Hot Work
Hidden Hazards & Controls

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Agenda

- Definitions
- Hot Work Regulatory Overview
- Typical Practices & Common Hazards
- The "Permit"
- PPE
- Control Strategies
- Not So Common Heat Generating Hazards
- Other Hazards
- Other Heat Producing activities
- Other Controls

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Definitions

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Definitions

Hot Work – anything that produces flame, heat, or sparks

- Electric or gas welding, abrasive cutting, soldering, grinding, torch work, and brazing;
- Includes acetylene torches, arc welding equipment, portable grinders, and propane torches;
- Also non-rated electrical tools and equipment when used in a hazardous environment

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Definitions

Fire Safety Supervisor

- Designated permit authorizer,
- Trained to authorize Hot Work Activities, and supervises the individual performing Hot Work

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Definitions

Fire Watch

- Designated and trained to observe Hot Work for the purpose of preventing, detecting, and suppressing fires
- Must continuously monitor Hot Work (during and after for 30 minutes)
- Must be trained to use manual firefighting equipment
- Must have the ability to summon emergency assistance if needed

CANNOT BE THE PERSON PERFORMING THE HOT WORK!!!!

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Auto-ignition

- The auto-ignition temperature is the temperature that a material will spontaneously combust without an outside ignition source.
- If temperatures reach a fuel sources auto-ignition temperature it can ignite (e.g. a hot engine exhaust, an electrical element creating high temperature, or a piece of hot steel).

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Regulatory Overview

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1910.252, Welding Cutting Brazing

- Fire Hazards
- Fire Watch
- Guarding of nearby objects
- Restriction work areas
- Combustible material
- Use of fire extinguishers

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1926.350 Gas welding and cutting

- Use, transport, and storage of cylinders
- Placement of cylinders
- Confined spaces
- Proper use
- Equipment
- Training
- Shielding

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1926.352 Fire Prevention

- Area preparation
- Protection of surroundings
- Prohibited on or around flammable materials
- Fire Extinguishers
- Multi-level fire watch

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1926.353 Ventilation & Protection

- Either general mechanical ventilation systems or local exhaust systems
- Must be clean air
- Confined spaces
- Fume generation
- Respiratory protection
- Inert gasses

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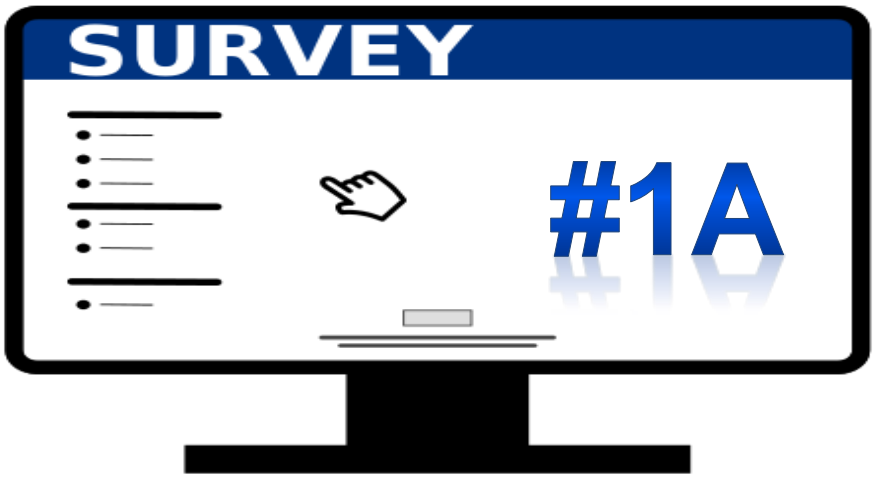

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Polling Question

Which are included as "hot work" per OSHA Standards? (Select all that apply)?

- **Welding**
- **Burning**
- **Use of Candles**
- **Laboratory Activities**
- **Propane Soldering**

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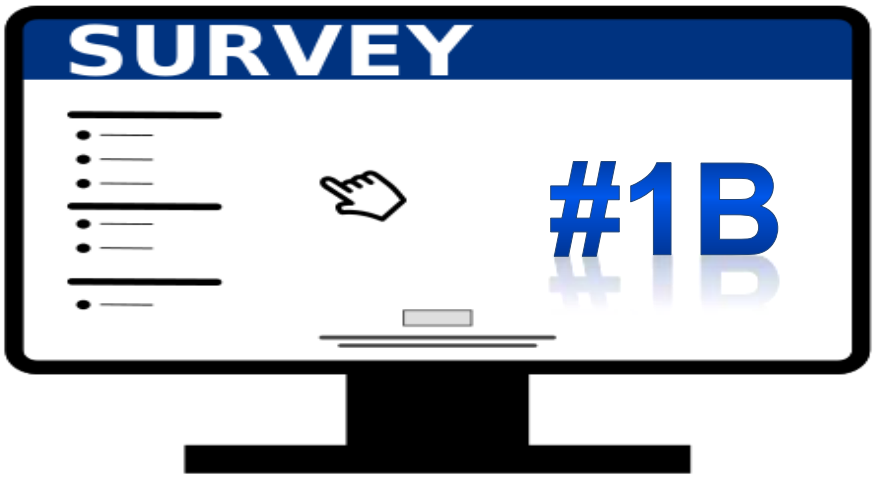

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Polling Question

Which are included as "hot work" per OSHA Standards? (Select all that apply)?

- **Brazing**
- **Cooking Equipment (e.g. restaurants)**
- **Electric Soldering Irons**
- **Grinding Ferrous Metals**
- **Torch Applied Roofing**

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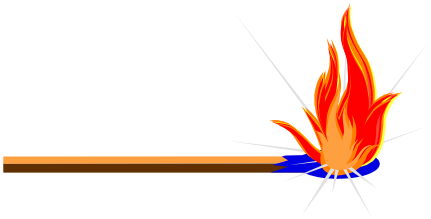
Examples of hot work are:

- Welding
- Burning
- Brazing
- Propane Soldering
- Oxyacetylene Cutting
- Grinding Ferrous Metals
- Torch Applied Roofing



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Examples of non-hot work are:

It does not apply to

- The use of candles
- Laboratory activities
- Cooking equipment
- Electric soldering irons

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“Typical” Practices & Common Hazards

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“Typical” Practices

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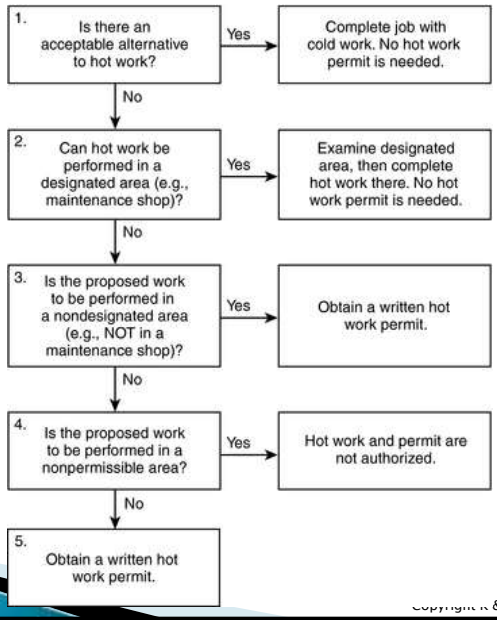
NFPA 51B Figure A.5.4

Hot Work Permit Decision Process



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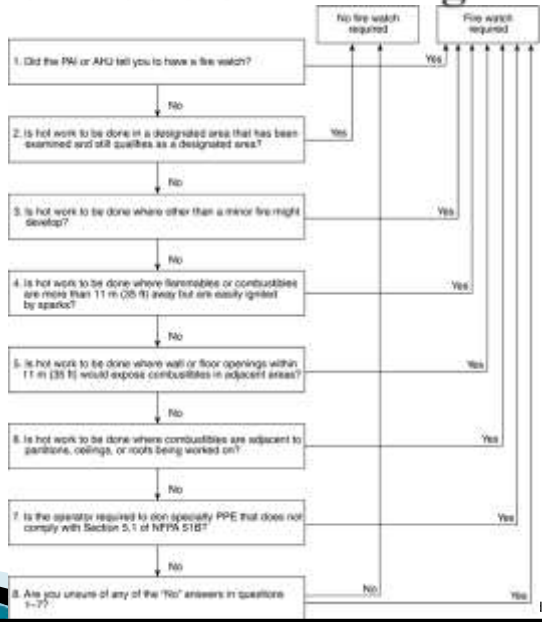
NFPA 51B Figure A.5.5.1

Spark Watcher Decision-Making

PAI= Person Authorizing Hot work.
AHJ= Management



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Fire Watch Requirements

- Qualified
- Wear proper PPE (e.g. Visor, flash gear…)
- Must cover all affected sides
- Must maintain communication between watch and heat producer (e.g. welder)
- Must be maintained at least 30 minutes after activity ends.
- Must have appropriate fire extinguisher and proper training.

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Duties of the Fire Watch

- Stop the Hot work and any other work should any safety hazard be detected.
- Sound the alarm in the event of a fire.
- Attempt to extinguish the fire only when it is safe to do so.
- Maintain watch in the hot work area for at least 30 minutes after completion of hot work.

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Lunch Break, End of Shift

- For at least 30 minutes following the Open Flame or spark producing activity, the fire watch shall remain in the area and continuously monitor the area for any signs of fire. This 30 minute rule shall also apply to breaks and lunch periods.
- Substitutions?
- What if a fire occurs as a result of Hot Work?

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The "Permit"

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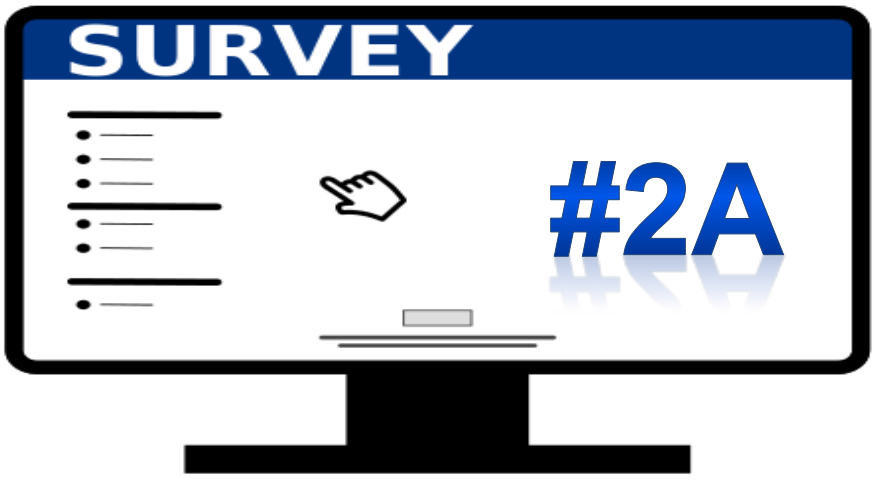

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Polling Question

Is a hot work permit required under related OSHA standards?

Choose one.

A. **Yes**
B. **No**

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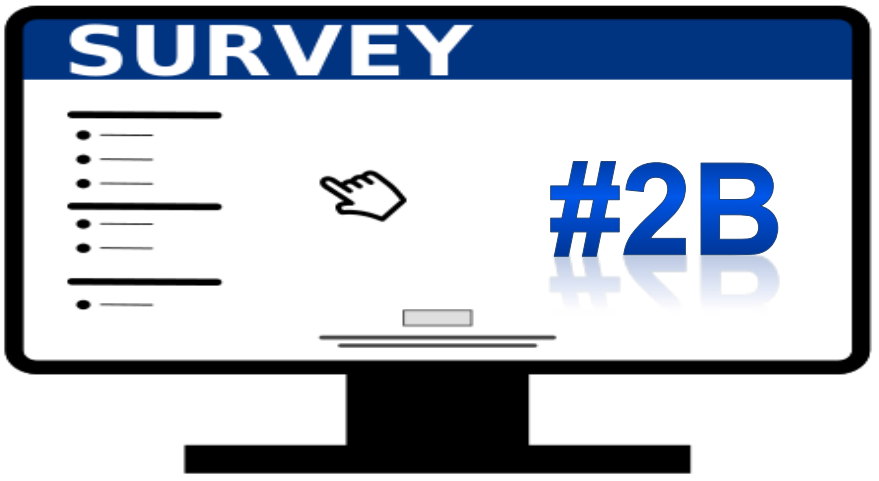

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Polling Question

Is a hot work permit a best practice?

Choose one.

A. **Yes**
B. **No**

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Hot Work Permit

- Is a hot work permit required under related OSHA standards?

NO!

- Is a hot work permit a "best practice?"

YES!

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Hot Work Permit

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Typical Permit requirements

- Combustible material removed
- Combustible material protected
- Sprinkler Systems
- Fire watch*
  - Sole duty
  - Coverage beyond hot work
- Equipment checks
- Communication system
- Trained in fire extinguisher use
- Emergency Notification
- Approval

*1910 and 1926 do not require a fire watch
1915 (shipyard) does require one

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General Requirements

Fire Prevention & Protection

- NFPA 51 B – "Standard for Fire Prevention in Use of Cutting and Welding Processes."
- Move all fire hazards away from work area.
- Use guards (fire blankets, etc.) if fire hazards cannot be moved.

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Personal Protective Equipment

e.g. Welding

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Eye Protection Requirements

- Welders and welders' helpers must wear appropriate eye protection.
- Lens of welding hoods, cutting goggles, and hand shields must:
- Be arranged to protect face, neck and ears from radiant energy.
- Be made of tempered glass and free of bubbles.
- Have lens shade readily identified on glass.

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Use Protective Clothing and Equipment

- Welders should consider using appropriate protective clothing which should include:
- Shield or helmet with a filtered lens;
- Fire resistant gloves; a leather apron;
- Boots;
- Leather spats;
- Felt skull-cap or beret and preferably overalls.

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Control Strategies

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Control Strategies

- Eliminate the Hazard
  - Rivets, screws, or bolts to attach parts
- Substitute the Base or Filler Metals
  - For example, use base metals and fillers with less chromium to reduce potential CrVI exposures.
- Use a Cleaner Welding Process
  - Carbon Arc Cutting > Plasma Cutting
  - Flux Core > MIG > Pulsed MIG > TIG

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Control Strategies

- Reduce the Amperage or Voltage
  - Welding parameters and specifications often have upper and lower ranges
- Use a Smaller Diameter Filler Wire or Welding Rod
  - Filler metals contribute more fumes than the base metal.
  - Larger diameter rods and wire may require additional general ventilation.
- Change the Shielding Gas
  - CO_2 creates good conditions for oxidizing chromium and other metals
  - Argon/CO_2 blend can provide the same results and less fumes.

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Control Strategies

- Change Body Position / Use Local Ventilation PROPERLY
  - Keep welders head out of the plume…significant increase in exposures.
  - Even small body adjustments can be beneficial.
  - Position of workpiece?

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Filtered, Portable Ventilation

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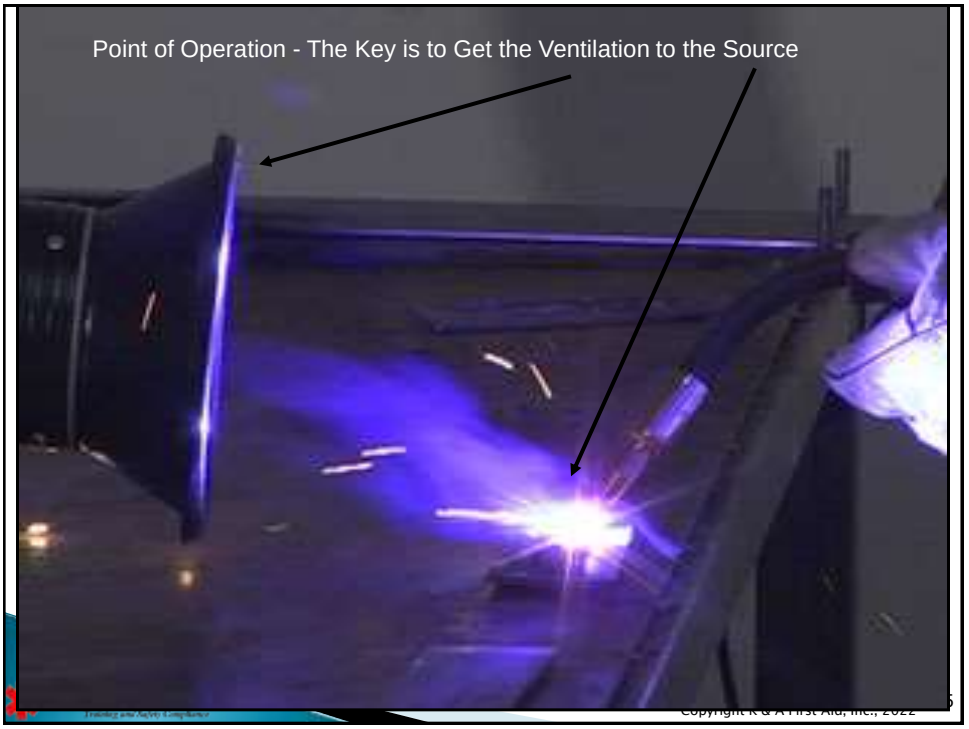

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Control Strategies

- Use Respiratory Protection
  - Last resort…often needed or requested.
  - P-100 filters

PAPR with filters and clean air blower motor on the belt

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Pre-work

- An audit check list is a good tool to use to review key preparation items.

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Pre-work

- Identify fire hazards.
- Protect smoke detectors/ sprinklers.
- Protect HVAC.
- Remove flammables (>35')
- Protect floors (wet or shield)
- Properly shield irremovable combustibles.
- Protect all openings (walls, floors ceilings) from sparks etc. escaping.

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Pre-work

- Screen personnel.
- Protect any conveyor system from splashing.
- Monitor potential hazardous atmosphere.
- Restrict access.
- Set up fire watch.

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If sparks or hot slag can reach the cylinders
INSTALL A SHIELD!

No striking the electrode to the cylinder to strike an arc!

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Not So Common Hot Work Hazards

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Health Hazards

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What's the difference

- Vapor
- Gas
- Fume
- Aerosol
- Mist
- Fog

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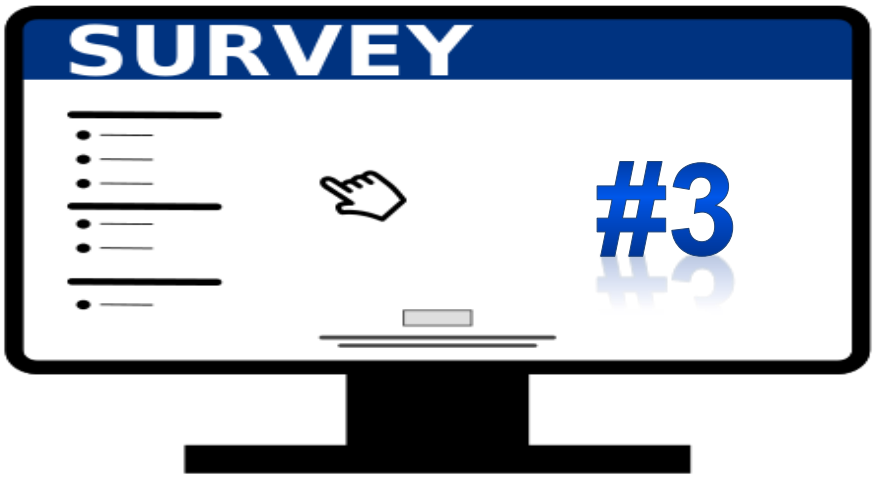

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Polling Question

What comes off when welding metals? (Select all that apply.)

- Vapor
- Gas
- Fume
- Aerosol
- Mist/Fog

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What's the difference

- Vapor
- Gas
- Fume
- Aerosol
- Mist
- Fog

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Known hazards but not necessarily associated with hot work

- Torch Cutting
- Demolition/Renovation
- Need to pay attention to potential exposure:
  - Asbestos
  - Lead
  - Silica
  - Mercury

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Other Hazards

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Sprinklers

- Sprinklers taken out of service require
  - Notification of alarm company
  - Notification of fire department
  - Fire watch* for unprotected areas

*This fire watch is not watching the work but walking the areas where the alarms are disabled. A temporary notification system needs to be in-place.

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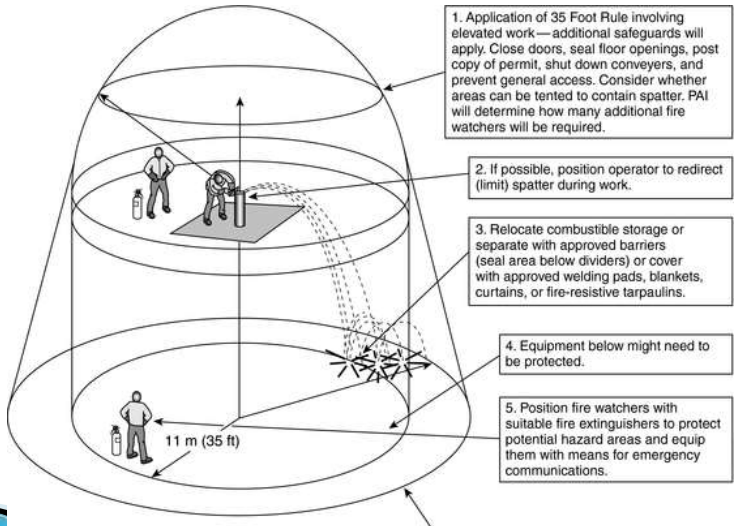
NFPA 51B Figure A.5.5.1(1)(b)

Multiple Spark Watchers Needed



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Oil and grease hazards

- Oxygen cylinders and fittings shall be kept away from oil or grease
- Cylinders, cylinder caps and valves, couplings, regulators, hose, and apparatus shall be kept free from oil or greasy substances and shall not be handled with oily hands or gloves

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Hot Work On Roofs

- Prior to any work being performed on a roof, planning must take place.
- Use of hot work for roof permit/form

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Transporting, Moving & Storing Gas Cylinders

- Valve protection caps in place & secure
- Cylinders hoisted on cradle, slingboard, or pallet only
- No magnets or choker slings!
- Move by tilting & rolling on edge
- Transport by powered vehicle: secured upright only

Confined Spaces

- Keep all cylinders outside of confined spaces.
- Turn off gases at cylinders and purge lines when away from the confined-space work area.
- Remove electrodes (rods) from electrode holders (stingers) and disconnect machine power source.

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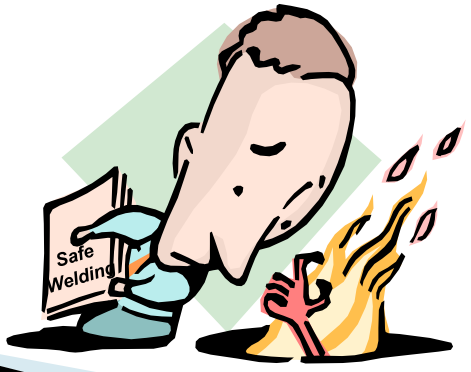
Never take **OXYGEN** **or** **ACETELYNE** **cylinders** into confined spaces!



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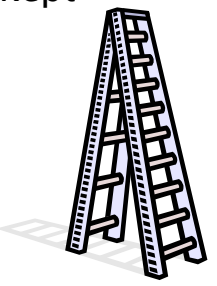
Working at Heights

- Workers on platforms, scaffolds or open sided floors must be protected from falls with:
  - A guardrail system or lifeline.
  - Safety harnesses with lanyards.
- Welding cable and hoses must be kept clear of passageways, ladders and stairways.



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Radiation Hazards

Results of excessive exposure to ultraviolet radiation:

- Causes eyes to feel like they are full of sand.
- Can lead to premature cataracts of the eyes.

Protect against ultraviolet radiation, sparks, fumes and slag.

- Wear protective clothing and respirators.
- Provide warning signs to warn of hot metal.

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Ducts

1910.252(a)(2)(viii)

- **Ducts and conveyor systems that might carry sparks to distant combustibles shall be suitably protected or shut down.**

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PIPES, TUBES, COILS:

- Certify safe prior to any hot work.
- Valves to pipes, tubes, coils must be closed and pipes blanked off.

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CLOSED CONTAINERS OR STRUCTURES:

Hollow Structures, Bilge Keels, Support Stanchions, Bits, Bollards

- Flushed, purged, inerted, filled with water, or otherwise made safe
- Ventilate as required

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FLAMMABLE / TOXIC COATING:

- Determine the Flammability of Coating
- Never use Flame or Uncontrolled Heat for Stripping Flammable Coating
- Shield Flammable Coating from Slag and Sparks in the Area of Hot Work
- Strip Coated Area 4 inches Beyond Area to be Heated
- Use Required PPE (e.g. Pressure Demand SCBA)
- Ventilate (e.g. One Air Change Every 3 Minutes)

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PRESSURIZED SYSTEMS:

- Depressurize System
- LOCKOUT/TAG OUT !!
- Protect Piping, Fittings, & Valves From Hot Slag
- Clean Space and Remove Contaminants Before Hot Work

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INSULATION

- Remove Insulation 12 inches from the hot work Area
- Wet Down Non-Removable Insulation and Cover with Fire Retardant Cloth

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AMMUNITION AND EXPLOSIVES:

- Remove Ammunition Prior to Availability or Overhaul
- No Hot Work in Any Space Containing Ammunition
- Apply 5 ft. Rule for Adjacent Spaces

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Other Heat Producing Activities

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Examples of non-hot work are:

It does not apply to

- the use of candles
- laboratory activities
- cooking equipment
- electric soldering irons

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Consequences

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WHY ALL THE DAMAGE?

- Combustibles
- Timing of fire
- Response time
- Detection/Suppression systems often disabled

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II. TIME LAPSE BETWEEN WELDING AND FIRE

Smoldering Fire

- How long?
- How does the process occur?
- Combustion without flame, usually with incandescence and smoke

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Other Controls

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A. The Thirty Five Foot Rule

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NFPA 5IB "STANDARD FOR FIRE PREVENTION DURING WELDING, CUTTING, AND OTHER HOT WORK."

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"Section 3-3.2(b)

- "Where combustible materials, such as paper clippings, wood shavings, or textile fibers, are on the floor, the floor shall be swept clean for a radius of 35 ft. Combustible floors shall be kept wet, be covered with damp sand, or be protected by noncombustible or fire-retardant shields."

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Section 3-3.2(c)

- "All combustibles shall be relocated at least 35 ft horizontally from the work site. If relocation is impractical, combustibles shall be protected with fire-retardant covers or otherwise shielded with metal or fire-retardant guards or curtains. Edges of covers at the floor shall be tight to prevent sparks from going under them, including where several covers overlap when protecting a large pile."

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Section 3-3.2(d)

- "Openings or cracks in walls, floors, or ducts within 35 ft of the site shall be tightly covered with fire-retardant or noncombustible material to prevent the passage of sparks to adjacent areas."

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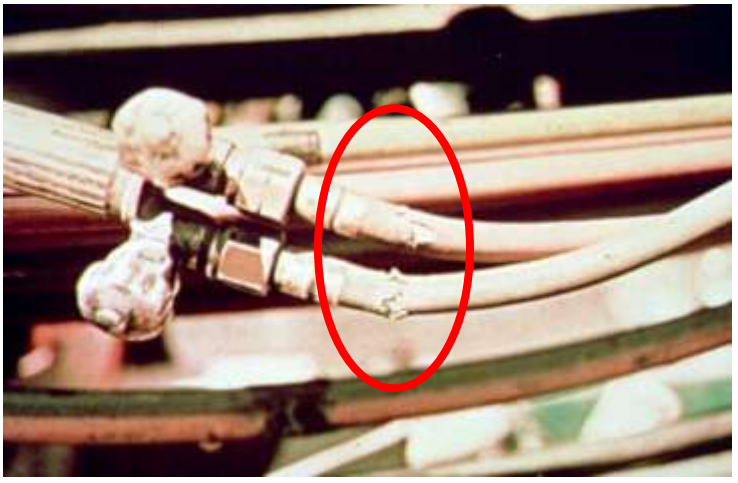
Defective Hose



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Gauges on Cylinders

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Operating Procedures

1910.253(b)(5)(ii)[E]

- Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while cylinders are in service.

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Bottles Laying in Bed of Pickup

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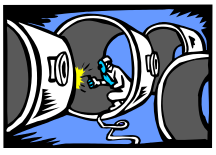
Prohibited Areas

1910.252(a)(2)(vi)(C)

- In presence of any of the following:
- Explosive atmospheres (mixtures of flammable gases, vapors, liquids, or dusts with air)
- Explosive atmospheres that may develop inside uncleaned or improperly prepared tanks or equipment
- Areas that may develop an accumulation of combustible dusts



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Cutting Possibly Too Close to Bottles

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Fire Extinguisher Training

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