



# Safety Brief

JCFPD Training Division

January 2010

2010-1



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## Situational Awareness- Chemical Suicide

In Sugar Creek, MO, on Dec. 21, 2009, four first responders were hospitalized after being exposed to toxic fumes a man used to commit suicide. The combination of chemicals the man used to kill himself created hydrogen cyanide gas. This is the fourth reported case of this type of suicide in the U.S. However, since 2008, over 500 people in Japan have killed themselves in the same way with hydrogen sulfide gas (H<sub>2</sub>S) or other toxic chemical mixtures. Although it seems rare, the possibility of responding to a hazard such as this should be in the back of every firefighter's mind. Remember to maintain a heightened sense of situational awareness at all times.

### Hazards for Firefighters

The chemicals used in many of these incidents can be very easy to come by. Considerable amounts of hydrogen sulfide can be created with simple household detergents and cleaners. Although many of these chemical suicides are linked to cars, some have been discovered in apartment complexes or houses. Inhalation is the most common route of exposure and can lead to:

- ☠ Nausea;
- ☠ Headaches;
- ☠ Dizziness;
- ☠ Convulsions;
- ☠ Skin/eye irritation;
- ☠ Respiratory problems;
- ☠ Unconsciousness; or
- ☠ Death.

Hydrogen sulfide is also a very flammable gas and is heavier than air. It is possible vapors could travel along the ground finding a source of ignition and flash back. H<sub>2</sub>S is also hard to detect. It can smell a lot like rotten eggs at first, but quickly deadens the sense of smell.

## Avoiding Injury

**Expect the unexpected.** When responding to calls, remember to be ready for anything. Take note of everything at the scene. If containers are present in cars or on scene that could be filled with suspicious chemicals, be cautious. Carelessly running into a situation where toxic fumes are present could cause more harm than good. Be on the look out for:

- ☠ Biohazard signs or notes on cars or dwellings.
- ☠ Suspicious chemical containers near unconscious victims.
- ☠ Suspicious chemical containers in cars.

**Wear SCBA.** If hazardous chemicals are suspected on scene, don SCBA early. Even minimal exposure to fumes like H<sub>2</sub>S can lead to health problems, hospitalization, or death.

**Isolate and Contain.** If a suspicious chemical is discovered on scene, evacuate, isolate the area, and refer to the Emergency Response Guidebooks on all JCFPD apparatus.

**Fire or Explosion.** H<sub>2</sub>S is extremely flammable. Its properties make it possible for it to have explosive mixtures with air. It can also ignite easily by heat, sparks, or flames. Run off from this chemical may also cause pollution and/or a fire or explosion hazard.

**Decontamination.** If a member of JCFPD comes into contact with this type of substance, move them to fresh air quickly. Any contact with the skin or eyes should be flushed with water for 20 minutes. Remove and isolate any contaminated clothing.

### Protect Yourself

As publicity about these incidents spreads, officers and firefighters should be aware of the possibility of running into this situation. When toned out for a call, we can never be 100% sure of what we're going to be working with. Remember to slow down, assess the scene, and expect the unexpected. Be safe!





# Safety Brief

JCFPD Training Division

2010-February

2010-2

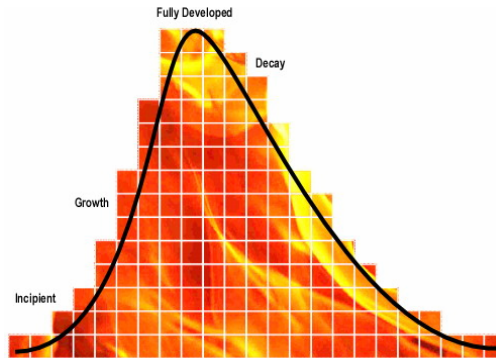


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## Recognizing Flashover Conditions

Flashover poses a great risk to firefighters. If caught in a compartment that flashes, the chances of living are slim to none. To make it worse, when units arrive on scene of most structure fires, it is nearly impossible to know how long the fire has been burning. It is crucial for both firefighters and fire officers to understand the stages of fire and recognize flashover conditions.



### Hazards for Firefighters

Compartment fires are grouped into five phases that occur in development:

- **Ignition**
- **Growth**
- **Flashover** (transition to fully developed fire)
- **Fully Developed**
- **Decay**

As defined by IFSTA, **flashover** is the sudden transition of a fire from the growth stage to the fully developed stage. This is the period during a fire that all exposed combustible surfaces within a compartment will ignite.

Flashover does not necessarily occur in every fire. The conditions for this phenomenon to occur depend on the heat release rate and the fire growth rate. Lack of air can prevent a compartment fire from generating a sufficient enough heat release rate to reach flashover.

The following are all factors that effect the development of a fire:

- Location
- Size and shape of the compartment
- Heat gain and heat loss of the fire
- Fire load present
- Ambient temperature of compartment at ignition.
- Location and height of openings the compartment.

## Avoiding Injury

Flashover can occur at different times depending on the growth rate of a compartment fire. It is important to note that it *can* occur without pre-flashover conditions being present. Flashover is somewhat unpredictable. However, prominent pre-flashover symptoms have been distinguished in many fires that have flashed. If your crew is in a structure, attacking a compartment fire with the following conditions, it may be time to start

thinking about getting out.

- The fire is in a ventilated compartment, so there is no shortage of oxygen in the room.
- The neutral plane is moving down towards the floor. In this situation, a flashover is plausible.
- All exposed combustible materials are showing signs of pyrolysis.
- "Rollover" or tongues of fire appear on the ceiling. This is the ignition of gases in the room.
- There is rapid flame spread and extension of flames out of compartment opening.
- There is a rapid buildup of heat. (This is one of the best indications of a flashover).

## Protect Yourself

Firefighters engaged in structural firefighting must wear full PPE, even though flashover conditions often exceed PPE limitations. It is our only barrier. Firefighters should consider alternate egress routes or shelter areas when attacking compartment fires (i.e. doors, windows, or adjacent rooms). Using proper ventilation techniques, along with properly placed hand lines, are also important factors to limiting the occurrence of flashover. Lastly, fire officers and firefighters should assess whether or not an interior attack is necessary. Risk a little to save a little, risk a lot to save a lot. Be Safe!



# Safety Brief

JCFPD Training Division

March 2010

2010-3



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## Structural Collapse

The longer a fire burns in a building, the more likely it is to collapse. This is a danger that firefighters face at nearly every structure fire. According to the U.S. Fire Administration, between the years of 1979 and 2002, there were approximately 180 firefighter fatalities due to structural collapse. This does not include the events of 9/11 or numerous other firefighter injuries resulting from the collapse of buildings. Knowledge of types of construction and the ability to recognize them on the fireground is important.

### Hazards for Firefighters

The following are classifications of building construction types:

#### Type I: Fire Resistant-

Structural members, including walls, columns, beams, floors, and roofs are made up of reinforced non-combustible materials. Fire spread is compartmentalized and concealed spaces are reduced. This type of construction is designed to withstand major fire exposure without major structural damage.

**Type II: Noncombustible-** Structural members, including walls, columns, beams, floors, and roofs, are made up of approved non-combustible or limited combustible materials. The structural elements are generally the same as Type I construction but won't resist fire as long as Type I. Fire spread is compartmentalized and concealed spaces are reduced. The risk of fire ignition of the building itself is low.

**Type III: Ordinary-** Exterior walls and structural members are constructed of approved non-combustible or limited combustible materials. Interior structural members, including walls, columns, beams, floors, and roofs are made up of smaller dimension wood. Unless combustible structural components are protected, this type of construction is subject to severe fire damage. Combustible building components add to the fuel load and fire may spread undetected through concealed spaces.

**Type IV: Heavy Timber-** Exterior walls and their structural members are constructed of

approved noncombustible or limited combustible materials. Interior structural members are made of solid or laminated wood *without* concealed spaces. Wood columns, beams, and supporting girders are all made up of heavy dimension lumber. Type IV construction resists failure in a fire longer than other combustible types of construction. The large dimension wood increases the fire resistance of the structure and prohibits concealed spaces.

**Type V: Wood Frame-** Walls, floors, roofs, and supports are made up wholly of wood materials. The dimensions of these materials are smaller than the wood used in Heavy Timber construction. Type V construction is the most vulnerable to damage from fire internally and externally. Fire resistance is usually non-existent. Voids and concealed spaces are present causing undetected fire spread.



### Avoiding Injury

Firefighters should be aware of the following building collapse indicators at every structure fire:

- Cracks or separations in walls, floors, ceilings, and roofs;
- Existing structural instability (i.e. tie rods, or stars on buildings);
- Loose bricks or stones falling from the building;
- Deteriorating mortar between masonry;
- Leaning walls;
- Distorted structural members;
- Fires beneath floors that support heavy loads;
- Prolonged fire exposure to structural members;
- Excessive weight of building contents.

### Protect Yourself

Firefighting operations can also increase the risk of building collapse. Cutting of structural supports or water that is used to extinguish a fire can add to collapse potential. Safety precautions should be taken if a collapse is believed imminent. The building should be evacuated and a collapse zone perimeter of one and a half times the height of the building should be set up. Be Safe!



# Safety Brief

JCFPD Training Division

2010-April

2010-4



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## Hydraulic Equipment Hazards

Hydraulic equipment is used in many jobs, including the fire service. JCFPD now has multiple hydraulic tools throughout the district. These hydraulic tools utilize high pressure liquid (hydraulic fluid) transmitted through hoses and tubes to hydraulic cylinders. This process is capable of transferring large amounts of power through small components, making hydraulic equipment efficient and popular.

### Hazards for Firefighters

When using hydraulic equipment, whether on or off an emergency scene, certain hazards should be taken into consideration.

**Burns from fluid.** Hydraulic systems store fluid under extremely high pressure (10,500 psi on new hydraulic spreaders and cutters). This fluid is also very hot. Removing or adjusting components that are under pressure can lead to serious burns.

**Bruises, cuts, or abrasions.** Removing or adjusting components while under pressure can lead to flailing hydraulic lines or hydraulic injection of fluid into the skin.

**Improper coupling.** Improperly coupled hydraulic fittings can fail under pressure and cause burns, bruises, cuts, or abrasions. Low-pressure components integrated into high-pressure systems can also pose a serious risk of injury. Ruptures can easily occur in the fittings or hoses.

**Pinhole leaks.** Leaks can sometimes occur in hoses. They are often invisible to the naked eye making them difficult to locate. Sometimes, a moist, oily area around the hydraulic line is noticeable. Running a hand or finger over the pinhole leak can cause fluid to be injected into the skin (like a hypodermic needle). Only a small stinging sensation may be noticeable at first, however, the problem can lead to serious pain and the loss of fingers or an entire arm.



**Fire/Explosion.** Hydraulic fluid is flammable. Escaping fluid exposed to an ignition source may burn or explode.

### Avoiding Injury

When using hydraulic equipment, safety is very important. The following are some guidelines for safe hydraulic operations:

- ❖ Ensure that all hose connections are tight and that lines are not damaged before use.
- ❖ Relieve all hydraulic pressure in the system before disconnecting or adjusting hose lines.
- ❖ Do not perform maintenance on hydraulic equipment while the system is running.
- ❖ Use a piece of cardboard or wood to check hoses for pinhole leaks instead of your hands.
- ❖ Avoid operating hydraulic equipment near sources of ignition or electrically charge equipment.

Periodically, hydraulic systems should also be given general maintenance inspections.

- ❖ Check and refill fluid levels.
- ❖ Inspect hoses, fittings, and connectors for physical damage, corrosion, and wear.
- ❖ Inspect all equipment for fluid leaks.
- ❖ Ensure all control valves operate properly.
- ❖ Make certain all components are clean and dry.
- ❖ Ensure nuts, bolts, and screws are in place and secure.
- ❖ Disassemble and lubricate equipment according to manufacturer's recommendations.
- ❖ Store the equipment in an area that will prevent damage.

### Protect Yourself

Anyone using any type of hydraulic equipment should try to learn as much as they can about the potential dangers involved. Proper maintenance and careful operations can help to reduce the risk of injury to operators. Be safe!







# Safety Brief

JCFPD Training Division

2010-July

2010-7



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## Immediately Dangerous to Life or Health (IDLH)

The National Fire Protection Agency (NFPA) defines immediately dangerous to life or health (IDLH) in NFPA 1500 as an atmospheric concentration of any toxic, corrosive or asphyxiant substance that poses an immediate threat to life or would interfere with an individual's ability to escape from a dangerous atmosphere.

There are three general types of IDLH environments which include:

- Toxic environments;
- Flammable environments; and
- Oxygen deficient environments.

Fires release different gases, depending on what is burning or how it is burning. Some of the most common gases found on the fire scene and what they are caused by:

- Carbon Dioxide: free-burning fires;
- Carbon Monoxide: incomplete combustion;
- Hydrogen Chloride: burning plastics;
- Hydrogen Cyanide: burning of wool, nylon, foam, or rubber;
- Nitrogen Dioxide: found in silos or grain bins; and
- Phosgene: when refrigerants, such as Freon, contact flame.

### Hazards for Firefighters

We must remember that a fire means that we could be exposed to combinations of irritants and toxicants. When combined, their true toxicity cannot be predicted and these combinations can be more toxic than the individual effects of the substances themselves.

At the fire scene, there is a high probability that toxic gases will be present. These gases, when inhaled, can create harmful effects on the body. Some of these gases can directly cause disease in our lungs while others can directly pass into the bloodstream and impair the red blood cell's oxygen carrying capacity.

### Avoiding Injury

There are many safety guidelines aimed at making sure that when we go into an IDLH environment, we come back out safely. Here are some of the ways that we can avoid injury.

- Do not remove face piece or any connection which could allow you to breathe ambient air while in an IDLH or unknown environment.
- Know how to manually operate your Personal Alert Safety System (PASS) device.
- If enough manpower is present, ensure that a RIT team is in place to rescue injured, lost, or trapped firefighters.
- Know when and how to use the Mayday call



including your name and approximate location within the structure.

- Keep constant voice or physical contact with your partner and do not leave the hose line unless it is absolutely necessary; the hose line shows you a way out.

### Protect Yourself

Most of the time, we know when the environment is unsuitable for breathing without an SCBA because of the visible smoke on arrival, yet we must remember that there other conditions which we may encounter that might not be quite as obvious. Use your SCBA to avoid oxygen-deficient and toxic environments.



# Safety Brief

JCFPD Training Division

2010-August

2010-8



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## Working or Trapped Above a Fire

**(The examples below are line of duty deaths which occurred after being trapped above or working above a fire.)**

In 1994, a captain and two firefighters were trapped in a second floor hallway with the fire rapidly spreading and water flow problems.

In 1995, a lieutenant was above a cellar fire when the floor collapsed trapping him near the fire.

In 1999, a captain and lieutenant were trapped in the rubble when the floors above the fire collapsed.

In 2001, a firefighter was trapped in a cellar after an explosion and floor collapse. The cause of the explosion was illegal storage of propane. Two other firefighters were also killed by the explosion.

These instances show just how dangerous working above a fire can be.

### Hazards for Firefighters

According to Vincent Dunn, a retired deputy chief and contributing editor to Firehouse magazine, working above a fire is one of the most dangerous assignments that a firefighter can take on the fire scene. This assignment is dangerous because the products of combustion rise and create a current of heat which can block the escape of the firefighter(s) through the original point of entry. Once the gas and smoke builds up and reaches a high enough temperature, the fire can flashover with the firefighter still in the structure. The specific hazards associated with working above the fire include:

- ☒ Blocking of original entry point;
- ☒ Disorientation;
- ☒ Build-up of extremely hot gases;
- ☒ Flashover;
- ☒ Floor collapse; and
- ☒ All can lead to serious injury or death.

When a firefighter is killed above a fire, we tend to think that a single event is to be blamed, yet it is most likely that compounding events led to the death. Here is an example of how compounding events can lead to a firefighter's death. First, the firefighter becomes trapped above the fire due to fire spread or extreme temperatures blocking the original point of entry. Second, under the stresses of the fire and the weight of water weakening the floor supports, the floor collapses. Finally, the firefighter is trapped in the rubble of the collapse, and then the firefighter runs out of air.



### Avoiding Injury

Before entering a building, look for ways out:

- ☒ Examine structure to determine fire origin and possible direction of fire spread.
  - ☒ Have a ladder raised to story of house which you will occupy.
  - ☒ Identify any obstructions which will limit the use of windows as an exit point such as window bars.
- Once inside the structure:
- ☒ Identify where the fire is and its current size;
  - ☒ Predict the fire's future spread; and
  - ☒ If fire appears to be uncontrollable by the hose line team, do not go above the fire.

### Protect Yourself

Remember when assign to search team to always identify secondary escape routes before entry, it could save your life.



# Safety Brief

JCFPD Training Division

2010-September

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## Back to Basics: PPE

Personal protective equipment (PPE) is an essential part of the firefighter toolbox. But because we use our PPE at every incident, we often forget the importance of that equipment.

PPE is often referred to as an ensemble, because no single piece of PPE can adequately protect a firefighter by itself. Instead, we must understand that each element of the PPE ensemble works with the other elements to provide a complete set of protective gear.

It is important to remember that PPE by itself does not guarantee firefighter safety. However, injuries can be reduced and prevented if PPE are used properly. It is important that firefighters recognize that PPE is not the first line of defense against injury; it is only your **LAST** line of defense. When your PPE fails, your body will be injured!

Your PPE ensemble includes:

- Helmet;
- Protective hood;
- Protective coat and trousers;
- Gloves;
- Safety shoes or boots;
- Eye protection;
- Hearing protection;
- Traffic safety vest;
- Self-contained breathing apparatus (SCBA); and
- Personal alert safety system (PASS).

### Hazards for Firefighters

Firefighters are exposed to many hazards while engaged in fire suppression and rescue activities. Some of these hazards include:

- Heat;
- Steam;
- Dust and grit;
- Blunt force impact;
- Penetrating injuries;
- Sharp edges;
- Toxic environments; and
- Oxygen-depleted environments.

Our PPE has been designed to protect our bodies from these hazards. It is important that we inspect and maintain our PPE so that it can protect us.

### Avoiding Injury

Poorly maintained PPE will fail to protect you, often without you realizing that the equipment is no longer working. The following suggestions will help you keep your PPE in good condition.

- Inspect your PPE regularly. No one else is responsible for your gear but you! A monthly inspection, in addition to a quick check after each use, will make sure your PPE is good order.
- Wash your PPE when it is dirty. In addition to looking bad, dirty gear is unable to protect fully and can actually expose you to contaminants left on your gear after a fire. Regular laundering using the specialized gear washer and dryer at Headquarters is important
- Make sure there are no cuts or tears in your vapor barrier. The vapor barrier inside your coat and pants is put there to protect you from steam burns. Cuts or tears will allow steam to penetrate to your body.
- Report damaged gear to your station officers. They will assist you in getting fully-protective replacement gear from Headquarters. No firefighter is expected to live with damaged gear.
- Wear your gear; every time, no matter what! Firefighters (and officers) who forget to put on gloves, coats, helmets, or other gear have only themselves to blame when injuries result. Set a good example!



### Protect Yourself

Finally, practice donning your gear and SCBA regularly. You cannot help your fellow firefighters until you are fully protected. The time it takes to don your PPE can be reduced through regular practice. Practice to be safe!







# Safety Brief

JCFPD Training Division

2010-December

2010-12



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## Cold Weather Operations- On Scene

As winter approaches, it is useful to consider how cold weather affects our operations. Cold weather issues have been addressed in earlier issues (December 2006; December 2009). In this issue, we will focus on operations at emergency scenes.

The primary issue during cold weather is the temperature. As the temperature drops, both equipment and personnel are negatively affected. Because the fire service relies primarily on water for fire suppression, there is always the possibility that ice will form during operations. And if nature provides the moisture, we may have to deal with ice or snow or both.

### Hazards for Firefighters

When ice is present at the emergency scene, consider using sand or kitty litter to reduce slipping hazards. This is especially true near the pumping engine, water supply points, or command posts. Now might be a good time to ensure that the supply of kitty litter on the engine is topped off.

Water used during suppression will not flow out of the building during cold weather. Ice buildup can add considerable weight to a building with structural supports weakened by the fire. Ice can also build up on ladders, porches, running boards and steps, as well as roadways.

Other equipment will also be affected by cold weather. Combustible gas meters may not work properly when cold. Gasoline in portable equipment may have water in the fuel, which will freeze as temperatures fall. SCBAs are supposed to function during cold weather, but problems can occur as moisture inside the

mask or regulator freezes. Handtools become difficult to use as wet gloves freeze and ice forms on the handle. Pumps and hoses may freeze, so keep nozzles cracked to keep water flowing.

Cold weather has a significant impact on water supplies. When using hydrants, operations can be affected by frozen, non-draining hydrants. Tanker operations will become hazardous as spilled water freezes at both fill sites and dump sites.

Snow complicates all operations. Engines may have to setup farther from the fire. Be ready to add extra sections of hose to the attack lines to reach the fire. Tools must be staged to prevent losing them under piles of snow. Hydrants may be covered by plowed snow and need to be shoveled out.

### Avoiding Injury

Firefighters and officers must recognize that cold weather requires some adjustment in operations. Consider the following steps to protect firefighters:

- Encourage firefighters to dress in layers.
- Suggest that firefighters keep dry socks in their gear bag or on the engine.
- Ensure that firefighters wear all PPE.
- Ask drivers to make sure cabs are warm while on scene to provide warm rehab space.
- Consider requesting extra units so firefighters can rotate through truck cabs to warm up.
- Call for Johnson County Fire Auxiliary support early in the operation.

### Protect Yourself

Cold weather affects how we conduct emergency operations. We must operate more slowly and use additional personnel to minimize injuries. Recognize how cold temperatures affect firefighters and equipment and take precautions to minimize the impact of cold weather.

