
4.8.8 — Voice Communication	The voice communication system provides an increased level of safety within the building and should be retained and tested as required by the NFC.	*Auditing; no construction cost impact*				$0
4.9.1 — Emergency Power	An electrical contractor should be retained to verify that the fire pump has been connected to the emergency generator circuit. The electrical contractor should also confirm that any self-powered emergency lights provide the minimum 30-minute duration.	*Auditing; no construction cost impact*				$0
4.9.2 — Emergency Lighting	Since testing of the emergency lighting systems would require a shutdown of the normal power systems, a contractor should be retained to perform testing that is coordinated with the tenants, so that power is not interrupted for other power-sensitive operations within the building. The contractor should confirm that emergency lighting levels are as required by the NBC.	*Auditing; no construction cost impact*				$0

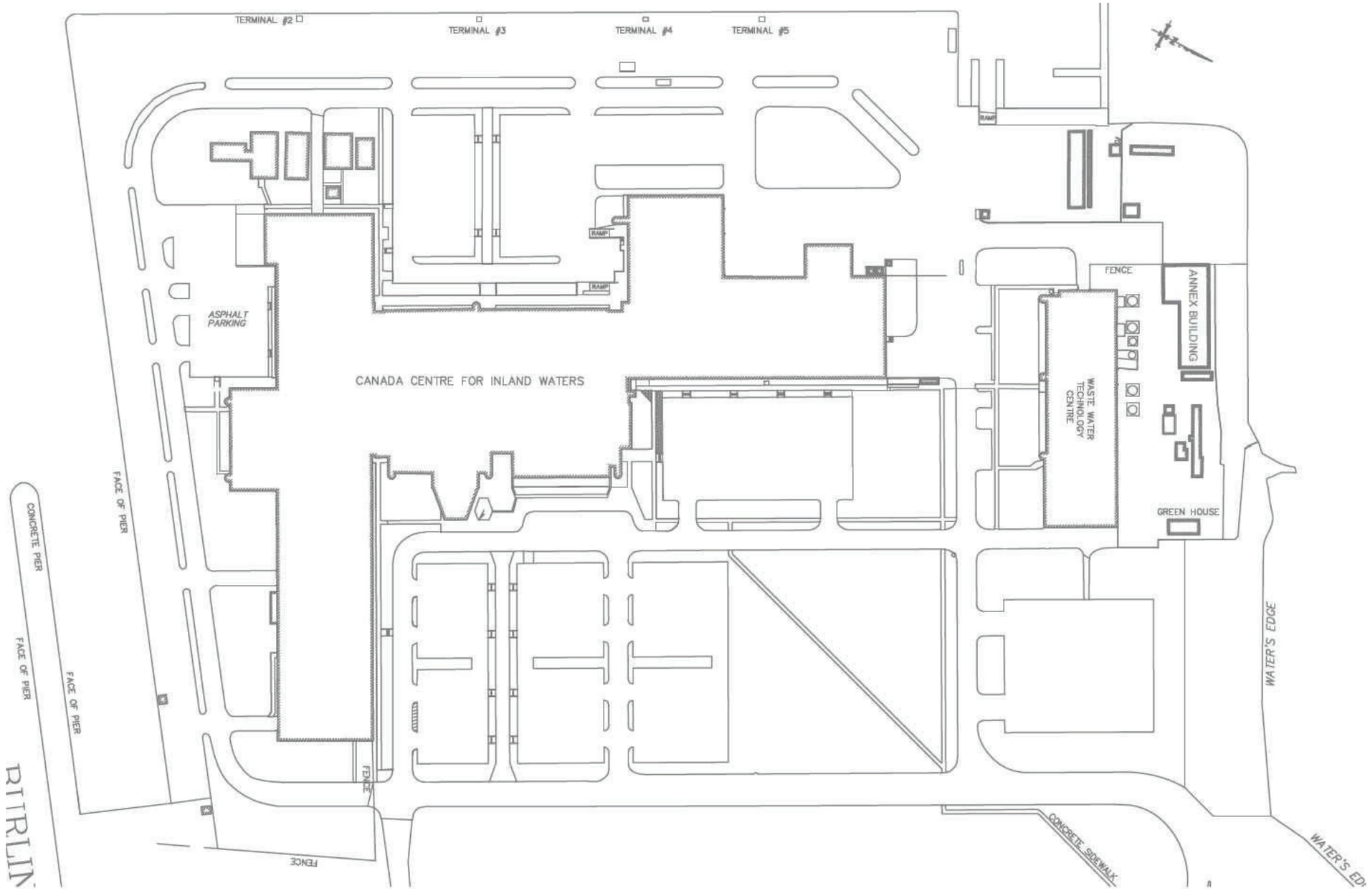
Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority A						
4.10 — Elevators (Applicable requirements?)	An elevator contractor should be retained to confirm that all elevators conform to CSA-B44-2007 and provide upgrades to the elevator systems if necessary.	*Allowance for elevator upgrades; not replacement*	1	sum	60,000	$60,000
4.11.1 — Compressed Gases	A list of flammable and toxic gases stored throughout the building should be prepared and maintained. This list should be cross-referenced against the requirements noted above to determine if the volumes of gases as currently stored meets the exemption requirements of Sentence 3.2.8.2.(2).	*Management cost; no construction cost impact.*				$0
4.11.2 — Rack Storage	A list of materials stored on the racks in the warehouse portion of the building that can be used to confirm that storage is in compliance with the NFC should be prepared and maintained.	*Consultant fees; no construction cost impact.*				$0
	This list should also be forwarded to a qualified sprinkler designer/inspector to confirm that the provided level of sprinkler protection meets the requirements of NFPA 13-2007.	*Consultant fees; no construction cost impact.*				$0
4.13.1 — Laboratories	Laboratories should be separated from the remainder of the building by a 1-hour fire separation.	*included in item 4.3.12*				$0
	The items noted in Articles 5.5.3.1. to 5.5.3.6. of the NFC should be reviewed and incorporated in to the Fire Safety Plan.	*Allowance for fire safety plan*	1	sum	3,000	$3,000
	A qualified electrical contractor should be retained to consult with the operators of each laboratory to identify materials and operations that could create flammable vapours and to confirm or upgrade any electrical equipment within these areas as required by Article 5.5.3.4. and CSA C22.1.	*Further information required; no construction cost impact.*				$0
	A specialty mechanical engineer should be retained to review the fume hoods and hood exhaust ducts from the hoods to the service cores throughout the building for their conformance with the NBC and NFC (particularly Subsection 5.4.4. of the NFC and Section 6.2. of the NBC) and to provide recommended upgrades.	*Further information is required; cost associated may be substantial if high plume exhaust system is required.*				$0

Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority A						
	A framework that permits the staff of each lab to know and comply with the various provisions regarding the storage and use of dangerous goods as described in Subsection 5.5.5 should be prepared and incorporated in to the Fire Safety Plan. This documentation should be provided in each laboratory.	*Documentation cost; no construction cost impact.*				$0
4.14.1 — Inspection Testing and Maintenance of Fire Protection Equipment	All periodic testing requirements should be consolidated into a single document that identifies the applicable systems and required testing criteria. The results of testing should also be consolidated in to a matching filing system that permits convenient checking.	*Maintenance and Testing cost; no construction cost impact*				$0
	The template provided by EC titled "Fire Protection Standards and Log Book" is a very comprehensive document, which should be used for this purpose. Our only additional comment is that this logbook be provided with a list of applicable and referenced standards at the start of the document so that as the referenced standards are updated, the relevant portions of the document can also be updated.	*Documentation; no construction cost impact*				$0
4.15 — Emergency Planning	A Fire Safety Plan that incorporates the requirements of Subsection 2.8.2. of the NFC should be prepared and incorporated in to the Fire Safety Plan for the CCIW site.	*Allowance for new Fire Safety Plan and emergency procedure signage; consistent throughout CCIW facility*	1	sum	11,300	$11,300
	Emergency procedure signage should be replaced with current information and consistent signage across the CCIW facility.	*included in item 4.15*				$0

Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority B						
4.3.10 — Garbage/Recycling Rooms	It should be determined if any rooms are specifically used for the storage of combustible recycling or refuse, and if so, provide a 1-hour fire separation around those rooms.	*Allowance for fire separation wall; 1 layers type X including doors.*	1	sum	3,500	$3,500
4.3.11 — Janitorial Rooms	By providing a sprinkler system throughout the building, the fire-resistance rating requirements for the janitorial rooms are waived and such rooms are only required to be provided with a door with self-closing device.	*Replace door hardware with self closing device*	1	no	900	$900
4.3.12 — Rooms Containing Hazardous Processes and Operations	It should be confirmed that no portions of the warehouse are being used for long-term storage of vehicles. If portions of the building are being used for this purpose, they should be separated from the remainder of the building by a fire separation with a fire-resistance rating not less than 1½-hours. If storage is generally transitory and limited to vehicles associated with the storage uses in the warehouse (and not just general vehicle storage), then this requirement may be waived.	*Not required as there are no repair garage/ vehicle storage area identified.*				$0
	Repair garages should be separated from the remainder of the building by fire separations with not less than a 2-hour fire-resistance rating.	*Not required as there are no repair garage/ vehicle storage area identified.*				$0
	An audit of compressed gas tanks within the building should be performed to confirm that the volume of compressed flammable gases within each fire compartment (each floor area or fire separated compartment within a floor area) is less than the 170 m³ permitted by the NFC.	*Auditing; no construction cost impact*				$0
	An audit should be performed of compressed gas tanks stored outside the building to confirm that, as based on the total volume of expanded gases, the storage is located sufficiently far enough away from openings within the building.	*Auditing; no construction cost impact*				$0
	For both cases noted above, once the maximum number of tanks has been determined for these specific areas, permanent signage should be installed in these locations to indicate these maximums to permit ongoing verification of compliance with the NFC.	*Allowance for permanent signage to gas tanks and compressed gas tanks (assume 20nos)*	1	sum	4,500	$4,500

Section	Recommendation	BTY Assumed scope of work	Quantity	Unit	Unit Cost	Estimated Cost
Priority B						
4.4.1 — Closures — Fire Doors/Shutters	Any doors that do not have tags but appear to be modern pressed steel doors that have at least a ¾-hour fire-protection rating should be upgraded as required with new doors with the required fire-protection rating.	*Allowance for fire rated doors*	10	nos	2,700	$27,000
4.6.20 — Exit Signs	Based on the inconsistency of exit signage observed throughout the building, and that some exit signs are not properly illuminated, all exit signs should be replaced with illuminated signs (with battery backup) complying with the current ISO standard.	*Allowance for new illuminated exit signs (10 nos); work performed in single trip*	10	nos	830	$8,300
TOTAL CONSTRUCTION COST (2016 DOLLARS)						**$615,700**

APPENDIX B
REDUCED ANNOTATED DRAWINGS



1 CANADA CENTRE FOR INLAND WATERS
SITE PLAN
NTS

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LMDG Project Number: 13-248
Drawn By: EWH/BV
File #: 13-248.CC.WTC.dwg
Date: March 30, 2016

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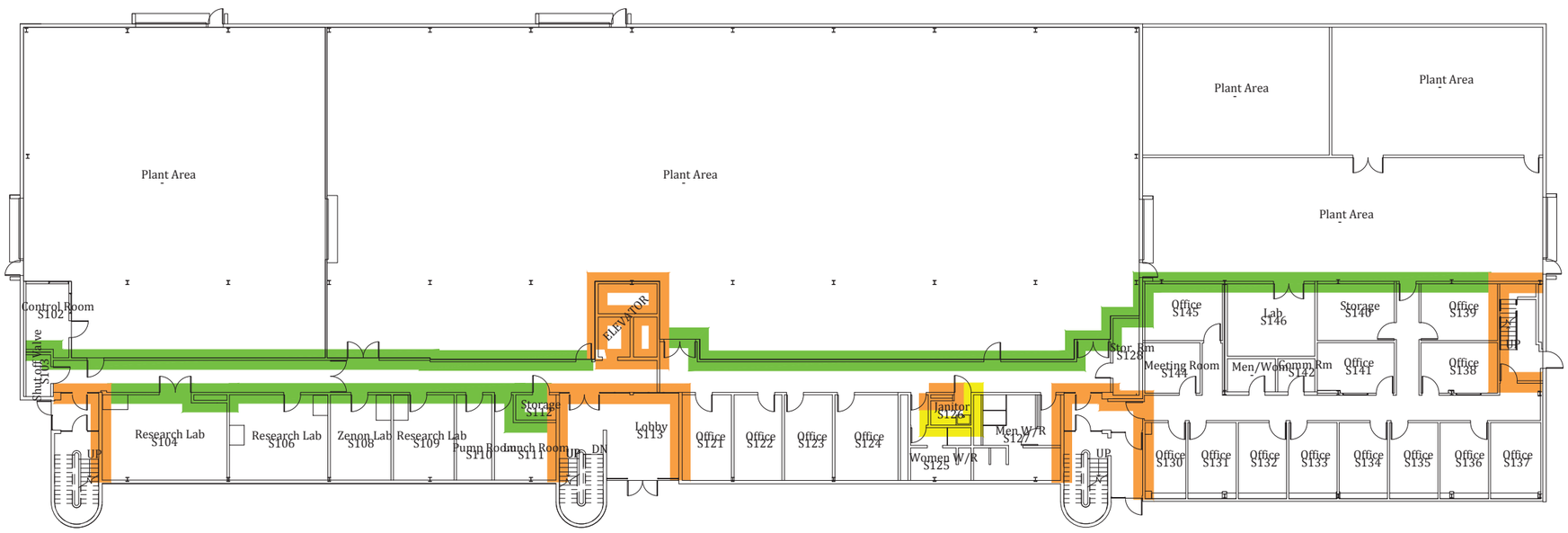
LEGEND

FIRE SEPARATIONS:

- 0-HOUR FIRE-RESISTANCE RATING
- 3/4-HOUR FIRE-RESISTANCE RATING
- 1-HOUR FIRE-RESISTANCE RATING
- 1-1/2-HOUR FIRE-RESISTANCE RATING
- 2-HOUR FIRE-RESISTANCE RATING

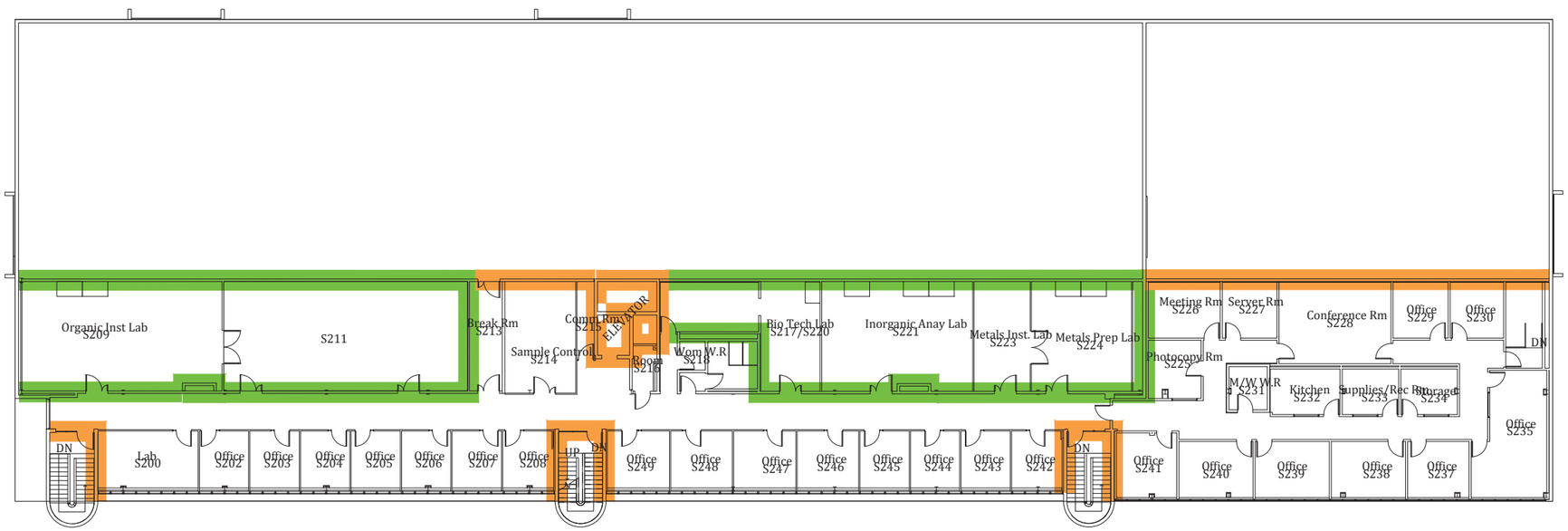
TRAVEL DISTANCE:

- TRAVEL DISTANCE TO AN EXIT



ANY ANNOTATIONS ON THESE DRAWINGS ARE NOT INTENDED TO DEMONSTRATE THAT REQUIRED FOR CODE COMPLIANCE. THE DIMENSIONS, WALL LOCATIONS, ROOM DESIGNATIONS, AND THE LIKE ASSOCIATED WITH THESE SPACE PLANS HAVE NOT BEEN CONFIRMED BY LMDG. THESE DRAWINGS HAVE BEEN INCLUDED TO FACILITATE LOCATION REFERENCES IN THE REPORT.

1 WTC BUILDING LEVEL 1
NTS



1 WTC BUILDING
LEVEL 2
NTS

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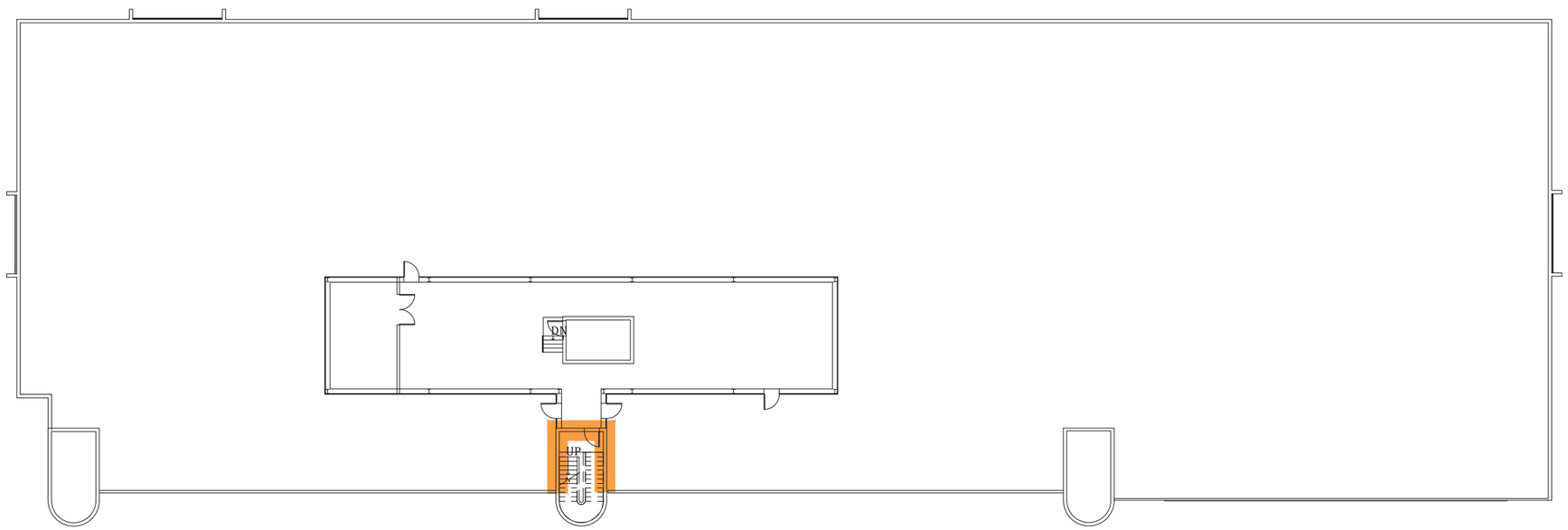
LEGEND

FIRE SEPARATIONS:

- 0-HOUR FIRE-RESISTANCE RATING
- 3/4-HOUR FIRE-RESISTANCE RATING
- 1-HOUR FIRE-RESISTANCE RATING
- 1-1/2-HOUR FIRE-RESISTANCE RATING
- 2-HOUR FIRE-RESISTANCE RATING

TRAVEL DISTANCE:

- TRAVEL DISTANCE TO AN EXIT



1 WTC BUILDING
PENTHOUSE LEVEL
NTS

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- 0-HOUR FIRE-RESISTANCE RATING
- 3/4-HOUR FIRE-RESISTANCE RATING
- 1-HOUR FIRE-RESISTANCE RATING
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- 2-HOUR FIRE-RESISTANCE RATING

TRAVEL DISTANCE:

- TRAVEL DISTANCE TO AN EXIT

LMDG

APPENDIX C
TREASURY BOARD OF CANADA SECRETARIAT'S FIRE PROTECTION STANDARD

Government of Canada Gouvernement du Canada

Canada

Home > Treasury Board Policy Suite

Fire Protection Standard

Tools & Resources
Table of Contents
Complete Text
Alternate Formats
Related Instruments
Policies
Directives
Standards
Related Links
Legislation and Regulations
Archives

1. Effective date

1.1 This standard takes effect on April 1, 2010.

1.2 This standard replaces the Treasury Board *Policy on Fire Protection, Investigation and Reporting* (1994-06-03).

2. Application

2.1 This standard applies to all departments within the meaning of section 2 of the *Financial Administration Act* (FAA), unless specific acts or regulations override it.

2.2 Sections 6.1.6, 6.1.7 and 6.1.8 do not apply to the Department of National Defence, for which fire protection services are provided by the Canadian Forces Fire Marshall pursuant to the Queen's Regulations and Orders issued under the authority of the *National Defence Act*.

3. Context

3.1 Further to the Treasury Board *Policy on Management of Real Property*, this standard establishes requirements for the departmental Fire Protection Coordinator with respect to the protection of federal real property and the safety of those who occupy and use these properties.

3.2 Fire protection is an essential and integral part of program and service delivery and key to public safety, real property protection and business continuity. Fire protection helps avert the interruption of government services that depend on physical infrastructure.

3.3 Fire protection is a continuous risk management process in which risks to real property and to the public are identified and reduced, and the costs and consequences of harmful or damaging incidents arising from those risks are minimized and contained. Fire protection relies on the collaborative efforts of federal custodians and tenants, private sector building owners, the Fire Protection Program (FPP) within the Labour Program at Human Resources and Skills Development Canada (HRSDC) and local fire services. Fire protection requires a comprehensive approach involving the application of building, fire, and occupational health and safety codes. These codes are primarily concerned with life safety and property protection. The National Building Code of Canada (NBC), the National Fire Code of Canada (NFC) and the National Farm Building Code of Canada (NFBC) prescribe the minimum standards for fire protection on federal property.

3.4 In most areas, local fire services provide firefighting and suppression services for federal real property; therefore, coordination and cooperation between departments, the Fire Protection Program (FPP) and local fire officials is important. Furthermore, the application of local building and fire codes may be sufficient when their requirements are equivalent to or greater than the requirements of the national codes.

3.5 This standard is issued pursuant to section 7 of the FAA.

3.6 This standard is to be read in conjunction with the *Policy on Management of Real Property*.

3.7 Treasury Board has delegated to the President of the Treasury Board the authority to amend this standard.

4. Definitions

Applicable local codes

Are building and fire codes enacted in Canada by provinces, territories and municipalities and abroad by local jurisdictions that meet or exceed the requirements of the National Building Code of Canada, the National Fire Code of Canada and the National Farm Building Code of Canada and are applied without contravening any federal statutes, laws or regulations and without prejudice to the Crown's legal and constitutional rights.

Departmental Fire Protection Coordinator

A senior official designated by the Deputy Head for the purpose of overseeing the implementation of the Fire Protection Standard.

Fire

Means any instance of destructive and uncontrolled burning of or in a federally owned or leased structure.

Fire protection

Means the protection of the life and safety of persons and real property from fire, including its prevention, detection, containment and extinguishment as well as alerting persons of its presence.

Serious fire

Is a fire that meets any of the following criteria:

- Involves death or serious injury;
- Results in a direct $250,000 loss or greater;
- Causes a significant interruption of essential federal services;
- Requires the suppression services of one or more local fire departments;
- Necessitates immediate action to prevent reoccurrence; or
- Damages the heritage character of one or more classified heritage buildings.

National Building Code of Canada

The 2005 version of the NBC (as amended periodically) sets out the requirements for the design and construction of new buildings. It also applies to the alteration, change of use and demolition of existing buildings.

National Fire Code of Canada

The 2005 version of the NFC (as amended periodically) sets out the requirements for the following:

- Activities related to the construction, use or demolition of buildings and facilities;
- The condition of specific elements of buildings and facilities;
- The design or construction of specific elements of facilities and their relation to certain hazards; and
- Protection measures for the current or intended use of buildings.

National Farm Building Code

The 2005 version of the NFBC (as amended periodically) outlines minimum requirements for human health, fire safety, and structural sufficiency in farm buildings.

Definitions found in Appendix A of the Treasury Board *Policy on Management of Real Property* also apply to this standard.

5. Standard statement

5.1 Objective

The objective of this standard is to protect and minimize losses to federal real property and protect the lives of those who use these properties from fire-related risks.

5.2 Expected results

5.2.1 Sound fire protection practices are in place in departments to ensure the following:

- The public is protected from fire-related injury on federal property;
- Damage from or destruction by fire of federal real property assets is averted;
- Fire-related interruption of federal program delivery is prevented; and
- Federal legal liability and costs to the Crown for loss due to fire are limited.

6. Requirements

6.1 The Departmental Fire Protection Coordinator is responsible for ensuring the following:

6.1.1 That cooperation between the department, the Fire Protection Program and the Treasury Board Secretariat (TBS) on matters related to fire protection is ongoing.

6.1.2 That real property in Canada administered by the department complies with the following:

a. The fire protection requirements of the NFC, the NBC and the NFBC or of applicable local codes when the following takes place:
   - There is a change in the use of the real property;
   - Real property is acquired (including lease renewal) or new structures are constructed; or
   - Existing real property is altered; and

b. The NFC or applicable local fire codes throughout the life cycle of the property.

6.1.3 That real property outside Canada administered by the department complies, to a reasonable and practical extent, with the following:

a. The fire protection requirements of the NFC, the NBC and the NFBC or of applicable local codes when the following takes place:
   - There is a change in the use of the real property;
   - Real property is acquired (including lease renewal) or new structures are constructed; or
   - Existing real property is altered; and

b. The NFC or applicable local fire codes throughout the life cycle of the property;

6.1.4 That fire protection equipment and systems under the department's operational control are inspected, tested and maintained in accordance with the requirements of the NFC and applicable local codes.

6.1.5 That fire protection equipment and systems installed to meet a tenant department's operational needs are compatible with the building's existing fire protection systems and are inspected, tested and maintained in accordance with the NFC and applicable local codes.

6.1.6 That conditions of access to departmental real property respect the following:

- The needs of the Fire Protection Program for the purpose of carrying out its duties and responsibilities;
- The needs of local fire officials for the purpose of carrying out their duties and responsibilities; and

- The specific security and operational requirements of the department.

6.1.7 That the Fire Protection Program is advised within 12 hours of any fire occurring in facilities administered by the department.

6.1.8 That when there is a serious fire, the development and implementation of a fire investigation plan and the investigation itself are carried out in cooperation with the Fire Protection Program and local authorities (where appropriate).

6.1.9 That in the case of a fire occurring in a tenant-occupied space, the Departmental Fire Protection Coordinator of the custodian department administering the property is immediately advised.

6.2 The Canadian Forces Fire Marshall of the Department of National Defence is responsible for ensuring that for properties administered by the Department, an annual report on the total number of fires, deaths and injuries and the total value of property loss is provided to the Fire Protection Program for inclusion in its *Fire Losses in Government of Canada Properties* report.

6.3 Monitoring and reporting

6.3.1 In addition to the requirements above, Departmental Fire Protection Coordinators are responsible for monitoring compliance with this standard within their departments and ensuring appropriate remedial action is taken when deficiencies arise.

6.3.2 TBS is responsible for monitoring departments' compliance with this standard, the performance measurement requirements of the *Policy on Management of Real Property* and the achievement of expected results in a variety of ways, including but not limited to the following:

- Advice and recommendations provided by the Fire Protection Program resulting from oversight inspections and risk-based audits conducted on behalf of TBS, fire loss reports, findings from the investigation of serious fires and other relevant information;
- Assessments under such systems of reporting as the Management Accountability Framework; and
- Examination of Treasury Board submissions and departmental performance reports.

6.3.3 TBS, in consultation with the Fire Protection Program, will review this standard and its effectiveness three years after the standard comes into effect.

7. Consequences

7.1 The deputy head can take remedial action to respond to situations of non-compliance, which could involve, for example, directing that certain work be undertaken, providing input on the performance assessments of implicated employees and raising substantive concerns with TBS.

7.2 Consequences of non-compliance may include TBS issuing requests for information or any measure allowed by the FAA that TBS determines to be appropriate and acceptable under the circumstances.

8. Roles and responsibilities of government organizations

This section in and of itself does not confer an authority.

8.1 TBS is responsible for leading the fire protection community of practice, which enables the sharing of best practices and lessons learned.

8.2 The Fire Protection Program, delivered by the Labour Program of the Department of Human Resources and Skills Development, is responsible for providing strategic advice to TBS with respect to the implementation of this standard, guiding the real property community through the

development of guidelines and best practices that support the effective implementation of this standard, preparing and publishing the *Fire Losses in Government of Canada Properties* report,and monitoring policy compliance and conducting risk-based oversight inspections on behalf of TBS. In addition, the FPP may provide various technical fire protection services to support custodians and tenants in their fire protection risk management activities subject to terms delineated in a service agreement between the FPP and departments.

9. References

9.1 Relevant legislation

Legislation of particular importance to the interpretation of this standard includes the following:

- *Financial Administration Act*
- *Federal Real Property and Federal Immovables Act*

9.2 Related policy instruments

This standard is to be read in conjunction with, among others, the following:

- *Policy on Management of Real Property* and its associated standards and directives:
  - *Accessibility Standard for Real Property*
  - *Reporting Standard on Real Property*
  - *Appraisals and Estimates Standard for Real Property*
  - *Directive on the Sale or Transfer of Surplus Real Property*
  - *Policy on Evaluation*
  - *Standard for fire safety planning and fire emergency organization*
  - *Policy on Internal Audit*
  - *Values and Ethics Code for the Public Service*

10. Enquiries

Please direct enquiries about this policy instrument to the organizational unit in your department responsible for this subject matter. For interpretation of this policy instrument, the responsible organizational unit should contact: TBS Public Enquiries.

Date Modified: 2009-11-09