



**Subject: Special Hazards Fire Extinguishing Systems**

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**SUMMARY:** Some Departments or other University locations contain certain fire hazards that standard automatic sprinklers systems cannot effectively control or extinguish, or might possess equipment or operations that upon the application of water may cause excessive collateral damage or an interruption of critical operations. These areas are termed “Special Hazards.”

For some of these locations, a special hazards fire extinguishing system may be employed using a non-water, “clean agent”, e.g., a halocarbon (halon) agent or an inert gas agent (a blend of one or more gases of helium, neon, argon, or nitrogen). Other special hazards fire extinguishing systems may utilize carbon dioxide (CO<sub>2</sub>), dry chemical or foam fire suppression agents.

University departments that have such systems installed must ensure they are in proper operating condition, that affected building occupants have been provided pertinent health and safety information; and that this Guideline documentation is readily available.

**SCOPE:** This Guideline applies to all University units that have special hazards fire extinguishing systems.

- REFERENCE REGULATIONS:**
- [MIOSHA Part 9: Fixed Fire Equipment](#)
  - NFPA 12: Standard on Carbon Dioxide Extinguishing Systems
  - NFPA 12A: Standard on Halon 1301 Fire Extinguishing Systems
  - NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems

**DEFINITIONS:** *Aqueous Film Forming Foam (AFFF)* – A concentrated aqueous solution of one or more hydrocarbon and/or fluorochemical surfactants that forms foam capable of producing a vapor-suppressing, aqueous film on the surface of hydrocarbon fuels. These agents are biodegradable and environmentally friendly and typically available as 1%, 3%, and 6% concentrates, for use at the proportioning rate of the product, e.g., 1% would be 1 part concentrate to 99 parts water.

*Class A Fire* – means a fire that has, as its fuel, ordinary combustible material, such as wood, cloth, paper, rubber and many plastics.

*Class B Fire* – means a fire that has, as its fuel, flammable liquids, gases or greases.

*Clean Agent* – an electrically non-conducting, volatile, or gaseous fire extinguishant that does not leave a residue upon evaporation. Examples include FM-200 (Heptafluoropropane), FE-25 (Pentafluoroethane), Argon and Nitrogen.

*Halogenated Extinguishing System* – a fixed system of pipes or hoses, nozzles, an actuating device, and a container containing a halogenated (“halon”) agent under pressure.

*Halon* – a halogenated hydrocarbon used as a fire extinguishing agent. The halon nomenclature system consists of a five digit number used to identify each compound. The first digit represents the number of carbon atoms in the compound; the second digit, the number of fluorine atoms; the third digit, the chlorine atoms; the fourth digit the number of bromine atoms and the fifth digit the number of iodine atoms.

For example Halon **1301** (Bromotrifluoromethane) has one carbon atom, three fluorine atoms, no chlorine atoms, one bromine atom, and no iodine atoms.

Note: the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer mobilized global action on ozone-depleting substances including halons and therefore halon systems are being phased-out on campus (anticipated sometime in 2020).

*Pre-discharge or Discharge Alarm* – means an audible or visual device interconnected with an extinguishing system and a detecting actuating device.

*Special Hazard* – a special hazard is classified as an area, process or piece of equipment contained within a facility where conventional methods of fire protection cannot offer adequate safety or where the application of water may cause excessive collateral damage or an interruption of critical operations.

*Saponification* – The formation of a soapy foam on burning cooking fats or oils through the application of an alkaline based fire extinguishing agent such as wet chemical, sodium bicarbonate or potassium bicarbonate based dry chemical. The foam is a reaction of the alkaline with the free fatty acids in the cooking medium.

**RESPONSIBILITY:** Deans, Directors and Department Heads

Designate and empower individuals who will be responsible for implementing appropriate maintenance, employee safeguards, and emergency procedures as outlined in this Guideline.

Ensure an environment where principal investigators/supervisors and other personnel are encouraged to follow this Guideline.

Principal Investigators/Supervisors

Implement procedures in accordance with this Guideline.

Assure that staff are aware of this Guideline and instructed on the department's emergency procedures.

Assign resources to support the implementation of this Guideline, including the establishment of an effective maintenance program for the special hazards system.

Follow Work~Connections procedures if there is an accident or injury. <http://www.workconnections.umich.edu/employees/work-related-illness-injury/step-one/>.

Contact EHS to request technical assistance, if needed.

#### Employees

Follow instructions on what to do during an emergency or discharge of the special hazards system.

#### Department of Public Safety (DPS)

Monitor all fire alarm systems and respond immediately to all fire alarm calls.

Contact EHS when it has been determined that the special hazards system has discharged or whenever there is a question regarding the safety and health of building occupants.

Take other appropriate action in accordance with established emergency procedures, including contacting the Ann Arbor Fire Department when necessary.

#### EHS

Provide technical assistance, as requested, to departments in implementing this Guideline.

Respond to all calls regarding discharge of special hazards systems or other calls requiring safety, health, or environmental assistance.

Review and revise this Guideline as necessary.

### **PROCEDURES:**

*General* – The discharge of a clean agent or other agent from a special hazards fire extinguishing system may create a hazard to personnel from the agent itself, from potential products of decomposition and/or from a low oxygen (less than 12% oxygen) atmosphere. Exposure to the agent itself is generally of less concern than is exposure to decomposition products.

However, unnecessary exposure of personnel to the agent, to decomposition products or to low oxygen atmospheres should be avoided. ***The maximum exposure time to any of these conditions must not exceed 5 minutes.***

*Employee Safeguards:*

1. In general, clean agent extinguishing systems must have a distinctive pre-discharge alarm and time delay, sufficient to allow personnel evacuation prior to discharge. Pre-discharge alarm agents for specific agents include: Carbon dioxide (CO<sub>2</sub>) systems with a concentration of 4 percent or greater; Halon 1301 systems with a concentration of 10 percent or greater.
2. The room should have signage informing persons that a special hazards fire extinguishing system is installed and that the area must be evacuated immediately upon sounding of the pre-discharge alarm when the concentration of extinguishing agent may be hazardous to employee health.
3. Evacuation procedures specific for the discharge of the particular extinguishing agent must be developed and incorporated into the building evacuation plan.
4. The extinguishing agent in use must be included in the department's Hazard Communication Program. Material Safety Data Sheets (MSDS) for this material must be kept on file at the facility and must be readily available to employees and emergency response personnel. Refer to the EHS [Hazard Communication Guideline](#) for further guidance.
5. The extinguishing agent's containers and associated hoses, piping, etc., must be labeled.
6. Employees must be trained on the following:
  - a. Evacuation procedures pertinent to the sounding of the pre-discharge and discharge alarm, as specified in the building evacuation plan.
  - b. Notification procedures, as specified in the building evacuation plan.
  - c. Procedures for re-entry into the area, including approval by EHS before entering.

*Maximum Permitted Exposure Times (per NFPA):*

<b>Halon 1301 (Bromotrifluoromethane)<sup>1</sup></b>		
<b>% (vol./vol.)</b>	<b>ppm</b>	<b>Time (min.)</b>
≤ 7	≤ 70,000	1
7 – 10	70,000 – 100,000	1 – 0.5
10 – 15	100,000 – 150,000	0.50
<b>FM-200 (Heptafluoropropane)<sup>2</sup></b>		
<b>% (vol./vol.)</b>	<b>ppm</b>	<b>Time (min.)</b>
≤ 10.5	≤ 105,000	5
11.0	110,000	1.13
11.5	115,000	0.60
12.0	120,000	0.49
<b>Carbon Dioxide (CO<sub>2</sub>)<sup>3</sup></b>		
<b>% (vol./vol.)</b>	<b>ppm</b>	<b>Time (min.)</b>
> 4	> 40,000	<i>Immediate evacuation</i>
<b>FE-25 (Pentafluoroethane)<sup>2,4</sup></b>		
<b>% (vol./vol.)</b>	<b>ppm</b>	<b>Time (min.)</b>
7.5 – 11.5	100,000 – 115,000	5
12	120,000	1.67
12.5	125,000	0.59
13	130,000	0.54
13.5	135,000	0.49

1. The MIOSHA 8-hour Permissible Exposure Limit (PEL) is 1,000 ppm.
2. DuPont's 8-hour & 12-hour Acceptable Exposure Limit (AEL) is 1,000 ppm.
3. The MIOSHA PEL is 10,000 ppm and the MIOSHA Short Term (15-minute) Exposure Limit (STEL) is 30,000 ppm.
4. The AIHA 8-hour Workplace Environmental Exposure Limit (WEEL) is 1,000 ppm.

*Emergency Procedures:*

In case of fire and discharge of a special hazards fire extinguishing system, the following response actions will be followed:

1. DPS dispatch will be automatically notified through the fire alarm system; facility personnel should contact DPS to provide on-scene details as to the extent and nature of the emergency.
2. Affected facility personnel will follow the building's evacuation plan, immediately leave the area of discharge, and meet at pre-designated assembly area(s).
3. DPS will respond to the fire call and, as appropriate, notify the Ann Arbor Fire Department (AAFD).
4. When the fire emergency is over, the work area will be ventilated to purge it of residual extinguishing agent and byproducts of combustion. DPS will contact EHS to evaluate the work area and approve the re-

entry of workers. No entry is permitted until EHS has evaluated the area.

5. EHS will review the appropriate Material Safety Data Sheets and test for substances listed as extinguisher components and/or potential byproducts, as well as the oxygen level, as applicable. When testing confirms that ventilation efforts have rendered the area safe, department workers may re-enter, provided that all other health and safety concerns have also been addressed. As the University's liaison with state health and safety enforcement agencies, EHS will be responsible for making any necessary notifications to the State regarding the release of Halon or other regulated materials.

*Inspection and Maintenance of Special Hazards Fire Extinguishing Systems:*

All special hazards fire extinguishing systems must be inspected annually (or more frequently if specified) by trained and authorized personnel to ensure proper operation. Inspection and associated testing shall be in accordance with the most current National Fire Protection Association (NFPA) Standards: NFPA 12, Standard on Carbon Dioxide Extinguishing Systems; NFPA 12A, Standard on Halon 1301 Fire Extinguishing Systems and NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems.

The weight and pressure of containers and agent dispensing control systems must be checked and documented **semiannually**. Inspection records will be kept by the designated facility contact person and made available upon request to EHS, DPS, Risk Management, MIOSHA inspectors, and insurance company representatives.

Plant Operations does not provide inspection and maintenance of these special hazards systems. Special hazards fire extinguishing systems are expected to meet this requirement by retention of an outside service. Three companies who currently provide this service to University units are:

[Erlich Protection Systems, Inc.](#)

32408 West Eight Mile Road  
Farmington Hills, Michigan 48336-5103  
248-471-1400  
[info@erlichpro.com](mailto:info@erlichpro.com)

[DeLau Fire & Safety, Inc.](#)

823 Terminal Road  
Lansing, Michigan 48906-3062  
517-321-1111  
[support@delaufire.com](mailto:support@delaufire.com)

[Spears Fire & Safety Services](#)

287 Jackson Plaza  
Ann Arbor, Michigan 48103  
734-663-4133

**RELATED  
DOCUMENTS:**

[EHS's Hazard Communication Guideline](#)

NFPA 12: Standard on Carbon Dioxide Extinguishing Systems  
NFPA 12A: Standard on Halon 1301 Fire Extinguishing Systems  
NFPA 2001: Standard on Clean Agent Fire Extinguishing Systems

**TECHNICAL  
SUPPORT:**

All referenced guidelines, regulations, and other documents are available through EHS (7-1142).

**ATTACHMENTS:**

Appendix A – [Supplemental Information –Fire Extinguishing Systems Agents](#)  
Appendix B – [Locations of Special Hazards Fire Protection Systems](#)