FIRE SAFETY and EMERGENCY PLAN
for
BOUNDARY LAYER WIND TUNNEL

The University of Western Ontario

FIRE ALARM AREA MAP # C-332

Last Update:
August, 2002

Prepared by:
UWO Fire Prevention
Services Building, Room 118
Ext. 88267
Building Fire Safety Plan for:

BOUNDARY LAYER WIND TUNNEL

C - 332
(Emergency Map Reference Number)

May, 2019
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1. Introduction

The Ontario Fire Code, Section 2.8 requires the implementation of a **Fire Safety Plan** for this building/occupancy. Typically, the plan is to be kept in the building in an approved location; however, due to the large number of buildings on and off campus, the Fire Safety Plans are maintained in a central database on the Western Fire Safety website. [www.fire.uwo.ca](http://www.fire.uwo.ca).

The implementation of the Fire Safety Plan helps to ensure effective utilization of life safety features in a building to protect people from fire. The required Fire Safety Plan should be designed to suit the resources of each individual building or complex of buildings. It is the responsibility of Western’s Fire Safety Department to ensure that the information contained within the Fire Safety Plan is accurate and complete.

The Fire Protection and Prevention Act Part VII, Section 28, states that in the case of an offence for contravention of the fire code, a corporation is liable to a fine of not more than $100,000 and an individual is liable to a fine of not more than $50,000 or imprisonment for a term of not more than one year or both.

This Official Document is to be kept readily available in the approved location for use by building occupants including; staff, fire officials, other public officials and Supervisory Staff.

**NOTE:** As per the letter of understanding between Western University (and its affiliates who wish to participate) and the London Fire Department received on February 5, 2014, the London Fire Department agrees with the purchasing of tablets and the provided fire safety plans via pdf or other agreed upon format as a means of alternate compliance concerning Sentence 2.8.2.1(3), [Functional statement F12 – to facilitate emergency response, Fire safety objectives 1.2 and 1.5 and Fire Protection Objective 1.2] of the Ontario Fire Code and the City of London Bylaw #F-167-159. London Fire and Western University will liaise going forward on updates of said Fire Safety Plans as required.
Definitions

**Alarm Signal**: an audible signal transmitted throughout a zone or zones or throughout a building to advise occupants that a fire emergency exists.

**Approved**: approved by the Chief Fire Official.

**Assembly**: the type of occupancy or the use of a building, or part thereof, occupancy by a gathering of persons for civic, political, travel, religious, social, educational, recreational or like purposes or for the consumption of food or drink.

**Building**: any structure used or intended for supporting or sheltering any use or occupancy.

**Check**: means visual observation to ensure the device or system is in place and is not obviously damaged or obstructed.

**Chief Fire Official**: the assistant to the Fire Marshal who is the City of London Fire Chief or a member or members of the fire department appointed by the City of London Fire Chief under Subsection 1.1.8. (of the Ontario Fire Code) or a person appointed by the Fire Marshal under Subsection 1.1.8.

**Class A**: a fire involving combustible materials such as wood, cloth and paper.

**Class B**: a fire involving a flammable or a combustible liquid, fat or grease.

**Class C**: a fire involving energized electrical equipment.

**Class D**: a fire involving a combustible metal.

**Class K**: a fire involving cooking oils.

**Exit**: that part of a means of egress, including doorways, that leads from the floor area it serves to a separate building, an open public thoroughfare or an exterior open space protected from fire exposure from the building and having access to an open public thoroughfare.

**Fire Separation**: construction assembly that acts as a barrier against the spread of fire and may or may not have a fire resistance rating or a fire protection rating.

**Incident Command**: the incident management structure used during emergencies by both Western University and municipal emergency agencies.
**Incident Commander:** the individual representing the authority having jurisdiction (London Fire Department) who is responsible for the coordination and response to a fire emergency.

**Incident Commander – Western University:** an individual authorized by the President to coordinate the University’s response to an emergency and to notify the Emergency Operations Control Group (EOCG) in the event of a major incident and/or the municipal emergency agencies incident manager.

**Inspect (Inspection):** means physical examination to determine that the device or system will apparently perform in accordance with its intended function.

**Occupancy:** the use or intended use of a building or part thereof for the shelter or support of persons, animals or property.

**Occupant Load:** the number of persons for which a building or part thereof is designed.

**Owner:** any person, firm or corporation having control over any portion of the building or property under consideration and includes the persons in the building or property.

**Single Stage Fire Alarm System:** a fire alarm system designed so that activation of any alarm initiating device (i.e. manual pull station, smoke or heat detector, etc.) will cause a general evacuation **alarm signal** to sound on all audible signal appliances throughout the building.

**Supervisory Staff:** those occupants of a building who have some delegated responsibility for the fire safety of other occupants under the Fire Safety Plan. This includes the Building Emergency Coordinator, Building Emergency Team members, and/or Residence Life Staff.

**Test:** means the operation of a device or system to ensure that it will perform in accordance with its intended operation or function.
2. Contact Information
   a. Emergency Contact Information

   **Fire, Police, Ambulance: 9-1-1**

   b. Building Key Holder(s) Information/Emergency Contacts:

   **Building Name:** Boundary Layer Wind Tunnel

   **Emergency Map Identification Number (Zone/Number):** C - 332

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone/Extension</th>
<th>Alternate Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campus Police</td>
<td>519-661-3300 / x83300</td>
<td>9-1-1</td>
</tr>
<tr>
<td>Fire Safety</td>
<td>519-661-3300</td>
<td>9-1-1</td>
</tr>
<tr>
<td>Fire Alarm Service</td>
<td>519-661-3304</td>
<td></td>
</tr>
<tr>
<td>(Electrical Shop)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sprinkler and Standpipe Service</td>
<td>661-3300</td>
<td></td>
</tr>
<tr>
<td>(Western Fire Safety)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elevator Service</td>
<td>519-661-3304</td>
<td></td>
</tr>
<tr>
<td>(Elevator Shop)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational Health and Safety</td>
<td>X82194</td>
<td></td>
</tr>
<tr>
<td>Damar Security Systems</td>
<td>1-800-265-7562</td>
<td></td>
</tr>
</tbody>
</table>

   c. Building Owner Information

   Western University C/O Fire Safety & Emergency Management

   Graphics Building Room 123

   London, ON N6G 1G9

   519-661-3300
3. Building Resources Audit

General
Occupancy Type: Group D/F – Offices/Laboratories

Occupant Load (If applicable): contact western fire safety for specific room occupancy loads

Designated Fire Route: South entrance off of Lambton drive via parking circle near Recreation Centre

Municipal/Private Hydrant Location: North of the building

Lockbox Location: N/A

Type of Heating: Steam

Main Gas Shut-off to Building: N/A

Main Electrical Shut-off Location: Room 24

Main Domestic Water Shut-off Location: Room 24

Fire Alarm System
Make: Simplex

Model: 4100U

Main Control Panel Location: North main entrance

Annunciator Panel Location(s): South Entrance #6 (temporary main entrance due to construction)

Fire Alarm Description: Conventional/Addressable Mixed

Monitoring: Damar Security Systems

Sprinkler System
Type: N/A

Connected to Fire Alarm System: N/A

Location of Shut-off/Isolation Valves: N/A

Fire Pump Location: N/A

Standpipe System: Yes

Location of Standpipe Shut-off/Isolation Valves: Room 24

Fire Department Connection: Yes, East of North Entrance
Other
Type of Specialty/Other Extinguishing System(s): N/A
Location: N/A

Portable Fire Extinguishers: Refer to Section 16, Building Diagrams

Type of Emergency Lighting: Battery Wall Packs

Type of Emergency Power: Battery backup

Generator Fuel Supply Type/Location: No Generator

Extra Hazardous Area Location(s): YES, Refer to Plan Appendix – Flarenet Research

Exits: Refer to Section 16, Building Diagrams

Elevators: No Elevators
4. Building Schematics (Floor Plans)

- Proposed Outdoor Cylinder Storage; Refer to Appendix for more details.
- Natural Gas Line and Outdoor Compressed Storage; Refer to Appendix for more details.
- Occupant Assembly Area
5. Controlling Building Fire Hazards
A high standard of housekeeping and general maintenance is the single most important factor in the prevention of fire. Subsequently, some common fire hazards have been identified;

- Combustible materials stored improperly and in mass quantities in unapproved locations.
- Fire Doors being propped open or not closing properly.
- Improper storage of flammable liquids and gases.
- Defective wiring of appliances and electrical equipment, and/or overloading of specific outlets, power bars and extension cords
- Improper disposal of oily rags

Reporting Fire Hazards
Please report all fire hazards to Western Fire Safety at 519-661-3300 or extension 83300. There is no need to give your name and all hazards will be investigated if reported by phone or in person (Please do not report fire hazards by fax or email).
6. Instruction to Occupants

Procedure in Event of a Fire

Throughout campus there are signs posted with instruction pertaining to fire procedures as well as directions to follow in the event of an emergency. A sample of this sign has been included in this plan. You should familiarize yourself with your building’s signage as well as the instructions listed on them.

When the Alarm Sounds:

- Gather your coat, keys, purse, etc. and close your door.
- Evacuate the building using the closest exit. DO NOT USE ELEVATORS
- Proceed to your predetermined meeting place and advise your supervisor, Building Emergency Team or Emergency Personnel of any pertinent information (i.e. People inside, location of the fire, etc.)
- DO NOT re-enter the building until given permission to do so.
Provisions for Persons with a Disability

Persons with a physical disability are, in many cases, limited in their ability to evacuate by means of stairwells. It is primarily for this type of disability that the following procedures apply.

For the purpose of fire safety planning, a “physical disability” is that which, even with the aid of Building Emergency Team members, would prevent that person from descending the stairs in an evacuation situation at a rate of speed consistent with the normal flow of other building occupants, or which would cause such person physical harm if they attempted to descend the stairs.

Procedure When an Alarm Sounds

Ground Level - Evacuation

If you can evacuate the building at ground level, a Building Emergency Team member (BET) or a volunteer should escort you to a safe location away from the building.

Above or below the ground floor – Shelter in Place

1. Seek a safe area with or without the assistance of a BET member.
2. When there is a fire alarm, if possible, phone Campus Police at 911 to inform them of your location, circumstance and intentions.
3. Tell the communication officer that your fire alarm is sounding but you have a disability and cannot leave your floor area. If you smell smoke, or are in immediate danger, immediately inform the communications officer.
4. The Building Emergency Team (BET) has been instructed to ask and help you to identify the location where you will wait for evacuation. They are not trained to lift and carry you out of the building. Please ask someone to remain in the building with you until trained rescue workers arrive from the fire department. Make sure someone either from the evacuation team or a volunteer has noted your location (which floor and/or stairwell/room number) and that this person will notify the authorities of your need for assistance.
5. Provide the phone number and extension you are calling from. It is IMPERATIVE that this number can receive return calls. Note that PAY telephones generally cannot receive incoming calls.
6. Campus Police have radio contact with officers at the scene and will provide you with updates on the situation via the phone number you provide. In the event that your safety could be compromised, Firefighters will assist in your safe evacuation. At any time, you can also call back for an update.

Whenever possible, the procedures to be taken for the evacuation of a person with disability must be discussed with the individual. Co-workers are also to be informed of these procedures in order to achieve a mutual understanding of the impairment, and the procedures to initiate during an evacuation.

The person(s) with the disability is usually the best judge of his/her abilities and can provide valuable assistance in developing an evacuation plan. Persons having a sensory
impairment (blindness, deafness, etc.) or a minor physical impairment can, with the assistance of their Building Emergency Team members, usually evacuate as quickly and safely as other building occupants. If this is the case, they may be permitted to carry out regular evacuation procedures. However, these persons may require at least one Building Emergency Team Member to alert them of the alarm, if necessary, and to assist them to evacuate.

In building fire evacuation exercises (i.e. fire drills), the Building Emergency Team members and persons with a disability are to carry out the actions they would normally carry out in an emergency (i.e., respond to the pre-arranged location on the floor area). In a drill situation, it is not necessary for persons with a disability to evacuate the building completely. This action could in fact pose a danger to these persons and their Building Emergency Team members, as well as for the other occupants of the building.

Upon initiation of a fire alarm, the Building Emergency Team members may respond with the persons with a disability to a pre-arranged location on the floor area that does not block other evacuation traffic.

In all situations, the Building Emergency Team members should ensure that one person is assigned to report to the Building Emergency Team Coordinator or Emergency Personnel, immediately upon evacuation, that the floor is clear and the number of persons with a disability, Building Emergency Team members, etc. evacuating at a slower rate and their location, so that assistance may be dispatched if available.

If for any reason the evacuation of a person with a disability must be suspended, and the people involved take refuge on a floor area other than their own, the Building Emergency Team members must make every effort to alert the Building Emergency Team Coordinator or other Emergency Personnel of their location. This can be done by advising other evacuees as they proceed down the stairs, by keeping a watch for would-be rescuers, searchers or fire fighters proceeding up the stairs, by using the telephone, or by waving or shouting from a window to alert bystanders and/or arriving emergency personnel.

The Building Emergency Team members or designated person should immediately advise the Building Emergency Team Coordinator or Emergency Personnel when the evacuation of persons with a physical disability has been completed.

It should be noted that telephone communications remain intact in many fire situations and an attempt should always be made to utilize this means of communication to either contact Campus Community Police Service or the Fire Department.

Occupants who require assistance in evacuating during an alarm are responsible for:
- Advising their Building Emergency Team Coordinator or Western Fire Safety so that a pre-plan can be established;
- Assisting the Building Emergency Team Coordinator or Western Fire Safety in appointing Building Emergency Team members;
- Telling their Building Emergency Team members how much help they may need; and
- Practicing the evacuation procedures.

Please send any unanswered questions or concerns to firesafety@uwo.ca
7. **Supervisory Staff**

- Campus Community Police
- Western Fire Safety
- Building Emergency Coordinator (BEC)
- Building Emergency Team members (BETs)
8. Responsibilities

Building Emergency Team (BET)

Building Emergency Teams are present in most buildings on campus. It is the function of the Building Emergency Team to assist and coordinate a prompt and organized evacuation of all building occupants in the event of an emergency. If members are in their designated area, they are to begin a sweep of the area and encourage everyone to exit and meet at the designated rally point. If members are not in their area, or they cannot get to their area, they are not to go back to do a sweep. Instead, members are to leave via the nearest exit and report this information to an official outside.

In the event of an emergency:

- Do not use your Building Emergency Team vest.
- Take your keys, coat, and any important information with you.
- Search your floor if you can do so safely.
- Encourage all occupants to close windows and doors to their area, and evacuate the building.
- As you leave the building, inform other occupants that they should be evacuating.
- If you know of persons who did not evacuate, notify the Building Emergency Coordinator or emergency personnel where these individuals are located upon exiting the building.
- If you see signs of smoke and/or fire, or any other emergency situation, react accordingly and report this information to your Building Emergency Coordinator and/or emergency personnel.
- If you feel confident in the operation of a fire extinguisher, and you feel it is safe to do so, first ensure the building fire alarm is activated, and then try to extinguish the fire. If you do not feel comfortable using a fire extinguisher, evacuate the fire area and ensure the building fire alarm is activated.
Building Emergency Coordinator (BEC)

The Building Emergency Team (BET) is coordinated by the **Building Emergency Coordinator (BEC)**. The Building Emergency Coordinator has the task of recruiting and maintaining a group of people who will act as members of their Building Emergency Team. During an Emergency evacuation, the BEC will proceed to a designated meeting place to await the arrival of the responding Emergency Services. The BEC will liaise with other Building Emergency Team members in order to determine any pertinent information about the emergency. Such information may include: areas of the building which have been searched, locations of people in the building, cause of the alarm, cause of the fire, signs of smoke or fire, or any other information which they deem important for responding Emergency Personnel. The BEC will relay this information to the incoming agencies and act as a liaison. An additional duty of the BEC is to inform other team members, upon the instructions from the Incident Commander be it Police, Fire or Other, that the building can be re-occupied. In the case that it is not possible to re-occupy the building, it is the duty of the BEC to relay to other team members that they will be required to move to the pre-determined temporary shelter building.

All Building Emergency Team members and Building Emergency Coordinators are issued vests which are to be donned in the event of an emergency. These vests assist responding Emergency Agencies as well as building occupants in identifying their designation as Building Emergency Team members.
**Supervisors**

- Keep the doors in fire separations closed at all times.
- Ensure that the doors to stairways are kept closed at all times (or will close on activation of a fire alarm)
- Keep access to exits and exit doors, inside and outside, clear of any obstructions at all times.
- Ensure that stairways, landings, hallways, passageways, and exits, inside and outside, are kept clear of any obstructions at all times.
- Ensure that combustible materials are not accumulated in any part of a stairway, fire escape or other means of egress, or near elevator and ventilation shafts.
- Ensure that combustible waste materials do not accumulate in locations that may constitute an undue fire hazard.
- Promptly remove all combustible waste from your area.
- Keep access roadways, fire routes and fire department connections clear and accessible for fire department use.
- Participate in fire drills.
- Have a working knowledge of fire alarm procedures and the building fire and life safety systems.
- Ensure the building fire and life safety systems are in operating condition.
- Maintain fire protection equipment visibility and access.
- Arrange for an alternate person to be responsible for your duties in the event of your absence.
- Comply with the Ontario Fire Code.
Western Fire Safety

Western Fire Safety has numerous responsibilities related to fire safety and must ensure that the following measures are enacted:

- Establishment of emergency procedures to be followed at the time of an emergency.
- Instruction of supervisory staff and other occupants so that they are aware of their responsibilities for fire safety.
- Conducting fire drills in accordance with the Ontario Fire Code, incorporating Emergency Procedures appropriate to the building.
- Control of fire hazards in the building.
- Provisions of alternate measures for safety of occupants during shut down of fire protection equipment.
- Assuring that checks, tests and inspections as required by the Ontario Fire Code are completed on schedule and that records are retained for the required period.
- Ensure that the information in the Fire Safety Plan is current.
- Train sufficient building supervisory staff and alternates
- Maintain the provisions of the Fire Safety Plan.
9. Assembly Area(s)
The following table indicates the assembly areas for the building:

<table>
<thead>
<tr>
<th>Boundary Layer Wind Tunnel</th>
<th>Assembly Area</th>
<th>North of building near Spencer Engineering or South of building near Western Rec. Centre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Shelter</td>
<td>Spencer Engineering Building</td>
<td></td>
</tr>
<tr>
<td>Secondary Shelter</td>
<td>University Community Centre</td>
<td></td>
</tr>
</tbody>
</table>
10. Fire Drills

Campus fire drills are conducted in accordance with the Ontario Fire Code. This Code states that a fire drill, for at least supervisory staff, must occur once per year in all buildings equipped with fire alarm systems, every six months in buildings that have laboratories that use flammable or combustible liquids, every three months in high rise buildings, and monthly for day-care facilities.

A fire drill is a tool that can be used to train employees who have supervisory duties, expose building occupants to fire evacuation procedures, identify concerns that affect the occupants’ ability to evacuate, and increase the general fire safety awareness among building occupants.

As the name implies, a fire drill is just that, a “drill”, or a “practice” that is conducted during a non-emergency time. Building occupants are given the opportunity to carry out any “fire alarm duties” assigned to them without the danger presented by an actual fire. Fire Drills also prove to be good practice for all Building Emergency Team members. This provides all occupants the opportunity to give feedback that can be used to alter and modify plans, routines and habits in an effort to make a real emergency as safe as possible.

A fire drill may also be used as a diagnostic tool that can help emergency planners understand the strengths and weaknesses of each building’s reaction to a fire alarm/emergency situation. These findings can then be used to make adjustments to fire safety plans, training programs, and future fire drills.

Fire drills identify to the occupants the audible and visual evacuation devices and emergency tones that are heard and seen during an alarm as well as reinforce the procedures that are to take place during an alarm.

Participation in fire drills is mandatory, and each person within a building is expected to evacuate when the fire alarm sounds.

Fire drills will be held at least annually in this building to ensure efficient execution of the Emergency Procedures. Fire drill records are required to be retained for a period of one year.
11. Fire Extinguishment/Control/Confinement

Ensure that the Fire Alarm System has been activated and that the Fire Department has been notified prior to an attempt to extinguish a fire. Only those persons who are trained and familiar with extinguisher operation should attempt to fight a fire. In the event that a small fire cannot be extinguished with the use of a portable fire extinguisher or the smoke presents a hazard for the operator, the door to the area should be closed to confine and contain the fire and the building should be evacuated.

**Portable Fire Extinguisher Operation**

Remember the acronym **P.A.S.S**.

**P** - Pull the safety pin

**A** - Aim the nozzle

**S** - Squeeze the trigger handle

**S** - Sweep from side to side (watch for fire restarting)

Never re-hang or put back extinguishers after they have been used. Ensure that discharged fire extinguishers are reported to Western Fire Safety and that a replacement extinguisher is provided.

Keep extinguishers visible and unobstructed.

Throughout campus there is signage posted indicating instructions pertaining to operation of fire protection equipment (Commercial Kitchen Suppression Systems, Special Fixed Extinguishing Systems, Fire Hose Stations, etc.) as well as directions to follow in the event of an emergency. The fire extinguisher procedure sign has been included in this plan. You should familiarize yourself with your building’s/area’s signage as well as the instructions provided. Contact Western Fire Safety for any further training.
12. Alternative Fire Safety Measures

Alternative fire safety measures will be implemented for any shutdown of fire protection equipment and systems or parts thereof. The London Fire Department will be notified of any shutdowns lasting longer than 24 hours.

All attempts to minimize the impact of malfunctioning equipment will be initiated. Where portions of a sprinkler or fire alarm system are placed out of service, service to remaining portions must be maintained, and where necessary, the use of fire watch personnel, radios, procedures, etc. will be employed to notify concerned parties of emergencies. Assistance and direction for specific situations are to be sought from Western Fire Safety & Emergency Management.

Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:

1. Adhere to all relevant University policies and procedures.
2. The London Fire Department is to be notified by Western Fire Safety of shutdowns lasting longer than 24 hours.
3. When required, persons/occupants in affected areas will be notified by the means identified by Western Fire Safety & Emergency Management.
4. When deemed necessary by Western Fire Safety & Emergency Management staff, or other reliable person(s), will conduct a Fire Watch within the affected area(s). All normally occupied areas shall be inspected and a log will be maintained via radio communication with CCPS radio system logging.
5. Alternative notification system(s) may need to be employed to evacuate occupants at the request of Western Fire Safety & Emergency Management or the London Fire Department.
6. During an emergency or unscheduled shutdown notify the Manager of Western Fire Safety & Emergency Management (or designate) via Campus Community Police Service Communications (519-661-3300). The notification is to be made by the employee or contractor creating the shutdown. Provide your name, address, phone number and/or location and a description of the problem including when you expect it to be corrected. Notify Community Campus Police Services again when repairs have been completed and systems are restored to normal.

Note: All shutdowns will be confined to as limited an area and duration as possible.

All hazardous operations (labs working with flammable and combustible liquids and gases) should be suspended in non-protected areas due to shutdowns.
13. Special Event Procedures

All Special Events are to have fire and life safety procedures developed if the provisions of the approved fire safety plan cannot be met. All special event organizers are to develop these plans in conjunction with Western Fire Safety.

The following are examples of special event items that would require the need for special procedures:

- Blocked exits
- Large quantities of combustibles
- Large number of persons with a physical disability
- High profile speaker(s)
- Change in building use
- Change in normal occupancy
- High occupancy loads

Check/Test/Inspect requirements of the Ontario Fire Code (OFC):

- Fire safety Officers check to ensure that the necessary checks, inspections, and/pr tests are being hon, when conducting their inspections
- This list has been prepared for the purpose of convenience only, for accurate reference please consult the OFC or Western Fire Safety
- The OFC states that records of all tests (and corrective measures required) be retained for a period of two years. For all documented records contact Western Fire Safety.
- All maintenance and testing of building fire and life safety systems are the responsibility of Western Fire Safety & Emergency Management.
General Fire Protection Systems/Equipment

General

- Fire hydrants shall be readily available and unobstructed for use at all times
- Doors in fire separations are to be checked as frequently as necessary to ensure that they remain closed
- Exit signs are to be clearly visible and maintained in a clean and legible condition
- Internally illuminated exit signs are to be kept clearly illuminated at all times when the building is occupied

Weekly

- When subject to accumulation of combustible deposits, hoods, filters, and ducts are to be checked weekly and be cleaned when such deposits create an undue fire hazard

Monthly

- Doors in fire separations are to be inspected monthly for proper operation

Yearly

- Hydrants shall be inspected annually after each use
  - Ensure hydrants are equipped with port caps, secured wrench tight. The port caps shall be removed annually and inspected for wear, rust, or obstructions
  - The hydrant barrel shall be inspected annually to ensure that no water has accumulated
  - The drain valve shall be inspected for operation if water is found in the hydrant barrel when main valve is closed
  - Hydrant water flow shall be inspected for operation annually and a record shall be kept
  - Yearly inspection and maintenance of hydrants is the responsibility of the City of London
- Fire dampers and fire-stop flaps are to be inspected annually, or based on a schedule, via contractor, acceptable to the Chief Fire Official
- Every chimney, flue and flue pipe are to be inspected annually and cleaned as often as necessary to keep them free from accumulations of combustible deposits
- Disconnect switches for mechanical air-conditioning and ventilating systems are to be inspected annually to establish that the system can be shut down
- Spark arresters are to be cleaned annually or more frequently where accumulations of debris will adversely affect operations. Burnt-out arresters should be repaired or replaced
Portable Fire Extinguishers

General

- Each portable extinguisher is to have a tag securely attached to it showing the maintenance or recharge date, the servicing agency, and the signature of the person who performed the service.
- A permanent record containing the maintenance date, the examiner’s name, and a description of any work or hydrostatic testing carried out is to be prepared and maintained for each portable extinguisher.
- All extinguishers are to be recharged after use or as indicated by an inspection or when performing maintenance. When recharging is performed, the recommendations of the manufacturer are to be followed.

Monthly

- Portable fire extinguishers are to be inspected monthly.

Yearly

- Extinguishers are to be subject to maintenance not more than one year apart or when specifically indicated by an inspection.
- Maintenance procedures are to include thorough examination of the three basic elements of an extinguisher:
  - Mechanical parts
  - Extinguishing agent
  - Means of expulsion

5 Years

- Every five years, pressurized water and carbon dioxide extinguishers are to be hydrostatically tested.

6 Years

- Every six years, stored pressure extinguishers that require a 12 year hydrostatic test are to be emptied and subjected to the applicable maintenance procedures.
Fire Alarm

General

- Fire alarm and voice communication system components are to be kept unobstructed
- Fire alarm control and annunciator panels are to be kept unobstructed
- Fire alarm system power supply disconnect switches are to be locked on in an approved manner

Daily

- The following daily checks should be conducted, and if a fault is established, appropriate corrective action should be taken:
  - The fire alarm panel is monitored 24/7 by Security for any alarms, faults, or trouble which will result in the immediate dispatch of persons to investigate.

Monthly

- Every month the following tests are to be conducted under battery back-up power and if a fault is established, appropriate corrective action if to be taken:
  - One manual fire alarm initiating device is to be operated, on a rotating basis, and should initiate an alarm condition
  - Function of all signal devices should be ensured
  - The annunciator panel is to be checked to ensure correct annunciation
  - Intended function of the audible and visual trouble signals are to be ensured
  - Fire alarm batteries are to be checked to ensure that:
    - Terminals are clean and lubricated where necessary
    - Terminal clamps are clean and tight
    - Electrolyte level and specific gravity, where applicable, meet manufacturer’s specification
  - Voice paging capability to one zone is to be tested monthly on a rotational basis
  - One emergency telephone is to be tested monthly on a rotational basis for operations and correct indication at control unit
  - Loudspeakers are to be tested monthly as an all-call signal to ensure they function as intended
  - At least one firefighter’s emergency telephone is to be tested monthly, on a rotational basis to ensure communication with the control unit. All telephones are to be tested each year

Yearly

- Yearly tests are to be conducted by a certified fire alarm technician as required by The Ontario Fire Code. Tests should be in conformance with CAN/ULC S536, “Inspection and Testing of Fire Alarm Systems”.

• Voice communications between floor areas and the central alarm control facility are to be tested annually, as required for fire alarm initiating and signalling devices.

Standpipe Systems

Monthly

• Hose cabinets are to be inspected monthly to ensure that the hose and equipment are in the proper position and appear to be operable

Yearly

• Plugs or caps on Fire Department connections are to be removed annually and the threads inspected for wear, rust, or obstruction. Re-secure plugs or caps wrench tight.
• If plugs or caps are missing, examine the Fire Department connections for obstructions, back flush is necessary, and replace plugs or caps
• Hose valves are to be inspected annually to ensure that they are tight and that there is no water leakage into the hose
• Standpipe hose is to be re-racked annually and after each use. Any work gaskets in the couplings, at the hose valve, and at the nozzle should be replaced.
Emergency Lighting System

Daily

- Check pilot lights for indication of proper operation

Monthly

- Batteries should be inspected monthly and maintained as per manufacturer’s specifications
- Ensure that the battery surface is clean and dry
- Ensure that the terminal connections are clean, free of corrosion and lubricated
- Ensure that the terminal clamps are clean and tight as per manufacturer’s specifications
- Emergency lighting equipment should be tested monthly to ensure that the emergency lighting will function upon failure of the primary power supply

Yearly

- Emergency lighting equipment should be tested annually to ensure that the units will provide emergency lighting for duration equal to the design criteria under simulated power failure conditions
- After completion, the charging conditions for voltage and current and the recovery period will be tested annually to ensure that the charging system is in accordance with the manufacturer’s specifications
Emergency Power Systems

General

- Emergency power systems should be inspected, tested and maintained in conformance with CSA C282, “Emergency Electrical Power Supply for Buildings”.
- To ensure continued reliable operation, the emergency power supply equipment should be operated and maintained in accordance with manufacturer’s instructions
- At least two copies of the instruction manual should be maintained

Monthly

- The emergency electrical power should be completely tested monthly as follows:
  - Simulate a failure of the normal power supply
  - Arrange so that:
    - An engine generator set operates under at least 30% of the rated load for 60 minutes and;
    - All automatic transfer switches are operated under load
  - Include an inspection for correct function of all auxiliary equipment such as radiator shutter control, coolant pumps, fuel transfer pumps, oil coolers, and engine room ventilation controls
  - Record all instrument readings associated with the prime mover and generator and verification that they are normal
  - Log and report as further prescribed in the manual of instruction for operation and maintenance
  - Check fuel supply for sufficient quantity

Annually

- Test the generator, control panel, and transfer switch in conformance with CSA C282, “Emergency Electrical Power Supply for Buildings”.
15. Fire Alarm System and Device Information

**Simplex 4100U**

Single Stage Fire Panel

**Automatic Devices:**

- Heat detectors
- Smoke detectors
- Duct detectors
- Gas Monitoring Equipment for Flarenet Research
  - Low level gas detection produces supervisory trouble
  - High level gas detection produces general fire alarm

**Manual Devices:**

- Manual Pull Stations
16. Gas Monitoring System Information

Electrochemical Carbon Monoxide (CO) Sensor/Transmitter
Model: AMC-291-M Series

Catalytic Combustible Sensor/Transmitter
Model: AMC-360 Series

Multi Channel Gas Monitor
Model: AMC-1800

Remote Alarm Modules
Model: AMC-RAM-3 Series
17. Appendix – Flarenet Research – Extra Hazardous Areas

EMERGENCY PLAN

Research Group: FlareNet

Author: Darcy Corbin

Last revision date: March 2018

Room and Building: Boundary Layer Wind Tunnel

Contact information:

Project Manager: Darcy Corbin – darcy.corbin@flarenet.ca – office: 519-661-2111 x 82240

Faculty Supervisor: Prof. Greg Kopp – gakopp@uwo.ca – office: 519-661-2111 x 87572

Section 1: This Emergency Plan is for:

- The storage, handling, and control of the compressed gas used for the Flarenet research project.

- Specific evacuating procedures for Boundary Layer Wind Tunnel building in emergency situation when Flarenet research is taking place.

Section 2: Compressed Gases to be Used

The specific gases to be used in FlareNet experiments have the following physical properties, warning properties, and exposure limits:

<table>
<thead>
<tr>
<th>Gas</th>
<th>Physical Properties</th>
<th>Warning Properties</th>
<th>O.Reg. 833 - Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>- colourless, odourless, flammable gas</td>
<td>- odourless to slight, sweet</td>
<td>TWA - 1000 ppm</td>
</tr>
<tr>
<td>Methane</td>
<td>- colourless, odourless, flammable gas</td>
<td>- none</td>
<td>- no limit</td>
</tr>
<tr>
<td>Ethane</td>
<td>- colourless, odourless, flammable, liquefied gas</td>
<td>- none</td>
<td>- no limit</td>
</tr>
<tr>
<td></td>
<td>- heavier than air and may accumulate in confined spaces</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Propane | - colourless, flammable, liquefied gas  
- heavier than air and may accumulate in confined spaces | - poor warning properties at low concentrations. stenchant often added. sweetish. | - no limit  

Butane | - colourless, flammable, liquefied gas  
- heavier than air and may accumulate in confined spaces | - unpleasant odour | - no limit  

Carbon Dioxide | - colourless, odourless, nonflammable, liquefied, inert gas  
- heavier than air and may accumulate in confined spaces | - none | TWA – 5000 ppm  
STEL – 30000 ppm  

Nitrogen | - colourless, odourless, nonflammable, inert gas | - none | - no limit  

Nitrous Oxide | - colourless, nonflammable, liquefied gas  
- heavier than air and may accumulate in confined spaces | - sweetish odour. Odour threshold is subjective and inadequate to warn for overexposure. | TWA – 25 ppm  

Hydrogen | - colourless, odourless, flammable gas | - none | - no limit  

The maximum size and quantities of gas cylinders expected to be required to sustain a single day of testing during FlareNet experiments are as follows:

<table>
<thead>
<tr>
<th>Gas</th>
<th>Location</th>
<th>Pressure – psig</th>
<th>Cylinder Capacity – m³ (kg)</th>
<th>Cylinders in Use</th>
<th>Total Capacity – m³ (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gas</td>
<td>Outdoors</td>
<td>3600</td>
<td>24 (16.8)</td>
<td>10</td>
<td>240 (168)</td>
</tr>
<tr>
<td>Methane</td>
<td>Indoors</td>
<td>2400</td>
<td>9.6 (6.4)</td>
<td>3</td>
<td>28.8 (19.2)</td>
</tr>
<tr>
<td>Ethane</td>
<td>Indoors</td>
<td>543</td>
<td>11.6 (14.5)</td>
<td>3</td>
<td>34.8 (43.5)</td>
</tr>
<tr>
<td>Propane</td>
<td>Indoors</td>
<td>109</td>
<td>9.9 (18.2)</td>
<td>2</td>
<td>19.8 (36.4)</td>
</tr>
<tr>
<td>Butane</td>
<td>Indoors</td>
<td>16.3</td>
<td>7.5 (18.2)</td>
<td>2</td>
<td>15 (36.4)</td>
</tr>
<tr>
<td>Gas</td>
<td>Environment</td>
<td>Pressure</td>
<td>Limit (LPC)</td>
<td>Flow Rate</td>
<td>Median Limit</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td>----------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------------</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>Indoors</td>
<td>830</td>
<td>14.9 (27.2)</td>
<td>1</td>
<td>14.9 (27.2)</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Indoors</td>
<td>2640</td>
<td>8.4 (9.8)</td>
<td>1</td>
<td>8.4 (9.8)</td>
</tr>
<tr>
<td>Nitrous Oxide</td>
<td>Indoors</td>
<td>745</td>
<td>15.9 (29)</td>
<td>1</td>
<td>15.9 (29)</td>
</tr>
<tr>
<td>Hydrogen</td>
<td>Indoors</td>
<td>2400</td>
<td>86.4 (7.2)</td>
<td>1</td>
<td>86.4 (7.2)</td>
</tr>
</tbody>
</table>

Additional cylinders to replenish the in use cylinders will require storage at a to be determined location in compliance with Sentence 5.6.2.3.(1) depending on the aggregate amount. It is preferred that a suitable location can be found which is greater than 15 m from any building opening such that volumes greater than 500 m³ can be stored.

**Section 3: Potential Hazards**

All compressed gases present the following hazards:

- contain gas under pressure and may explode if heated,
- may displace oxygen and cause rapid suffocation.

Additional specific hazard statements for the gases to be used in FlareNet experiments include:

- Natural gas:
  - extremely flammable gas
  - may form explosive mixtures with air
- Methane (CH₄)
  - extremely flammable gas
  - may form explosive mixtures with air
- Ethane:
  - extremely flammable gas
  - may form explosive mixtures with air
- Propane:
  - extremely flammable gas
  - may form explosive mixtures with air
- Butane:
o extremely flammable gas
 o may form explosive mixtures with air

- Nitrous Oxide:
  o may cause or intensify fire: oxidizer
  o may cause drowsiness or dizziness

- Hydrogen:
  o extremely flammable gas
  o may form explosive mixtures with air
  o burns with invisible flame

Section 4: Personal Protective Equipment

Any special requirements when working with the gas cylinders or on other parts of the project such as:

- Close-toe shoes
- Long pants or long skirt covering the legs from the waist to the top of shoes
- Safety glasses or goggles, as appropriate

Section 5: Engineering Controls

Engineering controls being utilized to minimize potential fires and exposures to compressed gases, include:

Kill switches, ventilation, wind tunnel automatic doors, gas monitoring equipment, fireproof paneling, etc.

- Flows of gases to the flare are controlled by mass flow controllers which have a fail to off valve in the event of a power failure.

- The mass flow controllers for the flare gases are centrally controlled by a data acquisition system that allows implementation of software controlled shut down or one-click cessation of gas flow to the flare

- Separate kill switches will be implemented at the control station to isolate fuel flow to the flare in the event of an uncontrolled gas leak or flame. One kill switch will control a solenoid at the outlet of the gas mixing manifold and cut off fuel flow to the flare. A second kill switch will control a solenoid located outside the building at the natural gas compressor station and isolate the flow of natural gas into the building.
• The wind tunnel has two large exterior doors which have been automated to allow them to be easily opened to purge unwanted gases from the wind tunnel between experiments or as otherwise desired. As the doors are controlled individually, either or both doors can be opened to purge the tunnel.

• To avoid any potential for ignition of the wind tunnel directly above the flare stack in the event of a system failure resulting in flame impingement on that surface, the plywood panels that comprise the entirety of the inside surface of the tunnel have been replaced with fireproof paneling in an area measuring 8’ wide and extending 4’ upstream and 20’ downstream of the flare.

• To protect the facility and personnel from an unknown leak of hydrocarbons, several hydrocarbon monitoring sensors have been installed and connected to the building fire alarm. The location of these sensors are: at the ceiling above the gas cylinder storage, at floor level adjacent the gas cylinder storage, at the lowest point of the wave tank in the event of a hydrocarbon leak from the burner, and at the ceiling of the wind tunnel space in the event of an unintended leak from the burner or a buildup of unburned hydrocarbon from the flame. All alarms are set to trigger at 20% and 40% of LEL. An additional monitor for CO is installed directly adjacent to the experiment control station in the laboratory space. Low alarms will trigger a local audio-visual alarm which will alert personnel to shut down the experiment. High alarms will trigger a building evacuation and notification of campus authorities.

• In addition to the separate, passively operated alarm system, the nature of the experiments -- which are intended to quantify pollutant emissions from gas flares - means that combustion products (including any unburned methane and produced carbon monoxide) are actively monitored during experiments.

Connection of Gas Cylinders and Natural Gas Line to Flare

• Gas cylinders are connected either directly to a regulator or in the case of multiple cylinders of the same gas to a manifold which is connected to a regulator. Each regulator will have a manually operated ball valve at its outlet downstream of which are mass flow controllers, check valves, mixing chambers, and the flare burner. To minimize discharge of pressurized gas in the lab space while disconnecting cylinders the procedure is as follows:
  
  o For disconnecting cylinders:
    
    ▪ Close valve (or valves) on cylinder stems of gas species to be changed.
    
    ▪ Open all relevant valves downstream of gas cylinders and purge the line pressure to the flare stack.
    
    ▪ Close ball valve at regulator outlet, disconnect CGA fittings from cylinders.
The natural gas line will enter the building through the east wall and cross over the top of the wind tunnel before terminating at a ball valve adjacent the cylinder area. Downstream of the ball valve, natural gas will be connected to a mass flow controller before being sent to the flare. As there is no need to connect or disconnect this line except from the ball valve to the mass flow controller, discharge from this line can be minimized by purging any pressurized volume downstream of the ball valve into the wind tunnel space.

**Potential for Ignition**

- All flammable gases used in the experiment are stored at a purity of 99% resulting in no risk of ignition of the stored gas as the purity is above the flammability limit. Flammable gases are regulated down to a working pressure of less than 60 psig by commercial gas regulators and then piped to mass flow controllers. The controlled flows of the individual gases are then mixed before being fed to the burner. At no point in the valve train is there oxygen present in the gas stream and therefore the conditions for ignition do not exist. Only after the gas exits the flare inside the wind tunnel volume is there sufficient oxygen for combustion to take place. The wind tunnel volume is approximately 1600 $m^3$ and the maximum flow rate of gas to the flare allowed by the controllers is on the order of 1 $m^3$ per minute. Assuming reasonable mixing it would take 16 minutes of uncontrolled gas release into the wind tunnel space to reach 20% of the LEL of methane. As such, it is suspected that the potential for unintended ignition of the flare gas is minimal.

**Section 6: Special Handling and Storage Requirements**

There are two project requirements for outdoor storage of compressed gases as indicated in Figure 1. Natural gas will be stored in permanently installed storage cylinders fed by a natural gas line and a commercial compressor. This system is being installed in the area between the east wall of the BLWT and the west wall of TEB in the fenced area as pictured in Figure 2. The second requirement is to find a satisfactory location for the temporary installation of a skid-based secure gas cage for storage of cylinders which will be brought inside for use. This location should be reasonably near the loading dock at the north end of the BLWT for ease of access.
Smaller volumes of compressed natural gas as outlined in Section 2 will be brought inside on a daily basis to be used as feedstock for the experiment. They will be secured at the location indicated in Figure 3 in the racks shown in Figure 4. These racks can hold up to six cylinders each with the cylinders being secured by chains. The location of the storage is directly adjacent to a hydrocarbon sensor installed at ground level to monitor heavier than air hydrocarbons and directly underneath a hydrocarbon sensor installed at ceiling level to monitor lighter than air hydrocarbons.
Section 7: Accidental Release Procedures

In the event of an accidental release of compressed gas, FlareNet personnel should act as follows:

- if safe to do so, isolate the source of the accidental release using the nearest upstream valve on the affected valve train,
- if safe to do so, isolate the source of the accidental release by decreasing to zero the outlet pressure of the gas regulator on the affected valve train, and
- if safe to do so, isolate the source of the accidental release by closing the individual cylinder valves on the affected valve train.

In the event of an accidental gas release which triggers a high alarm on the installed building gas monitor system, or in the event of a fire, the following procedure should be followed:

- pulling the fire alarm,
- evacuation of the building,
• if safe to do so, sweep building on your way out to check on other building occupants (including the closed loop wind tunnel laboratory space, workshop, other laboratory spaces, and offices),

• calling Campus Police at ext. 83300 or dial 911 for emergency assistance, and

• remaining on scene in a safe location until help arrives to assist.

Section 8: Exposure Procedures

As there are no toxicological risks associated with the gases used in the FlareNet experiments, the following procedures apply if exposure by inhalation occurs as a results of an accidental release of gas:

• remove to fresh air and keep at rest in a position comfortable for breathing,

• if breathing is difficult, qualified or trained personnel should give oxygen,

• if not breathing, give artificial respiration, with supplemental oxygen provided by qualified or trained personnel,

• call a physician.

Section 9: Waste Disposal Procedures

Not applicable

Section 10: Material Safety Data Sheets / Safety Data Sheets

See attached.

Section 11: Training and Awareness

Employees working on this project must complete the following training:

□ Compressed gas storage, handling, and control

□ Fire Safety Plan Review with Fire Safety Department

□ Review and signature of this document

□ Other ____________________________

Section 11: Protocols

Attach your protocol here, including an estimate of how long in total the research will be conducted and how frequently it will be conducted. Provide a general sequential description of work as you currently see it.
Research under the FlareNet project will take place over the period lasting until at least June 30, 2021 at an intermittent frequency. It is expected that experiments will take place over 1-2 week periods at frequencies of 2-4 months over the lifetime of the project. The first full experiments are tentatively scheduled for June 2018 pending the required approvals and hardware acquisition.

Section 12: Plan Review and Approval

Please list any other people who will be involved in this research group and have them sign this document to acknowledge they have read and understand their responsibilities.

Name: ____________________________________________
Name: ____________________________________________
Name: ____________________________________________
Supervisor signature: ______________________________ Date: ______________

I have reviewed and understand the Flarenet Emergency Procedures, and agree to abide by the protocols described herein:

Signature:________________________________________ Date: __________
Signature:________________________________________ Date: __________
Signature:________________________________________ Date: __________

A completed copy of this Emergency Procedure has been reviewed and approved by Western University Fire Safety Department:

WU FSEM Staff:
________________________________________ Date: __________
18. Laboratory Health and Safety Manual for General Laboratory Practices