The Office of the Fire Marshal
Bureau du Commissaire des incendies

Fire Investigation Services

Fire Investigation Report

Investigation No.: 252-034-2018

Investigation No.:	252-034-2018
Occurrence Date:	21-Aug-2018
Alarm Time:	12:51:05
Street. #:	650
Street:	Parliment St
Apt. #:	
City:	Toronto
Municipality:	Toronto
Province:	ON

Chris ter Stege	21-Aug-2019	**Kevin Pahor**	21-Aug-2019
Fire Investigator	Date	Technical Reviewer	Date

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Investigation No.: 252-034-2018

Major Occurrence: ☑

Explosion ☐ Fire Fatal ☐ Non-Fire Fatal ☐ Serious Injury ☐ Large Loss ☑ Fire Safety Issues ☐

Fire Investigator: Chris ter Stege
Fire Investigation Supervisor: Bob Deasy

Occurrence Date: 21-Aug-2018
Street: Parliment St
City: Toronto
Municipality: Toronto
Postal Code: M4X 1R3

Alarm Time: 12:51:05
Street. #: 650
Apt. #:

Attending Fire Department: Toronto Fire Services
Attending Police Department: Toronto Police Service

Fire Cause: Accidental - Electrical Failure
Property Type: Multi-Unit Dwelling - Over 12 Units

Property Loss:	$6,000,000
Content Loss:	$570,000
Exposure Loss:	$0
Total Loss:	$6,570,000

FD Incident Number: F18089480
FD Initial Attack: ☑ Offensive ☐ Defensive
FD Date and time On Scene: 21-Aug-2018 12:54:08
Date of Applic of the Agent: 21-Aug-2018 14:15:21
No Agent Applied: ☐

Scene Release Date: 23-Aug-2018
Report Approved Date: 15-Aug-2019

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Introduction

At 12:51 pm on the 21st of August 2018, the Toronto Fire Services were dispatched to a reported fire event at a multi-story, high rise apartment building. Emergency callers indicated fire and smoke spread within several floors of the apartment building.

Fire crews arrived at the 22 storey, 570 apartment, rental apartment unit located at 650 Parliament Street in the City of Toronto. Crews entered the building and identified smoke within the lobby area and persons trapped on their balconies above. Fire personnel searched the building looking for injured persons and active fire within each floor level as well as below grade. Initial information indicated that some sort of failure had occurred in the building's hydro vault within the first level below grade. This failure resulted in localized fires at the electrical panels on each of the residential floors causing smoke to enter into the hallways and some apartments throughout the building. Small fires that were located were extinguished using hand held extinguishers. Four persons were treated for minor smoke inhalation with two of the persons admitted to local hospital and discharged shortly afterwards. Upon suppression, fire crews and the Toronto Police Service assisted with the evacuation of all apartment units with persons transported to a local shelter nearby.

Preliminary information was provided by residents who indicated hearing a loud "Boom" from the basement level of the building with smoke erupting from the electrical closets on individual floors, spreading down hallways. These circumstances occurred shortly after a heavy rain flash downpour. Observations by fire crews identified localized fire within floors four through eighteen at the electrical closet panels. The loud eruptions continued in sequence with the floor shaking from beneath. Shortly after the smoke migrated throughout the hallway spaces with fire exposure observed on levels four to eighteen.

As a result of the injuries and large loss, the Toronto Fire Services requested the assistance from the Office of the Fire Marshal and Emergency Management (OFMEM) in determining the origin, cause and circumstances of this fire related event. Further, the Electrical Safety Authority (ESA) was contacted to attend due to indications of electrical issues that may have contributed to this occurrence.

650 Parliament street in the City of Toronto is described as a 24 storey (including basement/sub-basement), residential high-rise apartment building, built in 1966. The building is located on the west side of Parliament Street, south of Bloor Street East. The apartment building is comprised of two main tower sections divided into a south and north tower with the main entrance in the centre providing elevators to both halves. The exterior is finished in brick façade, concrete foundation and flat bitumen tar and gravel roof. The apartment units facing to the east and west elevation have exterior balcony's with steel guardrails. Resident parking is provided in the west and in underground parking shared with the adjacent building to the south. The natural gas shut off valve is located on the south elevation of the property while the main electrical vault (Toronto Hydro) is located centrally underground on the east elevation where it is fed to the main electrical room within the building on the first sub floor

basement via underground conductors to distribution panels in the basement. Each unit has its own dedicated electrical breaker panel within the apartment. The water meter room is located north of the electrical room where the main shut off valve is located. The main entrance to the building is located on the central east elevation where a designated fire route enters from the street. The building is protected by ADT private alarm monitoring company, private hydrants, fire hose cabinets (four per floor), as well as pressurized water and dry chemical extinguishers. Emergency lighting is powered by battery cells (120-minute duration – batteries replaced in November 2016). A sprinkler system maintains coverage within the basement, sub-basement, compactor room and garbage chutes. Smoke alarms are placed within each individual apartment unit and are battery powered. Heat detectors are located in the basement laundry, pump, sprinkler, locker, garbage, moving and disposal rooms. Smoke detectors are located in the elevator, ceilings of stairwells, and offices. The pull stations are located at every exit door on every floor. The fire alarm system is a single stage system with pull stations, acknowledge switch, emergency backup, alarm speakers and annunciator in the main entrance. 250 Wellesley St. E. (to the south) and 650 Parliament St. share the underground parking area and their fire alarms are interconnected.

The building is owned by Parwell Investment Ltd. The building and administration is compliant with current Fire and Building code regulations which is inspected regularly by a contracted private security and fire protection agency.

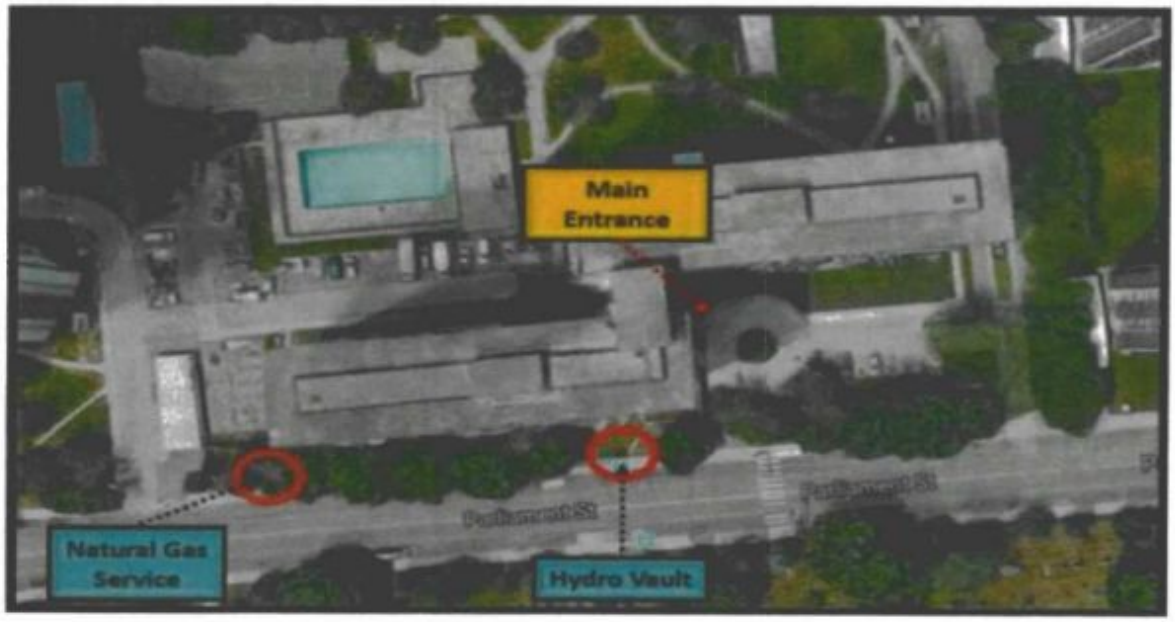

Photo # 1 - 650 Parliament St, Toronto, ON – *Photo Courtesy of GOOGLE Maps August 2017

Origin Analysis/ Validation

Exterior Fire Patterns

The exterior of the building was examined prior to entering the building. The exterior of the building did not present fire damage to the front (east), north, west and south elevations. The lack of exterior fire patterns or significant smoke spread indicate an interior fire origin.

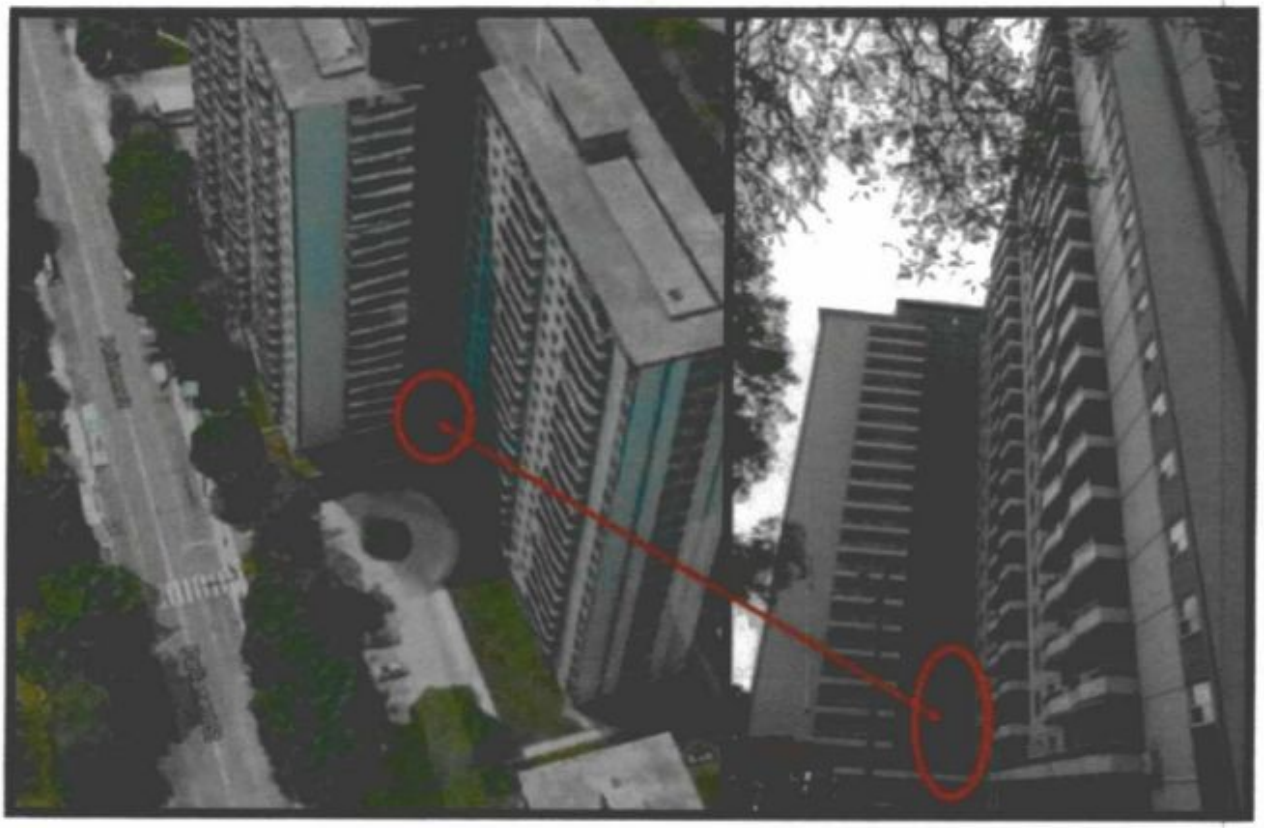

Photo # 2 (East Facing Side) – North and South Apartment Complex Units (Right Photo – Main Entrance) – Right Photo: Jpg # 1766

Interior Fire Patterns

The basement, apartment floors 1 through 22 and the roof were inspected for fire spread and exposure. Fire damage and subsequent fire patterns were concentrated to electrical closets on the individual apartment unit floors as well as in the basement where the main electrical distribution cabinets were located.

The electrical closets located on the south end of the hallway measured (L) 82" x (W) 43" x (H) 96". These closets were secured by deadbolts and fire safety double doors. The interior spaces were constructed of concrete within their interiors with plywood cladding along the west, north and south walls. The main circuits from the switch cabinet in the basement was routed along the west wall extending vertically to the floors above. Heat detectors were affixed to the ceilings within each cabinet unit.

Photo # 3 - **Exemplar Electrcial Cabinets Within Apartment Floors** *jpg # 1867

The following fire patterns were observed within the electrical cabinets and individual floors within the south apartment building:

Floors 1 to 5 – Fire damage was limited on these floors with partial consumption and charring occurring to the plywood wall cladding within the cabinets on floors four and five. The cabinet on floor five had charring and partial consumption to the plywood paneling in the southwest corner. This fire pattern extended from a confined vertical channel behind the plywood from floor to the ceiling.

Photo # 4 – **Electrical Cabinet on Floor Four – Charring to Plywood paneling** *Jpg # 1817/1822

Floors 6 to 14 – There was severe fire damage and evidence of arcing in these sets of closets including consumption of the plywood wall coverings lining the closets, paint consumption, charring and oxidation to the metal circuit channels. The paint on the fire doors on these floors was charred with sections o paint partially consumed on their surface areas. Fire patterns within these cabinets were a result o conductive and radiant heat transfer from the overheating electrical circuits routed through the wes wall cavity.

Photo # 5 - **Electrical Cabinet on Floor Seven – Paint Consumption and Oxidation to Metal Surfaces** *Jpg # 1862/1867

Floor 15 – There was severe damage to the heating buss duct with melting and solidifying of the aluminum, resulting in a large deposit of pooled aluminum at the bottom of the buss duct baseplate within the electrical cabinet. The plywood wall covering lining the closets remained intact with paint consumption occurring to the metal cabinets and fixtures. Charring to other painted surfaces was predominant on elevated cabinets and fixtures at ceiling height while oxidation occurred to the exposed metal circuit channels. The paint on the fire doors on this floor was charred with sections of paint partially consumed on their surface areas. Fire patterns within these cabinets were a result of conductive and radiant heat transfer from the main electrical circuits routed through the duct work.

Photo # 6 - **Electrical Cabinet on Floor Fifteen – Melted Aluminum and Oxidation to Metal Surfaces** *Jpg # 2008/2007

Apartments # 1512 and # 1514 had fire patterns to their interiors due to smoke migration from the electrical closet at the end of the hallway. Once the thermal layer from the cabinet impacted the doorways in the corner of the hallway, smoke was able to migrate into the entry ways of these apartments from gaps along and to the sides of the fire break doors. Smoke that penetrated through these gaps allowed for products of incomplete combustion to cool within and on the interior walls.

Photo # 6 – Radiant Heat Exposure to Apartment Unit # 1514 (Interior Unaffected) *Jpg # 2017/2018

Photo # 7 – Radiant Heat Exposure to Apartment Unit # 1512 (Interior Unaffected) *Jpg # 2026/2027

Floors 16 to 22 – There was less of a degree of fire spread to these upper floors. Soot and charring occurred to the plywood wall cladding. Charring to painted surfaces was predominant on elevated cabinets and fixtures at ceiling height while oxidation occurred to the exposed metal circuit channels. The fire patterns within these electrical closets on floors 16 through 22 was a result of smoke spread from below migrating through the confined wall cavities and conduit channels.

Photo # 8 – Electrical Cabinet on Floor Sixteen – Soot on Interior Surfaces/Charring to Plywood at South *jpg # 2034/2035

Photo # 9 – Electrical Cabinet on Floor Sixteen – Soot on Interior Surfaces/Oxidation to Channel Duct *jpg # 2040

Roof top elevator room – There was no visible damage to the elevator controls and equipment in this room or on the roof top itself.

Basement - The basement was examined, with fire pattern physical evidence isolated and contained within the electrical room in the east side of the building. Within the electrical room, fire damage was visible to the outsides of the switchgear cabinets. A soot layer was evident on all the equipment within this room. The main service cables entering the building from the outside vault entered through the east wall into a caged and secured room behind the switchgear cabinets.

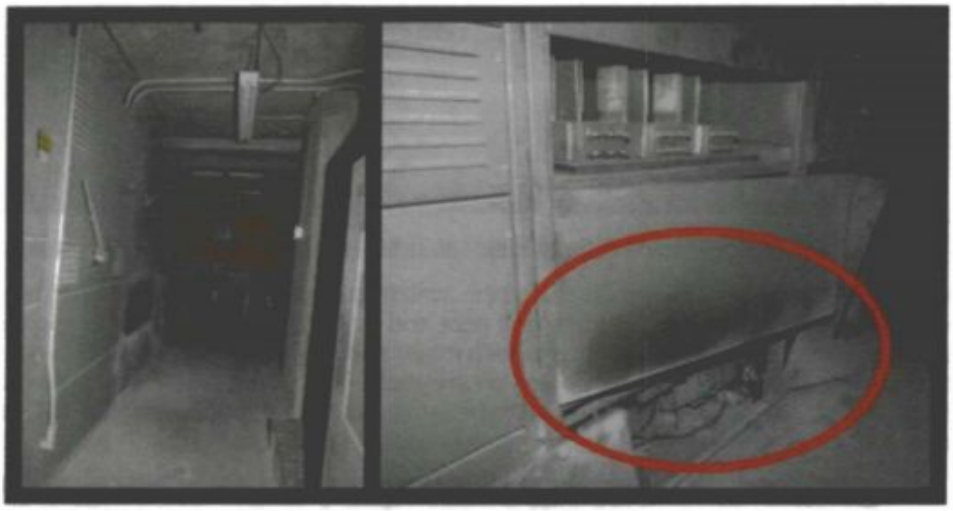

Photo # 10 - **Entrance to Electrical Room in Basment/Fire Pattern on Switchgear Cabinet** "jpg # 1794/2141

Switchgear cabinets had the doors pushed out slightly. Within, several banks of equipment had damage to the switchgear and/or had water pooled inside. The three main input fuses were physically intact. Subsequent testing confirmed that one had operated (tripped). The switchgear for the main service feed from the transformers was severely damaged, with evidence of arcing, and one of the service legs after the main fuses was damaged and consumed.

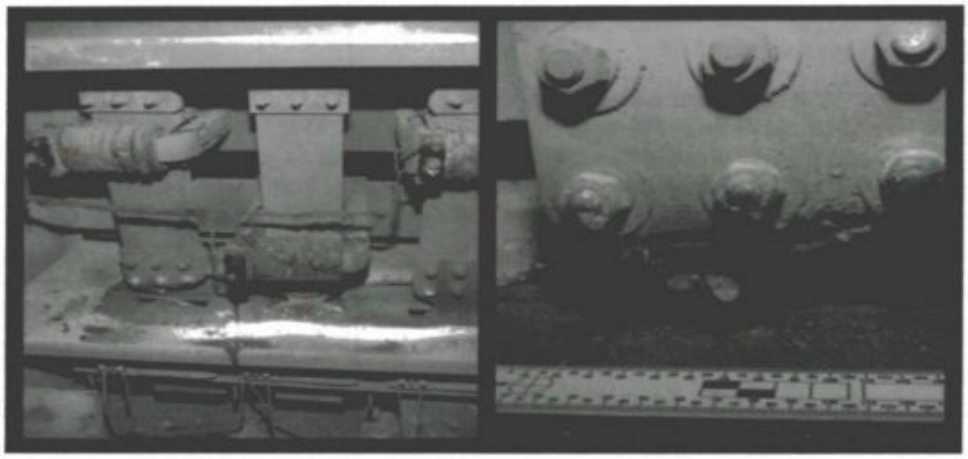

Photo # 11 – **Main Service Leg within Switchgear Cabinet / Close Up of Damaged Switchgear Link** *Jpg # 2142/2165

A vertical rack cabinet at the south end of the switchgear had four damaged shelves, each with doors, for switches and fuses. The top shelf had soot and burning evident to the components. The second shelf down contained undamaged fuses with minor soot deposits. The third shelf contained fuses with approximately a half inch of water pooled on the shelf. The bottom shelf had severe arcing evident and damaged shut off switches. In the northern most cabinet of the switchgear the ground cable had evidence of severe arcing with a portion consumed within the cabinet.

Photo # 12 – **Switch/Fuse Cabinet south of Switchgear Cabinet - Close Up of Damaged Switches** *Jpg # 2145/2144

Area of Origin

With regards to the area of fire origin, this investigator refers to the findings provided by OFMEM Forensic Engineering. They are as follows:

"The area of fire origin originated from a catastrophic failure of the electrical system in the building which caused the explosion in the electrical room and smaller explosions and fires throughout the building. From the severe damage observed throughout the different locations in the building determining one precise location as the start of the occurrence was not possible".

Fire Spread

The fire spread due to the lack of a direct route to the neutral ground of the buildings electrical system. The low current continued to reroute to an alternate path back to the ground within the transformer vault via the circuit conduits within the metal cabinets on the subsequent apartment floors above. These metal cabinets in the electrical closets on the floors became live electrically and began to increase in temperature. These high surface temperatures then allowed conductive heat transfer to impact combustible materials that came into contact with the energized circuits (such as plastic circuit wrap insulation and plywood lining the compartments). Once these combustibles heated up to their individual ignition temperatures, they began to off gas and ignite within the electrical closets. Further, smoke from the products of incomplete combustion migrated outwards from the doorways of the electrical cabinets as they were not a fully sealed compartment. This smoke that migrated outwards from the electrical closets cooled, creating soot deposits on interior hallway and apartment surfaces.

Fire Spread (exposure)

The fire did not spread beyond the building of fire origin resulting in any additional exposure losses to adjacent structures.

Fire Dynamics/ Ignition

Consideration and Isolation of Ignition Source

Under the Consideration of Ignition Sources title of this report, the mechanism of accidental ignition means was considered (within the area of fire origin) and isolated in the defining of the ignition sequence for the cause of the fire.

1. The ignition sequence, namely the ignition from a catastrophic failure of the electrical system in the building caused the explosion in the electrical room and smaller explosions and fires throughout the building. This ignition sequence hypothesis was formulated on the fire pattern evidence within the area of fire origin (the building), witness statements, and physical evidence located during the scene examination. This catastrophic failure of the electrical system generated enough heat energy to cause pyrolysis to the surrounding combustible materials, and subsequent ignition of those materials within the building and associated identified area of fire impact damage.

Validation and Testing of Hypothesis

Area of Fire Origin Analysis:

The reconstruction and fire pattern evidence discussed under the Area of Origin title of this report credibly supports an electrical failure originating from within the main switch gear cabinet of the hydro room in the east basement level of the building. The area of fire origin opinion is determined to be within the electrical system of the building itself and cannot be narrowed further. Firefighters first on scene observed fire within the electrical closets on each floor above the main electrical room which continued to spread to the interior spaces of the remaining electrical closets during fire suppression.

During the scene examination, several electrical conduits that was routed though the west wall channel wall joists of the electrical closets were affected along with evidence of electrical failure within the main switch gear in the basement. The electrical system of the building was examined by OFMEM FFPE B. PATERSON along with assistance from the Electrical Safety Authority (ESA).

A Forensic Engineering report was compiled by OFMEM Forensic Engineer B. PATERSON. The following excerpt from this report provided information on the scene analysis and subsequent follow up investigation of the electrical system within the building:

"I was advised by Fire Investigator ter Stege that the building maintenance staff reported water running down the staircase into the basement during the rain storm in the morning of the explosion/fire. ESA advised there were holes in the roof membrane that could allow water to enter the building. Consequently, the rain water entering the building must be considered a major catalyst and potential cause for shorting out the electrical system, causing arcing and possibly high resistance faults.

Lack of the neutral bond being carried from the vault to the electrical room could influence the operation of the system. With no neutral bond to ground in the building's electrical system high resistance faults might not trip a fuse. With no direct route to ground, the low current would try to find an alternate path back to the ground in the transformer vault via cabling, conduit or metal cabinets. Since the power remained on to the switchgear equipment for over an hour and seventeen minutes, the metal cabinets in the electrical closets on the floors could become live electrically, heat up and glow red. This high surface temperature could then ignite any combustible material in contact with the cabinets, including the plywood lining the electrical closets, causing the fires within the closets. Significantly sized fires were found in the electrical closets on floors 6 to 9 where the plywood lining had been consumed.

A catastrophic failure of the electrical system in the building caused the explosion in the electrical room and smaller explosions and fires throughout the building. From the severe damage observed throughout the different locations in the building determining one precise location as the start of the occurrence was not possible.

Potential causes for this occurrence to consider would be:

1) *Water impingement into the building's electrical system*

2) *Lack of a neutral bond wire in the building's electrical room; and*

3) *The age and maintenance of the building and electrical system"*

The detailed scene examination identified a singular ignition source - the accidental ignition of combustibles as a result of a catastrophic failure of the electrical system within the building which caused the explosion in the electrical room and smaller explosions and fires throughout the building. In this instance, the combustible material of the electrical conductors was identified as the first fuel ignited. Once ignited it allowed other combustibles in the area(s) (wood structural materials) to off gas and ignite (aided by the ventilation provided by the floor, wall channels and wall vents) once their ignition temperatures were obtained.

For a more detailed explanation of the cause and circumstances related to this fire, this investigation refers to the findings provided by the OFMEM Forensic Engineering report.

Conclusion

It is the opinion of this investigator that the fire event at the apartment complex property located at 650 Parliament Street in the City of Toronto, ON is of an ***Accidental*** cause. It is further the opinion of this investigator the cause of the fire was the ignition from a catastrophic failure of the electrical system within the building. Once the system went into overload failure, the circuits routed above to the overhead floors caused the plastic sheathing of the wires to melt. These exposed wires impacted upon the plywood wall sheeting of the electrical cabinets and other nearby combustibles causing them to off gas and ignite.

Therefore, this fire will be classified as: **Accidental - Electrical Failure**

Fire Safety Issues

*Please see FFPE Paterson's report and recommendations.

References

1. NFPA 921 Guide for Fire and Explosion Investigations, 2017 Edition
2. FFPE B. Paterson Engineering Report

Fire Investigation Report

Investigation No.: 252-034-2018

ELECTRONIC MEDIA

DVD — Scene Photos

FIRE CAUSE

Fire Cause:	Accidental - Electrical Failure
Motive:	Unknown
Explosion Type:	
Fuel Involved:	
Property type:	Multi-Unit Dwelling - Over 12 Units
Ignition Source:	Distribution Equipment (includes panel boards, fuses, circu
Fuel of Ignition Source:	Electricity
Area of Origin:	Hallway, Corridor, Mall
Object First Ignited:	Electrical Wiring Insulation
Incendiary Device:	Not applicable

STRUCTURAL DATA ELEMENTS

Complex:	Apartment
Building Status:	Normal (no change)
Occupancy Status:	Permanent - Person(s) Present
Construction Date:	1945-1975
Number Storyes:	24.0
Building Area:	2,001-4,500 sq M (21,258-48,349 sq ft)
Floor Construction:	Non-combustible
Ceiling Construction:	Concrete
Roof Construction:	Non-combustible
Interior Construction:	Masonry or concrete
Level of Origin:	More than one level
Flashover:	No
Fire Spread:	Confined to object of origin

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Fire Spread Reason(s):	Fuel Load Multiple points of origin Spread through ventilation Walls breached by fire
Smoke Spread:	Entire structure
Smoke Spread Reason(s):	Closures not smoke tight Interior walls not a complete enclosure Multiple points of origin Spread through ventilation

FIRE ALARM

Device Closest to the Area of Origin	Present - operated
Device Number:	1
Device Type:	Heat detector (part of a fire alarm system)
Device Location:	In room of fire origin
Alarm Type:	Other
Alarm Power:	Hardwired
Alarm Placement:	Ceiling mounted
Device Operation:	Device operated
Reason Inoperation:	Not reported
Device Number:	2
Device Type:	Interconnected smoke alarm
Device Location:	Same floor, beyond room of fire origin
Alarm Type:	Photo electric
Alarm Power:	Hardwired
Alarm Placement:	Ceiling mounted
Device Operation:	Device operated
Reason Inoperation:	Not reported
Device Number:	3
Device Type:	Smoke alarm (standalone)
Device Location:	Same floor, beyond room of fire origin

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Alarm Type:	Photo electric
Alarm Power:	Battery
Alarm Placement:	Ceiling mounted
Device Operation:	Device operated
Reason Inoperation:	Not reported

HUMAN BEHAVIOR

Number Persons in Structure:

Number Persons Escaped:

Building Safety Plan:

Plan Posted:

Followed Escape Plan:

Alcohol a Factor:

Smoking a Factor:

FI ASSISTANCE

Anticipated Evidence of: Lonnie Schubert

August 22, 2018 @ 0727 hours I was assigned, by Duty Supervisor Fischer, to attend the fire scene at 650 Parliament Street, Toronto.
1015 hours I met with TFS FI Bourne, FFPE Paterson, FI's terStege Chapdelaine, QARM Supervisor Hay and ESA personnel. We discussed the direction and a plan of action to successfully complete the investigation.
During the scene examination and investigation Toronto Fire Service personnel were escorting tenants to and from their apartments in the building.
TFS conducted all media releases during my time on scene.
August 23, 2018 @ 0810 hours I arrived back on the scene and stayed until OFMEM personnel had completed their tasks.
My purpose for attending at this scene was to assist with coordination of the investigation ibn assistance to FI terStege (Lead FI).