PetroHab™

Hot Work Safety Solutions

Hot Work Dangers and Safety Measures

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What is Hot Work?

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Hot work is any process that can be a source of ignition when flammable material is present or can be a fire hazard regardless of the presence of flammable material in the workplace. Common hot work processes are welding, soldering, cutting and brazing. When flammable materials are present processes such as grinding and drilling become hot work processes.

Welding

- Welding is a fabrication or sculptural process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. This is in contrast with soldering and brazing, which involve melting a lower-melting-point material between the work pieces to form a bond between them, without melting the work pieces.

Soldering

- Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal (solder) into the joint, the filler metal having a lower melting point than the adjoining metal. Soldering differs from welding in that soldering does not involve melting the work pieces. In brazing, the filler metal melts at a higher temperature, but the work piece metal does not melt. In the past, nearly all solders contained lead, but environmental concerns have increasingly dictated use of lead-free alloys for electronics and plumbing purposes.

Cutting

- Metal cutting

- Cutting has been at the core of manufacturing throughout history. For metals many methods are used and can be grouped by the physical phenomenon used.

- Chip forming - sawing, drilling, milling, turning etc.
- Shearing - punching, stamping, scissoring.
- Abrading - Grinding, lapping, polishing; water-jet.
- Heat - flame cutting, plasma cutting, laser cutting.
- Electro-Chemical - Etching, Electrical discharge machining (EDM).

Brazing

- Brazing is a metal-joining process whereby a filler metal is heated above melting point and distributed between two or more close-fitting parts by capillary action. The filler metal is brought slightly above its melting (liquidus) temperature while protected by a suitable atmosphere, usually a flux. It then flows over the base metal (known as wetting) and is then cooled to join the work pieces together.[1] It is similar to soldering, except the temperatures used to melt the filler metal are higher for brazing.

Dangers of Hot Work

Hot Work Incident Statistics

- Between 2011 and 2015, municipal fire departments in the U.S. responded to an estimated average of 37,910 fires at industrial or manufacturing properties each year, with annual losses from these fires estimated at 16 civilian deaths, 273 civilian injures, and $1.2 billion in direct property damage. [1]
- Structure fires accounted for 20% of the fires, but 49% of civilian deaths, 80% of civilian injuries, and 67% of direct property damage. [1]
- U.S. fire departments responded to an average of 4,440 structure fires involving hot work per year. These fires caused an average of 12 civilian deaths, 208 civilian injuries and $287 million in direct property damage per year. [2]
- 58% of the fires involving hot work in 2010-2014 occurred in or on-non-home properties. [2]
- Welding torches were involved in one-third (34%) of hot work structure fires. [2]
- Exterior roof surfaces and processing or manufacturing areas were peak areas for non-home incidents. [2]

[1] NFPA Fires in Industrial and Manufacturing Properties March 2018 Richard Campbell

[2] NFPA Structure Fires Started by Hot Work September 2016 Marty Ahrens

Hot Work Incident Statistics

- **When outside contractors are involved, the risk of fire increases simply because contractors don't understand the hazards at the facility**. FM Global loss history shows the **risk of fire can increase over 100% when outside contractors are involved in hot work WITHOUT facility supervision**. Between 1995 and 2010, contractors have accounted for 66.5% of hot work losses at FM Global client properties. [3]

[3] http://www.safteng.net/index.php/free-section/safety-info-posts/chemical-process-safety-psmrmp/4145-fm-global-updates-their-hot-work-fire-statistics-involving-contractors-2013

Hot work should only be performed where strict controls are in place to prevent these kinds of risks from occurring. Consideration should be given to:

- the removal of flammable or explosive materials before work commences;
- the reduction in the flammability of materials (wetting down);
- isolating hot work;
- residues of flammable materials;
- testing for flammable and fermentation gases (e.g. methane);
- special precautions (e.g. using a firewatch or lookout);
- Personal Protective Equipment (PPE);
- suitable tools, equipment and materials to be used for the work;
- emergency procedures; and
- the location of the fire fighting equipment.

What Role Do Hot Work Safety Enclosures Play In Hot Work Risk Mitigation?

Spark Containment

- Spark containment is a very important part of keeping hot work areas safe.
- By helping ensure that sparks are adequately contained during hot work procedures, the Petro-Habitat HWSE offers the safest and most isolated work area on the market.
- Petrohab’s patented and trademarked Quadra-Lock® panel interlocking system creates and maintains spark containment throughout the Petro-Habitat HWSE.

Pressurization

- Positive pressure is a pressure within a system that is greater than the environment that surrounds that system and serves to ensure that there is no ingress of the environment into the pressurized system.
- A typical example of the use of positive pressure is utilizing a pressurized habitat in an area in which flammable gases may exist, such as on an oil platform.
- Custom made 5 HP pneumatic blowers are utilized to pressurize the Petro-Habitat HWSE's by introducing air into the Petro-Habitat at a rate of up to 7,000 CFM.

Gas Detection

- Gas Detection is an extremely important part of keeping areas wherein hot work is conducted as safe as possible.
- The three main types of gases that are of concern, depending on their concentrations, whenever hot work is being conducted are: Methane, Oxygen, and Hydrogen Sulfide.

LEL

- Lower Explosive Limit (LEL) is the lowest concentration (percentage) of a gas or a vapor in air that is capable of producing a flash of fire in presence of an ignition source (such as a spark, an arc, a flame, or heat).
- At a concentration in air lower than the LEL, gas mixtures are "too lean" to burn and therefore are not considered too dangerous.
- Methane gas has a LEL of 4.4%. If the atmosphere has less than 4.4% methane, an explosion cannot occur even if a source of ignition is present.

H2S

Hydrogen sulfide is a chemical compound with the formula H2S and is:

- A colorless gas that has a foul odor like rotten eggs.
- Is heavier than air and may travel along the ground.
- Is very poisonous, corrosive, flammable, and explosive.

Inhalation of high concentrations of hydrogen sulfide can produce extremely rapid unconsciousness and death.

O2

- While normal atmosphere contains approximately 21% oxygen, OSHA defines as *oxygen deficient* any atmosphere that contains less than 19.5% oxygen, and as *oxygen enriched*, any atmosphere that contains more than 22%.
- **Oxygen-deficient atmospheres** may be created when oxygen is displaced by inert gases, such as carbon dioxide, nitrogen, argon, or a facility's inert gas system or firefighting system. Oxygen can also be consumed by rusting metal, ripening fruits, drying paint, or coatings, combustion, or bacterial activities.
- **Oxygen-enriched atmospheres** may be produced by certain chemical reactions, but are typically caused by leaking oxygen hoses and torches. Oxygen enriched atmospheres present a significant fire and explosion risk.

What do I need to do?

- Consult with Health and Safety Representatives (HSR) and employees regarding hot work hazards;
- Identify the hazards associated with the hot work to be performed;
- Complete a risk assessment for the identified hazards to determine risk priorities;
- Develop and implement controls to reduce risks associated with hot work;
- Develop safe work instructions to instruct employees on how to perform the hot work safely;
- Train and assess employees in safe work instructions;
- Issue a hot work permit to perform the work only in accordance with the control measures; and
- Monitor the hot work to respond to any risks as they occur.