Life Safety and Catastrophic Loss Potential

The purpose of this document is to provide United Heartland Loss Control staff with an overview of Life Safety and Catastrophic Loss Potential. We will also provide some of the underlying Property Insurance basics which are some tools and knowledge to you to prevent and/or minimize some of this from occurring.

Examples of CAT/Life Safety Exposures

- Fire and explosion potential
- Risk types/exposures examples
  - Manufacturing with painting and chemical storage
  - Woodworking and other sources of dust potential
  - Healthcare with oxygen and ethylene oxide (ETOH)
  - Hot Work

Here are primary items in our niche types:

- Hospitals/Long-Term Care/Medical Services
  - Usually fire-resistive construction
  - Required to perform evac planning quarterly
  - Mobility issues
  - Compressed gasses, cooking, Ethylene Oxide (ETOH), 24-hour exposure

- Social services and others with habitation exposure
  - Building construction
  - Mobility or cognitive issues

- Schools
  - Active shooter
  - Cooking, shop class (welding, gasses, etc.), laboratories with chemicals

- Manufacturing
  - Painting and chemical storage
  - Combustible dust – woodworking and other sources of dust potential
  - Hot work
  - Flammable/combustible liquids

- High-rise buildings
  - Usually fire-resistive construction – good
  - Egress significantly more challenging
  - Smoke spread (elevator shafts and stairwells)
  - Accessibility with fire department ladder truck and EMTs can be a challenge
ISO Building Classifications

- ISO 1 – Frame Construction (wood walls & roof, foundation construction does not matter) – Masonry veneer or accents still count as ISO 1. The building itself is its own combustible fire loading. We can experience rapid fire/flame spread; this can be further enhanced by floor coverings (i.e. carpeting), wall hangings, concealed combustible ceilings, etc.

- ISO 2 – Joisted Masonry – Freestanding masonry shell with wood floors and joists, flammable roof. (If structure burns, masonry walls remain.) This is a very common construction in older buildings from the 1920s to mid 1950s. Many of the old “industrial manufacturing and warehousing” was of this construction type. As with ISO 1, we have combustible/flammable fire loading with wood/roof.

- ISO 3 – Light Noncombustible – Structure does not add to fire (fuel) load of building, but does not resist fire well. Light steel construction. This is commonly called “metal on slab” or “metal on metal” construction. This is very commonly found in manufacturing, warehousing, etc. These buildings tend to be easily constructed and conversely can fail easily in fire due to exposure metal that will fail rapidly when exposed to the intense heat of a fire.

- ISO 4 – Masonry Noncombustible – Freestanding masonry walls with noncombustible floors and roof. You may have heard of the term “tilt up” construction or building. Commonly wall panels are tiled and/or set in place supported by metal beams and roof truss structure. Again, common in newer manufacturing, warehousing and newer schools.

- ISO 5 – Modified Fire Resistive – Walls between fire divisions in structure have 1 hour fire rating. Noncombustible structure – seen in health care, office buildings and schools.

- ISO 6 – Fire Resistive – Walls between fire divisions have 2 hour fire rating; otherwise noncombustible structure – seen in health care, hospital, office/high rise buildings.
Building Basics – Property 101

- **Sprinkler Riser/Types of Sprinkler and Suppression Systems:**
  - Wet pipe (most buildings and photo to the right) and antifreeze (outside cold areas). Water is under pressure in the pipes (can be from standard city pressure or fire pump). Once the sprinkler head is activated, water begins to flow. For antifreeze systems, glycol is added to the water supply in the system to prevent the pipe from freezing when temperatures go below 32°F.
  
  - Dry pipe (cold areas, air in pipe). Pressurized air is contained in the sprinkler pipes suitable to hold back the water pressure. Upon sprinkler head activation, the air leaks out of the pipe (NFPA indicates that water needs to be flowing within 40 to 60 seconds of sprinkler head activation based on occupancy hazard) before the water flows. There is a delay.
  
  - ESFR (early sensing, fast response, warehousing) – this is a type of system (usually wet pipe) that is the most commonly installed for warehousing, rack storage and/or combustible building operations. These systems can flow a considerable amount of water in a short period of time. These systems are also designed for fire suppression, where other systems are simply designed to control a fire in a certain area (i.e. designed to contain a fire to 2000 sq. ft.).
  
  - Deluge – A deluge system is similar to a pre-action system except the sprinkler heads are open and the pipe is not pressurized with air. Deluge systems are connected to a water supply through a deluge valve that is opened by the operation of a smoke or heat detection system. The detection system is installed in the same area as the sprinklers. When the detection system is activated, water discharges through all of the sprinkler heads in the system. Deluge systems are used in places that are considered high hazard areas, such as power plants, aircraft hangars and chemical storage or processing facilities. They are also commonly found in schools to protect theater stages. Deluge systems are needed where high velocity suppression is necessary to prevent fire spread.
  
  - FM-200 is a waterless fire suppression system that can be used as an alternative to Halon 1301. FM-200 also provides an environmentally safe, non-toxic product that requires no clean up, and can be used in rooms that have anything from computer servers and data processing to art and history collections. FM-200 requires a concentration range of between 6.25 percent and 9.0 percent for effective fire extinguishment. The upper limit of 9 percent concentration is the maximum allowable by the EPA without the need for a mandated egress time. FM-200 is stored in cylinders as a liquid. The cylinders are pressurized with nitrogen, which acts as a propelling mechanism for the discharge of the agent. As the agent reaches the discharge nozzle it is vaporized and floods the hazard area as a gas. An FM-200 system can provide an effective fire extinguishing medium with modular hardware that requires minimal space for installation and a most effective means of fire suppression.
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Manual Pull Stations – A fire alarm pull station is an active fire protection device, usually wall-mounted, that, when activated, initiates an alarm on a fire alarm system. In its simplest form, the user activates the alarm by pulling the handle down, which completes a circuit and locks the handle in the activated position, sending an alarm to the fire alarm control panel.

Audible Fire Alarms:
- Typically you will see a ‘gong’ on the outside of a building.
- On the inside of the building you will see devices as pictured to the right. These are both audible and sensory (flashing light).
- NFPA 72 states that these audible fire alarm notification appliances must be a minimum of 15 dBA above the average ambient sound level.

Smoke Detection – Smoke detectors will detect most fires more rapidly than heat detectors. There are currently three types of smoke alarms on the market: ionization, photoelectric and combination ionization/photoelectric.
- An ionization smoke alarm contains a small amount of radioactive material. The radiation passes through an ionization chamber, which is an air-filled space between two electrodes, and permits a small, constant current between the electrodes. Any smoke that enters the chamber absorbs the alpha particles, which reduces the ionization and interrupts this current, setting off the alarm. This type of alarm responds best to fast, raging fires.
- Photoelectric smoke alarms operate using a light source, a light beam collimating system and a photoelectric sensor. When smoke enters the optical chamber and crosses the path of the light beam, some light is scattered by the smoke particles, directing it at the sensor and thus activating the alarm. This type of alarm responds best to slow, smoldering fires.
- Combination smoke alarms feature both ionization and photoelectric technologies. Ionization smoke alarms respond faster to high energy fires, whereas photoelectric detectors respond better to low energy, smoldering fires.

Heat Detection – Heat detectors are the oldest and least expensive type of automatic fire detection. They are designed to operate when there is a specified or predetermined rate of temperature change or when a detecting element reaches a predetermined fixed temperature. The two types of heat detectors are spot and line type.
- A spot type heat detector monitors temperature at a given point. These detectors vary with respect to the mechanisms used to detect heat. The two most common types of spot type heat detectors are:
  - Fixed-Temperature Heat Detectors – designed to initiate an alarm when its heat sensitive material or element is heated to a specific temperature. The air temperature at the time of alarm is considerably higher as it takes time for the surrounding air to raise the temperature of the element to its set point. The operating range of these detectors start at 100F. There are two types of fixed-temperature heat detectors:
    ➢ Restorable – returns to its ready state without any interaction from an outside source, once it has cooled below its set point.
Non-Restorable – requires replacement of its element after actuation.

- Rate-of-Rise Heat Detectors - operate on a rate-of-temperature change per unit of time basis. This type of heat detector contains a chamber with a calibrated vent. When the air in the chamber expands faster than it can escape from the vent, the increase in pressure causes the electrical contacts to close sending a signal to the fire alarm control unit. If the air in the chamber rises slowly and can escape from the vent, the electrical contacts do not close and there is no alarm.

- Fire Department Connections (FDCs) – A Siamese connection or splitter in fire protection engineering is a pipe fitting that allows two or more fire hoses to be connected to a single standpipe riser at the same general location. Here the fire pumper/truck can attach hoses to supplement interior building’s fire suppression systems (wet or dry pipe sprinkler system). The red caps are to be designed of breakable construction for easier access to fire departments. They are placed on the ends of the connection to prevent/deter foreign objects from being placed inside, which will cause water flow obstruction.

Exit Routes
Primary components
- A continuous and unobstructed path of exit travel.
- Consists of three parts:
  - the way of exit access
  - the exit
  - the way of exit discharge

Escape Route
- A continuous and unobstructed path of exit travel from any point in a building or structure to a public way (a street, yard, court or other open space leading to the street).

Escape Route General Requirements
- Fire alarms are required if a fire could start without providing adequate warning to occupants.
- There must be enough exits in the proper arrangement for quick escape.
- Adequate and reliable illumination must be provided for all exit facilities.
- Escape Routes:
  - Minimum width = 28 inches
  - Minimum ceiling height = 7½ feet

Locking Exits
- Must not install any lock or fastening that impedes or prevents escape from the inside of any building.

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Access to Exits
  o Exits must be readily accessible at all times.
  o A door from a room to an exit or escape route must be a side-hinged swinging type, and swing in the direction of exit travel when the room is occupied by more than 50 people or contains high hazard contents.

Maintaining Escape Routes
  • Escape routes from all parts of the building must be continuously maintained free of all obstructions in case of emergency.

Exit Marking
  • Exits must be marked by a readily visible sign when the exit or way to reach it is not immediately visible to occupants.
  • If a door, passage or stairway is not an exit or a way of exit access, but may be mistaken for one, it must be identified by a sign reading “Not an Exit”, “Storeroom”, “To Basement”, etc.
  • A sign reading “Exit” with an arrow indicating the directions must be placed in every location where the direction of travel to the nearest exit is not immediately apparent.
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OSHA Standard – 1910.38 Emergency Action Plans – also refer to LC-1007

- **1910.38(a)**
  *Application.* An employer must have an emergency action plan whenever an OSHA standard in this part requires one. The requirements in this section apply to each such emergency action plan.

- **1910.38(b)**
  *Written and oral emergency action plans.* An emergency action plan must be in writing, kept in the workplace and available to employees for review. However, an employer with 10 or fewer employees may communicate the plan orally to employees.

- **1910.38(c)**
  *Minimum elements of an emergency action plan.* An emergency action plan must include at a minimum:

  - 1910.38(c)(1) Procedures for reporting a fire or other emergency;
  - 1910.38(c)(2) Procedures for emergency evacuation, including type of evacuation and exit route assignments;
  - 1910.38(c)(3) Procedures to be followed by employees who remain to operate critical plant operations before they evacuate;
  - 1910.38(c)(4) Procedures to account for all employees after evacuation;
  - 1910.38(c)(5) Procedures to be followed by employees performing rescue or medical duties; and
  - 1910.38(c)(6) The name or job title of every employee who may be contacted by employees who need more information about the plan or an explanation of their duties under the plan.

- **1910.38(d)**
  *Employee alarm system.* An employer must have and maintain an employee alarm system. The employee alarm system must use a distinctive signal for each purpose and comply with the requirements in § 1910.165.

- **1910.38(e)**
  *Training.* An employer must designate and train employees to assist in a safe and orderly evacuation of other employees.

- **1910.38(f)**
  *Review of emergency action plan.* An employer must review the emergency action plan with each employee covered by the plan:

  - 1910.38(f)(1) When the plan is developed or the employee is assigned initially to a job;
  - 1910.38(f)(2) When the employee’s responsibilities under the plan change; and
  - 1910.38(f)(3) When the plan is changed.
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OSHA Standard – 1910.39 Fire Prevention Plan

- 1910.39(a)
  Application. An employer must have a fire prevention plan when an OSHA standard in this part requires one. The requirements in this section apply to each such fire prevention plan.

- 1910.39(b)
  Written and oral fire prevention plans. A fire prevention plan must be in writing, be kept in the workplace and be made available to employees for review. However, an employer with 10 or fewer employees may communicate the plan orally to employees.

- 1910.39(c)
  Minimum elements of a fire prevention plan. A fire prevention plan must include:
  - 1910.39(c)(1)
    A list of all major fire hazards, proper handling and storage procedures for hazardous materials, potential ignition sources and their control, and the type of fire protection equipment necessary to control each major hazard;
  - 1910.39(c)(2)
    Procedures to control accumulations of flammable and combustible waste materials;
  - 1910.39(c)(3)
    Procedures for regular maintenance of safeguards installed on heat-producing equipment to prevent the accidental ignition of combustible materials;
  - 1910.39(c)(4)
    The name or job title of employees responsible for maintaining equipment to prevent or control sources of ignition or fires; and
  - 1910.39(c)(5)
    The name or job title of employees responsible for the control of fuel source hazards.

- 1910.39(d)
  Employee information. An employer must inform employees upon initial assignment to a job of the fire hazards to which they are exposed. An employer must also review with each employee those parts of the fire prevention plan necessary for self-protection.
Fire Protection
- Identify the combustion process and different fire classes.
- Identify requirements for portable fire extinguishers and their intended uses.
- Identify OSHA requirements for maintenance, inspection and training.
- Identify basic firefighting concepts:
  - R.A.C.E.
  - P.A.S.S.

Fire Extinguishers

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<th>Electrical</th>
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<td>B Liquids</td>
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Types of Extinguishers
- Air-pressurized water (APW )
  - Extinguish Class A type A fires
  - Recognizable by large silver container
  - Cools surface of the fuel to remove the "heat" element of the fire triangle

- Carbon Dioxide (CO2 )
  - Extinguish Class B and C (flammable liquid and electrical) fires only
  - Puts out fires by displacing oxygen
  - Recognized by large horn and absent pressure gauge

- Dry Chemical
  - Extinguishes Class B and C fires
  - May be marked multi-purpose use in A, B, and C fires – most common fire extinguishers
  - Puts out fires by interrupting the chemical reaction

Extinguisher Rating
- Class A: Wood, paper, cloth, trash, plastics (solids that are not metals).
  - The numerical rating for a Class A fire extinguisher refers to the amount of chemicals/agent in the extinguisher. The number represents the chemical/agent’s equivalent to gallons of water the extinguisher holds. Multiply the number in front of A by 1.25 to figure out the equivalent to gallons of water. Example: A Fire Extinguisher with a rating of 2A would contain the equivalent to 2.5 gallons of water (2 x 1.25)
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- **Class B**: Flammable liquids – Gasoline, oil, grease, acetone (includes flammable gases).
  - The numerical rating for a class B fire extinguisher refers to the number of cubic feet that the fire extinguisher will be able to extinguish. **Example**: A fire extinguisher with a rating of 1A:10B:C would contain agents equal to 1.25 gallons of water (1 x 1.25) and would be able to extinguish 10 square feet of a class B fire. (The extinguisher would also be rated non-conductive due to the C rating.)

- **Class C**: Electrical fires; energized electrical equipment fires (anything that is plugged in).
  - Class C does not have a numerical classification. When "C" is present in the classification/UL rating, it indicates that the agents in the fire extinguisher are non-conductive, meaning that you can use them on an electrical fire (meaning anything that is plugged in). **Example**: A fire extinguisher with a rating of 5B:C would be able to extinguish 5 square feet of a class B fire and could also be used on a Class C fire (electrical/anything plugged in) due to its non-conductive properties.

- **Class D**: Metal fires involving magnesium, sodium, potassium and sodium-potassium alloys.
  - Class D fire extinguishers are generally not given a numerical rating. They are simply classified as a "Class D" extinguisher.

- **Class K**: Commercial deep fat fryers (cooking oil fires).
  - Class K fire extinguishers are rated to be used on kitchen fires involving cooking oils and deep fryers. Class K are not given a numerical rating. **Example**: A fire extinguisher with a rating of 2A:K would contain the equivalent to 2.5 gallons of water (2 x 1.25) and would also be approved to be used on a Class K (cooking oil) fire.

**OSHA Standard – 29 CFR 1910.157 Portable Fire Extinguishers – a few highlight sections, there is more.**

- **1910.157(c)**
  - General requirements.

- **1910.157(c)(1)**
  - The employer shall provide portable fire extinguishers and shall mount, locate and identify them so that they are readily accessible to employees without subjecting the employees to possible injury.

- **1910.157(c)(2)**
  - Only approved portable fire extinguishers shall be used to meet the requirements of this section.

- **1910.157(c)(3)**
  - The employer shall not provide or make available in the workplace portable fire extinguishers using carbon tetrachloride or chlorobromomethane extinguishing agents.

- **1910.157(c)(4)**
  - The employer shall assure that portable fire extinguishers are maintained in a fully charged and operable condition and kept in their designated places at all times except during use.

- **1910.157(c)(5)**
  - The employer shall remove from service all soldered or riveted shell self-generating soda acid or self-generating foam or gas cartridge water type portable fire extinguishers which are operated by inverting the extinguisher to rupture the cartridge or to initiate an uncontrollable pressure generating chemical reaction to expel the agent.

- **1910.157(d)**
  - Selection and distribution.
• **1910.157(d)(1)**
  Portable fire extinguishers shall be provided for employee use and selected and distributed based on the classes of anticipated workplace fires and on the size and degree of hazard which would affect their use.

• **1910.157(d)(2)**
  The employer shall distribute portable fire extinguishers for use by employees on Class A fires so that the travel distance for employees to any extinguisher is 75 feet (22.9 m) or less.

• **1910.157(d)(3)**
  The employer may use uniformly spaced standpipe systems or hose stations connected to a sprinkler system installed for emergency use by employees instead of Class A portable fire extinguishers, provided that such systems meet the respective requirements of 1910.158 or 1910.159, that they provide total coverage of the area to be protected, and that employees are trained at least annually in their use.

• **1910.157(d)(4)**
  The employer shall distribute portable fire extinguishers for use by employees on Class B fires so that the travel distance from the Class B hazard area to any extinguisher is 50 feet (15.2 m) or less.

• **1910.157(d)(5)**
  The employer shall distribute portable fire extinguishers used for Class C hazards on the basis of the appropriate pattern for the existing Class A or Class B hazards.

• **1910.157(d)(6)**
  The employer shall distribute portable fire extinguishers or other containers of Class D extinguishing agent for use by employees so that the travel distance from the combustible metal working area to any extinguishing agent is 75 feet (22.9 m) or less. Portable fire extinguishers for Class D hazards are required in those combustible metal working areas where combustible metal powders, flakes, shavings, or similarly sized products are generated at least once every two weeks.

• **1910.157(g)**
  Training and education.

• **1910.157(g)(1)**
  Where the employer has provided portable fire extinguishers for employee use in the workplace, the employer shall also provide an educational program to familiarize employees with the general principles of fire extinguisher use and the hazards involved with incipient stage fire fighting.

• **1910.157(g)(2)**
  The employer shall provide the education required in paragraph (g)(1) of this section upon initial employment and at least annually thereafter.

• **1910.157(g)(3)**
  The employer shall provide employees who have been designated to use fire fighting equipment as part of an emergency action plan with training in the use of the appropriate equipment.

• **1910.157(g)(4)**
  The employer shall provide the training required in paragraph (g)(3) of this section upon initial assignment to the designated group of employees and at least annually thereafter.
Firefighting Decision Criteria

- Know department emergency procedures and evacuation routes.
- Know locations of extinguishers in your area and how to use them.
- Always sound the alarm regardless of fire size.
- Avoid smoky conditions.
- Ensure area is evacuated.
- Don’t attempt to fight unless:
  - Alarm is sounded.
  - Fire is small and contained.
  - You have a safe egress route (can be reached without exposure to fire).
  - Available extinguishers are rated for size and type of fire.
- If in doubt, evacuate!

Fire Extinguisher Easy Operation Slogan

- **P**ull the pin
- **A**im low at the base of flames
- **S**queeze the Handle
- **S**weep side to side

Fire Emergency Responses – Health Care

**R** = RESCUE anyone in immediate danger from the fire, if it does not endanger your life.

**A** = ALARM: sound the alarm by calling *** and activating a pull station box.

**C** = CONTAIN or CONFINE the fire by closing all doors and windows.

**E** = EXTINGUISH the fire with a fire extinguisher, or EVACUATE the area if the fire is too large for a fire extinguisher.
Dust Combustibility
Combustible dust definition per NFPA: A combustible particulate solid that presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations, regardless of particle size or shape = Generally 420 microns or smaller

A wide variety of materials that can be explosible in dust form exist in many industries. Examples of these materials include: food (e.g., candy, sugar, spice, starch, flour, feed), grain, tobacco, plastics, wood, paper, pulp, rubber, pesticides, pharmaceuticals, dyes, coal, metals (e.g., aluminum, chromium, iron, magnesium and zinc). These materials are used in a wide range of industries and processes, such as agriculture, chemical manufacturing, pharmaceutical production, furniture, textiles, fossil fuel power generation, recycling operations, and metal working and processing which includes 3D welding - a form of 3D printing.

Explosible Range

![Explosible Range Diagram]

Deflagration Vs. Detonation
Deflagration. Propagation of a combustion zone at a speed that is less than the speed of sound in the unreacted medium.

Detonation. Propagation of a combustion zone at a velocity that is greater than the speed of sound in the unreacted medium.

 Explosion. The bursting or rupture of an enclosure or a container due to the development of internal pressure from deflagration.
Explosion Ingredients
Fuel – Dust or Gas, or Both. Dust must be IN SUSPENSION.
Oxygen – Usually Air, but sometimes a process ingredient, and sometimes a product of combustion.

Hazard Mitigation
• Dust control
• Containment
• Ignition source control
• Damage control

Dust Layer Thickness Guidelines
• Depends on type of dust
  o 1/8” in grain standard
  o 1/8” for wood dust – per NFPA
• Rule of thumb in NFPA
  o 1/32” over 5% of area – Bar joist surface area equals about 5% of floor area
  o Max 20,000 SF
• Develop a housekeeping schedule – include high spaces
  o Maintain dust free as possible
  o No blow down unless All electrical power and processes have been shutdown.
  o No welding, cutting or grinding unless under hot-work permit
  o Comfort heating equipment shall obtain combustion air from clean outside source.

OSHA Stance – [https://www.osha.gov/dsg/combustibledust/index.html](https://www.osha.gov/dsg/combustibledust/index.html). This is a full page with useful e-tools.

Highlighted Standards
• 1910 Subpart D, Walking-working surfaces [related topic page]
• 1910.22, Housekeeping
• 1910 Subpart E, Exit routes, emergency action plans, and fire prevention plans
• 1910.38, Emergency action plans [related topic page]
• 1910 Subpart G, Occupational health and environmental control
• 1910.94, Ventilation [related topic page]
• 1910 Subpart J, General environmental controls
• 1910.146, Permit-required confined spaces [related topic page]
• 1910 Subpart L, Fire protection [related topic page]
• 1910.157, Portable fire extinguishers
• 1910.165, Employee alarm systems
• 1910 Subpart N, Materials handling and storage
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General Duty Clause
If a hazard is not addressed by an OSHA standard, Section 5(a)(1) of the OSH Act, often referred to as the General Duty Clause, may apply. This section requires employers to "furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees". This is discussed further in the Consensus Standards section below.

Spark Detection & Extinguishing Systems – Dust Collection Fire Prevention
Spark detection systems are primarily used as a fire prevention method in dust collectors, mechanical and pneumatic conveying systems by detecting and extinguishing sparks and embers. When working materials, sparks are created very quickly. A dull tool, a damaged fan bearing, an over heated motor, or a foreign object within the material can be the cause. This is a constant danger for all facilities where combustible materials are being worked, exhausted, transported, filtered or dried. The damage statistics provided by insurance companies point out that filters, dust collection bins, silos and even complete production lines are the areas at greatest risk. Foreign objects in the conveyed material, defective parts of production machinery, friction processes as well as electric sparks are all identified as fire generating.

Upon sensor detection and activation on a control panel, extinguishing apparatus release an atomized water spray to immediately extinguish any sparks or burning embers. Special nozzle design, when coupled with required water pressure creates the most effective atomized extinguishment spray pattern.

Most systems will need a booster pump to provide increased water pressure for sufficient extinguishment operation. Standard booster pumps are designed to increase plant pressure up to 65 PSI (or higher if needed) as measured at the extinguishment valve. Water pump is self-activated with flow and pressure monitored by the spark detection control console. When the spark detection system triggers activation of a zone’s extinguishing device, the booster pump’s motor will engage when the lower pressure limit is reached and will pump water from the source into the system. After extinguishing devices valves are closed, the booster pump's motor may continue running until the system reaches the upper water pressure limit.
Welding and Hot Work – also refer to LC-1012

- Hot Work/Welding
  - Designated area
  - Welding screens – reduce welding eye flash to others and contain sparks
  - Fire extinguishers readily available
  - Compressed gasses stored properly – 20’ separation for Oxy/acetylene or a barrier ≥5 ft high with half-hour fire-resistance rating and secured when not in use
  - A Hot Work Permit is required whenever welding, cutting or burning is done outside an area designated for that purpose
    - This permit is a checklist to ensure precautions are taken to prevent the ignition of flammable or combustible materials in a 35 foot area surrounding the work.
    - This permit must be posted.
    - A fire watch must be in place – during and 30 minutes after work.

Cutting – Welding – Hot Work Permit

This form is to be filled out in its entirety by the responsible person actually performing the "Hot Work" and then brought to the Department.

<table>
<thead>
<tr>
<th>Company:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsible Person:</td>
<td>Start Time:</td>
</tr>
<tr>
<td>Work to be Performed:</td>
<td>Building:</td>
</tr>
<tr>
<td>Is it possible to perform this work in the shop?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Please place a check mark if the following items have been completed

- Flame or spark-producing equipment to be used has been inspected and found in good repair.
- Sprinklers, where provided, are in commission and will not be taken out of service while this work is being done.
- There are no combustible fibers, dusts, vapors, gases or liquids in the area. Tanks and equipment previously containing such materials have been purged. The absence of gases or vapors has been verified by a combustible gas detection instrument. If there is a possibility of a leak developing in nearby piping, equipment or tanks, this area is being continuously monitored.
- Fire alarms will not be taken out of service while work is being performed. If alarm system must be inactivated during work then __________ will be contacted prior to taking alarm out of service so that a suitable "fire watch" can be coordinated.
- The work will be confined to the area or equipment specified on this permit.
- Surrounding floors have been swept clean and, if combustible, wet down.
- Contractor has ample portable fire extinguishers available and trained personnel to use them.
- All combustibles have been relocated 35 feet from the operation and the remainder protected with metal guards or flame-proofed curtains or covers (not ordinary tarpaulins).
- All floor and wall openings within 35 feet of the operations have been tightly covered.
- Responsible personnel have been assigned to provide a "Fire Watch" for dangerous sparks in the work area, as well as on floors above and below while work is being performed.
- Arrangements have been made to provide a "Fire Watch" to patrol the area, including floors above and below, during any lunch or rest period and for at least one-half hour after the work has been completed.

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Definitions
- **Flash point** means the minimum temperature at which a liquid gives off enough vapor to form an ignitable mixture.
- In general, the lower the flash point, the greater the hazard.
- Flammable liquids have flash points below 100°F, and are more dangerous than combustible liquids, since they may be ignited at room temperature.
- **Combustible liquids** have flash points at or above 100°F.
- Although combustible liquids have higher flash points than flammable liquids, they can pose serious fire and/or explosion hazards when heated.

Storage
- Storage must not limit the use of exits, stairways or areas normally used for the safe egress of people.
- In office occupancies:
  - Storage prohibited except that which is required for maintenance and operation of equipment.
  - Storage must be in:
    - closed metal containers inside a storage cabinet, or
    - safety cans, or an inside storage room

Program Components
A good plan for safe use of flammable and combustible liquids contains at least these components:
- Control of ignition sources
- Proper storage
- Fire control
- Safe handling

Controlling Static Electricity
- Generated when a fluid flows through a pipe or from an opening into a tank.
- Main hazards are fire and explosion from sparks containing enough energy to ignite flammable vapors.
- Bonding or grounding of flammable liquid containers is necessary to prevent static electricity from causing a spark.

Bonding
- Physically connect two conductive objects together with a bond wire to eliminate a difference in static charge potential between them.
- Must provide a bond wire between containers during flammable liquid filling operations, unless a metallic path between them is otherwise present.

Grounding
- Eliminates a difference in static charge potential between conductive objects and ground.
- Although bonding will eliminate a difference in potential between objects, it will not eliminate a difference in potential between these objects and earth unless one of the objects is connected to earth with a ground wire.
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Safety Cans
- Approved container of not more than 5 gallons capacity
- Spring-closing lid and spout cover
- Safely relieves internal pressure when exposed to fire

Flame Arrestor Screen Inside of the Cans
- Prevents fire flashback into can contents
- Double wire-mesh construction
- Large surface area provides rapid dissipation of heat from fire so that vapor temperature inside can remain below ignition point

Storage Cabinets
- Not more than 60 gal of Class I and/or Class II liquids, or not more than 120 gal of Class III liquids permitted in a cabinet
- Must be conspicuously labeled, “Flammable - Keep Fire Away”
- Doors on metal cabinets must have a three-point lock (top, side, and bottom), and the door sill must be raised at least 2 inches above the bottom of the cabinet

Safety Handling Fundamentals
- Carefully read the manufacturer’s label on the flammable liquid container before storing or using it.
- Practice good housekeeping in flammable liquid storage areas.
- Clean up spills immediately then place the cleanup rags in a covered metal container.
- Only use approved metal safety containers or original manufacturer’s container to store flammable liquids.
- Keep the containers closed when not in use and store away from exits or passageways.
- Use flammable liquids only where there is plenty of ventilation.
- Keep flammable liquids away from ignition sources such as open flames, sparks, smoking, cutting, welding, etc.
Hurricane Safety Information
The following is taken from http://www.nhc.noaa.gov/prepare/wwa.php.

Understanding the difference between National Weather Service watches and warnings is critical to being prepared for any dangerous weather hazard, including hurricanes.

A watch lets you know that weather conditions are favorable for a hazard to occur. It literally means "be on guard!" During a weather watch, gather awareness of the specific threat and prepare for action – monitor the weather to find out if severe weather conditions have deteriorated and discuss your protective action plans with your family.

A warning requires immediate action. This means a weather hazard is imminent – it is either occurring (a tornado has been spotted, for example) – or it is about to occur at any moment. During a weather warning, it is important to take action: grab the emergency kit you have prepared in advance and head to safety immediately. Both watches and warnings are important, but warnings are more urgent.

Tropical Storm Watch: An announcement that tropical storm conditions are possible within the specified area.

Hurricane Watch: An announcement that hurricane conditions are possible within the specified area.

Because outside preparedness activities become difficult once winds reach tropical storm force, watches are issued 48 hours in advance of the anticipated onset of tropical storm force winds. Action: During a watch, prepare your home and review your plan for evacuation in case a Hurricane or Tropical Storm Warning is issued. Listen closely to instructions from local officials.

Tropical Storm Warning: An announcement that tropical storm conditions are expected within the specified area.

Hurricane Warning: An announcement that hurricane conditions are expected within the specified area.

Because outside preparedness activities become difficult once winds reach tropical storm force, warnings are issued 36 hours in advance of the anticipated onset of tropical storm force winds. Action: During a warning, complete storm preparations and immediately leave the threatened area if directed by local officials.

Extreme Wind Warning: Extreme sustained winds of a major hurricane (115 mph or greater), usually associated with the eyewall, are expected to begin within an hour. Action: Take immediate shelter in the interior portion of a well-built structure.

Additional Watches and Warnings may be issued to provide detailed information on specific threats such as floods and tornadoes. Local National Weather Service offices issue Flash Flood/Flood Watches and Warnings as well as Tornado Warnings.

How to Stay Informed
Use all of the above information to make an informed decision on your risk and what actions to take. Listen to recommendations of local officials on TV, radio and other media and to NOAA Weather Radio All Hazards for the latest tropical storm information. The National Weather Service (NWS) continuously broadcasts warnings, watches, forecasts and other non-weather related hazard information on NOAA Weather Radio All Hazards (NWR). The average range of
the 1000+ NWR transmitters is 40 miles, depending on topography. For the best performing NWR receivers, NWS suggests you look at devices certified to Public Alert™ standards.

**Workplace Plans**
Schools, daycare providers and workplaces should all have site-specific emergency plans.
- Make sure your workplace has a building evacuation plan that is regularly practiced.
- Take a critical look at your **heating, ventilation and air conditioning system** to determine if it is secure, or if it could feasibly be upgraded to better filter potential contaminants, and be sure you know how to turn it off if you need to.
- Think about what to do if your employees **can't go home**.
- Make sure you have appropriate **supplies** on hand.


**Basic Disaster Supplies Kit**
A basic emergency supply kit could include the following recommended items:
- **Water** – one gallon of water per person per day for at least three days, for drinking and sanitation
- **Food** – at least a three-day supply of non-perishable food
- Battery-powered or hand-crank radio, a NOAA Weather Radio with tone alert and extra batteries for both
- Flashlight and extra batteries
- First aid kit
- Whistle to signal for help
- Dust mask to help filter contaminated air and plastic sheeting and duct tape to **shelter-in-place**
- Moist towelettes, garbage bags and plastic ties for personal sanitation
- Wrench or pliers to **turn off utilities**
- Manual can opener for food
- Local maps
- Cell phone with chargers, inverter or solar charger
Tornado Safety Information
The following is taken from http://www.redcross.org/prepare/disaster/tornado.

Tornado Watch – Tornadoes are possible in and near the watch area. Review and discuss your emergency plans, and check supplies and your safe room. Be ready to act quickly if a warning is issued or you suspect a tornado is approaching. Acting early helps to save lives!

Tornado Warning – A tornado has been sighted or indicated by weather radar. Tornado warnings indicate imminent danger to life and property. Go immediately under ground to a basement, storm cellar or an interior room (closet, hallway or bathroom).

How to Prepare for a Tornado
• During any storm, listen to local news or a NOAA Weather Radio to stay informed about tornado watches and warnings.
• Know your community's warning system. Communities have different ways of warning residents about tornados, with many having sirens intended for outdoor warning purposes.
• Pick a safe room in your home where household members and pets may gather during a tornado. This should be a basement, storm cellar or an interior room on the lowest floor with no windows.
• Practice periodic tornado drills so that everyone knows what to do if a tornado is approaching.
• Consider having your safe room reinforced. Plans for reinforcing an interior room to provide better protection can be found on the FEMA web site.
• Prepare for high winds by removing diseased and damaged limbs from trees.
• Move or secure lawn furniture, trash cans, hanging plants or anything else that can be picked up by the wind and become a projectile.

Watch for Tornado Danger Signs
• Dark, often greenish clouds – a phenomenon caused by hail
• Wall cloud – an isolated lowering of the base of a thunderstorm
• Cloud of debris
• Large hail
• Funnel cloud – a visible rotating extension of the cloud base
• Roaring noise

What to Do During a Tornado
• The safest place to be is an underground shelter, basement or safe room.
• If no underground shelter or safe room is available, a small, windowless interior room or hallway on the lowest level of a sturdy building is the safest alternative.
• Mobile homes are not safe during tornadoes or other severe winds.
• Do not seek shelter in a hallway or bathroom of a mobile home.
• If you have access to a sturdy shelter or a vehicle, abandon your mobile home immediately.
• Go to the nearest sturdy building or shelter immediately, using your seat belt if driving.
• Do not wait until you see the tornado.
• If you are caught outdoors, seek shelter in a basement, shelter or sturdy building. If you cannot quickly walk to a shelter:

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o Immediately get into a vehicle, buckle your seat belt and try to drive to the closest sturdy shelter.
o If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:
  ▪ Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.
  ▪ If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.
  ▪ Your choice should be driven by your specific circumstances.

What to Do After a Tornado
• Continue listening to local news or a NOAA Weather Radio for updated information and instructions.
• If you are away from home, return only when authorities say it is safe to do so.
• Wear long pants, a long-sleeved shirt and sturdy shoes when examining your walls, doors, staircases and windows for damage.
• Watch out for fallen power lines or broken gas lines and report them to the utility company immediately.
• Stay out of damaged buildings.
• Use battery-powered flashlights when examining buildings – do NOT use candles.
• If you smell gas or hear a blowing or hissing noise, open a window and get everyone out of the building quickly and call the gas company or fire department.
• Take pictures of damage, both of the building and its contents, for insurance claims.
• Use the telephone only for emergency calls.
• Keep all of your animals under your direct control.
• Clean up spilled medications, bleaches, gasoline or other flammable liquids that could become a fire hazard.
• Check for injuries. If you are trained, provide first aid to persons in need until emergency responders arrive.
Earthquake Safety Information

The following is taken from http://www.redcross.org/prepare/disaster/earthquake.

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth’s surface. Earthquakes strike suddenly, without warning, and they can occur at any time of the year, day or night. Forty-five states and territories in the United States are at moderate to very high risk of earthquakes, and they are located in every region of the country.

Are You at Increased Risk from Earthquakes?
Contact your local emergency management office, local American Red Cross, state geological survey or department of natural resources for specific information about your community’s risk. However, bear in mind:

- Mobile homes and homes not attached to their foundations are at particular risk during an earthquake.
- Buildings with foundations resting on landfill and other unstable soils are at increased risk of damage.

Did You Know?
Doorways are no stronger than any other part of a structure, so don’t rely on them for protection! During an earthquake, get under a sturdy piece of furniture and hold on. It will help shelter you from falling objects that could injure you during an earthquake.

Prepare for an Earthquake

- Become aware of fire evacuation and earthquake safety plans for all of the buildings you occupy regularly.
- Pick safe places in each room of your home, workplace and/or school. A safe place could be under a piece of furniture or against an interior wall away from windows, bookcases or tall furniture that could fall on you.
- Practice “drop, cover and hold on” in each safe place. If you do not have sturdy furniture to hold on to, sit on the floor next to an interior wall and cover your head and neck with your arms.
- Keep a flashlight and sturdy shoes by each person’s bed in case the earthquake strikes in the middle of the night.
- Make sure your home is securely anchored to its foundation.
- Bolt and brace water heaters and gas appliances to wall studs.
- Bolt bookcases, china cabinets and other tall furniture to wall studs.
- Hang heavy items, such as pictures and mirrors, away from beds, couches and anywhere people sleep or sit.
- Brace overhead light fixtures.
- Install strong latches or bolts on cabinets. Large or heavy items should be closest to the floor.
- Learn how to shut off the gas valves in your home and keep a wrench handy for that purpose.
- Learn about your area’s seismic building standards and land use codes before you begin new construction.
- Keep and maintain an emergency supplies kit in an easy-to-access location.

If You Are Inside When the Shaking Starts...

- Drop, cover and hold on. Move as little as possible.
- If you are in bed, stay there, curl up and hold on. Protect your head with a pillow.
- Stay away from windows to avoid being injured by shattered glass.
- Stay indoors until the shaking stops, and you are sure it is safe to exit. When it is, use stairs rather than the elevator in case there are aftershocks, power outages or other damage.
• Be aware that fire alarms and sprinkler systems frequently go off in buildings during an earthquake, even if there is no fire.

If You Are Outside When the Shaking Starts...
• Find a clear spot (away from buildings, power lines, trees, streetlights) and drop to the ground. Stay there until the shaking stops.
• If you are in a vehicle, pull over to a clear location and stop. Avoid bridges, overpasses and power lines if possible. Stay inside with your seatbelt fastened until the shaking stops. Then, drive carefully, avoiding bridges and ramps that may have been damaged.
• If a power line falls on your vehicle, do not get out. Wait for assistance.
• If you are in a mountainous area or near unstable slopes or cliffs, be alert for falling rocks and other debris. Landslides are often triggered by earthquakes.

What to Do After an Earthquake
• After an earthquake, the disaster may continue. Expect and prepare for potential aftershocks, landslides or even a tsunami. Tsunamis are often generated by earthquakes.
• Each time you feel an aftershock, drop, cover and hold on. Aftershocks frequently occur minutes, days, weeks and even months following an earthquake.
• Check yourself for injuries and get First Aid, if necessary, before helping injured or trapped persons.
• Put on long pants, a long-sleeved shirt, sturdy shoes and work gloves to protect against injury from broken objects.
• Look quickly for damage in and around your home and get everyone out if your home is unsafe.
• Listen to a portable, battery-operated or hand-crank radio for updated emergency information and instructions.
• Check the telephones in your home or workplace to see if you can get a dial tone. Make brief calls to report life-threatening emergencies.
• Look for and extinguish small fires. Fire is the most common hazard after an earthquake.
• Clean up spilled medications, bleach, gasoline or other flammable liquids immediately.
• Open closet and cabinet doors carefully as contents may have shifted.
• Help people who require special assistance, such as infants, children and the elderly or disabled.
• Watch out for fallen power lines or broken gas lines and stay out of damaged areas.
• Keep animals under your direct control.
• Stay out of damaged buildings.
• If you were away from home, return only when authorities say it is safe to do so. Use extreme caution and examine walls, floors, doors, staircases and windows to check for damage.
• Be careful when driving after an earthquake and anticipate traffic light outages.
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