Hot Work Safety Training

Introduction - Greeting Your Trainees

Good morning everyone. My name is _____, and I am your Safety Officer.
Today we are going to focus on Hot Work Safety. Hot work includes welding, cutting, brazing, soldering, grinding, and any task that produces sparks, flames, or enough heat to ignite materials. These activities are routine on many sites, but they account for a large percentage of serious fires, explosions, and burn injuries. Our goal is simple: do every hot work job without a single spark causing damage.
You will learn how to prepare a work area, choose the right controls, issue and close a hot work permit, use fire watches effectively, handle gas cylinders, and respond to an emergency. By the end of this session you should feel confident to recognize hot work hazards and apply safe practices so that everyone goes home safe.

1. What Counts as Hot Work

Hot work is any temporary operation that involves open flames, sparks, or heat sufficient to ignite combustible materials. Common examples on our sites include:
- Electric arc welding and gas welding.
- Oxy fuel cutting and gouging.
- Grinding with abrasive wheels, wire brushing with powered tools, or using needle scalers.
- Soldering and brazing.
- Thawing pipes and using heat guns in flammable areas.
- Using torches to remove paint or roofing materials.

Less obvious hot work can include drilling into tanks that may contain flammable residues, or using portable generators and compressors that exhaust hot gases into confined or poorly ventilated spaces. If there is any doubt about whether an activity generates ignition sources, treat it as hot work.

2. Why Hot Work Is Dangerous

The hazards of hot work can be grouped into three main categories.
First, there is the obvious fire and explosion risk. Sparks can travel more than 10 meters and roll through cracks, gaps, and cable trays. They can fall to lower levels and start smoldering fires that become visible only after the crew leaves. Flammable vapor clouds can ignite from very small sparks.
Second, there are health hazards from fumes, UV radiation, infrared radiation, and noise. Welding fume can contain manganese, chromium, nickel, zinc oxide, and other substances that cause both short term irritation and long term illness. UV and infrared radiation can damage eyes and skin. High noise levels can damage hearing.
Third, there are physical hazards from the equipment itself: hot surfaces, pressurized hoses, electrical shock, flashback in gas systems, and burns from molten metal or slag. In short, hot work multiplies the typical hazards of a job, so planning and discipline are essential.

3. Legal and Company Requirements

Most jurisdictions require a written hot work program, a permit system, and training for all workers who perform or supervise hot work. Our company policy meets or exceeds these requirements. The essentials are:

- No hot work without a written and approved hot work permit.
- A risk assessment is completed and documented before work begins.
- Fire watches are assigned and trained, and they remain on station during hot work and for at least 60 minutes after completion or longer if the risk assessment requires.
- Combustibles are removed or protected, and fire protection equipment is ready.
- Gas testing is conducted where required, particularly in confined spaces or near flammable liquids and gases.
- Work stops if conditions change or alarms are triggered.

Permits and records must be kept for inspection. These documents are not paperwork for its own sake; they are the recipe for a fire free job.

4. Planning and Risk Assessment

Every hot work job starts with a plan.

1) Define the scope. What exactly will be welded, cut, or ground? For how long? In which location?
2) Identify hazards. Combustible construction, dust layers, oily residues, hidden voids, cable trays, insulation, vapors, weather, and wind can all change the risk profile.
3) Select controls following the hierarchy. If possible, eliminate hot work by using cold cutting methods like shears, hydraulic guillotine, or water jet. If hot work is unavoidable, engineer out the hazards with shielding, isolation, and ventilation, and enforce administrative controls and PPE.
4) Assign competent people. Authorize an issuer, a performer, and a fire watch. Confirm they understand the procedure and their responsibilities.
5) Prepare emergency response. Know the nearest extinguisher, hydrant, fire alarm station, and egress route. If the risk is high, arrange a standby hose line or additional extinguishers.
6) Communicate. Hold a toolbox talk with everyone in the area who might be affected by noise, sparks, or fumes. Confirm how you will stop work and how you will report a problem.

A written risk assessment and method statement should be attached to the permit.

5. The Hot Work Permit System

A hot work permit is written authorization that the job may proceed under defined conditions. It must be issued by a competent person who has inspected the work area. The permit includes:
- The exact location, description of the work, and duration.
- Hazards identified and controls to be in place before starting.
- Names of the welder or hot work performer, the fire watch, and the permit issuer.
- Gas test results if required, including oxygen level, combustible gas percentage, and any toxic gas data.
- Required equipment and PPE.
- Time when the fire watch can stand down and when the permit expires.

No permit means no hot work. If conditions change, if a control fails, or if the job takes longer than permitted, stop, reassess, and reissue the permit.

6. Preparing the Work Area

Good preparation prevents most fires. Before striking an arc or lighting a torch, do the following steps.
- Remove combustible materials from within a minimum 10 meter radius if possible. This includes paper, cardboard, wood, dust, insulation, foam, liquids, and plastic. If removal is impossible, cover materials with fire resistant blankets or welding screens.

- Sweep away dust and debris. Fine dust can ignite from a single spark and can carry fire across a floor.
- Seal gaps, cracks, and openings with fire resistant materials. Pay attention to floor penetrations, wall openings, drains, and open cable trays. Sparks can travel through and light combustibles on the other side.
- Protect nearby equipment. Use barriers to shield pipes, cables, and control panels from heat and spatter. Remove or isolate fuel lines and lubricants if feasible.
- Verify sprinkler and fire systems are in service. If a system must be impaired for the job, implement additional compensating measures such as a charged hose line or extra extinguishers, and document them on the permit.
- Provide local ventilation to manage smoke and fumes. Set up extractors to pull fumes away from the worker and the rest of the site.
- Confirm the fire watch position, equipment, and clear line of sight to the hot work zone.

7. Gas Testing and Ventilation

Hot work in confined spaces, tanks, pits, or areas where flammable vapors may be present requires gas testing before and during the job. A competent person should test for:
- Oxygen content. Keep oxygen between safe limits, typically 19.5 percent to 23.5 percent.
- Flammable gases and vapors. Keep levels well below 10 percent of the lower explosive limit. If readings rise, stop and ventilate.
- Toxic gases such as carbon monoxide and hydrogen sulfide when applicable.
Use calibrated detectors and record readings on the permit. Ventilate with blowers or extraction fans to keep the atmosphere safe. Never rely on ventilation alone; keep monitoring.

8. Fire Watch - The Linchpin of Hot Work Safety

The fire watch is the person who prevents small sparks from becoming large losses. Their duties are:
- Arrive before the job starts and inspect the area for combustibles and hidden routes for sparks.
- Have appropriate extinguishers on hand and know how to use them. For welding and cutting, ABC dry chemical and CO2 are typical. For metal fires such as magnesium, Class D agents are required.
- Maintain continuous surveillance during hot work. Do not perform other tasks.
- Watch the area above, below, and on the far side of walls or partitions.
- Remain after work stops for the period defined on the permit, typically 60 minutes or longer, and conduct a final inspection before leaving.
- Call for help immediately if a fire starts that cannot be controlled with the available extinguisher.
The best welders request a strong fire watch because they know even skilled work can throw sparks into unexpected places.

9. Handling and Storing Gas Cylinders

Oxy fuel work introduces specific hazards from oxygen and fuel gases such as acetylene or propane. Follow these rules.
- Secure cylinders upright with chains or straps. Do not let them fall or be struck.
- Keep oxygen and fuel cylinders separated when stored and protect them from heat and sunlight.
- Use regulators, hoses, and flashback arrestors designed for the gas and in good condition. Inspect threads and seals.
- Purge hoses before lighting to remove air. Use a spark lighter rather than matches.
- Close cylinder valves when not in use, even during short breaks. Bleed pressure from hoses at the

end of the shift.
- Keep oil and grease away from oxygen equipment. These can ignite violently in oxygen rich conditions.
- Transport cylinders with caps in place and do not lift them by the cap.

10. Electrical Safety for Arc Welding and Cutting

Electric shock is a major risk for arc welding. Control it by:
- Inspecting leads for damage, cracked insulation, and loose connections. Replace damaged leads immediately.
- Keeping equipment dry. Do not stand in water or on wet surfaces while welding. Use dry gloves and clothing.
- Turning off the power source before changing electrodes. Use proper lockout or tagout when servicing equipment.
- Ensuring the ground clamp makes a solid connection near the work to minimize current paths through structures.
- Avoiding tangled leads and trip hazards. Keep cables off hot surfaces.
- Using screens to protect others from arc flash.

11. Personal Protective Equipment

Hot work PPE must protect against sparks, heat, UV radiation, fumes, and noise. Minimum requirements typically include:
- Helmet and face shield or welding hood with the correct shade lens for the process.
- Flame resistant clothing such as cotton treated FR or leather for high exposure. Do not wear synthetic materials that melt.
- Leather gloves appropriate to the task, with gauntlets for heavy spatter.
- Safety boots with metatarsal protection in heavy work, otherwise sturdy leather boots.
- Hearing protection when grinding or in high noise areas.
- Safety glasses under the hood and side shields as needed.
- Respiratory protection when ventilation is not sufficient or when welding stainless steel, galvanized steel, or coated materials.
Inspect PPE daily and replace damaged items.

12. Controlling Sparks, Heat, and Radiation

Use engineering controls to keep sparks and heat where they belong.
- Fit welding screens and curtains to shield other workers and prevent UV exposure.
- Use fire blankets, pads, and curtains rated for hot work to protect floors and nearby equipment.
- Position workpieces so that sparks are directed into safe areas and collect slag in trays.
- Use heat sinks and wet rags when protecting temperature sensitive equipment.
- Monitor hot work on elevated platforms to ensure sparks do not fall through grating.
- Wet down combustible surfaces if acceptable for the process.

13. Housekeeping and Material Control

A clean site is a safe site. Good housekeeping removes fuel for fire and reduces trip hazards.
- Keep only the tools and materials you need at the work face.
- Remove packaging and waste regularly.

- Label and close solvent containers. Do not keep open containers near hot work.
- Manage oily rags in self closing metal bins.
- Maintain clear access to extinguishers, egress routes, and electrical disconnects.
- Coil welding leads neatly and store cylinders properly after the shift.

14. Hot Work Near Flammable Liquids or Gases

Working in chemical plants, refineries, or facilities with flammable liquids demands additional controls.
- Verify the area classification and obtain authorization from operations.
- Drain and neutralize lines and equipment. Blind or blank as required.
- Use continuous gas monitoring around the work area. Stop work if readings rise.
- Prohibit vehicle and engine operation that could introduce ignition sources unless specifically permitted.
- Use intrinsically safe equipment where required.
- Consider foam or water curtains as additional protection when sparks cannot be fully contained.

15. Hot Work in Confined Spaces

Hot work in confined spaces is high risk because heat, smoke, and fume build quickly, and oxygen can be displaced. Follow both confined space entry procedures and hot work procedures.
- Use a permit that covers both confined space hazards and hot work hazards.
- Provide mechanical ventilation to move fresh air in and contaminated air out.
- Conduct gas monitoring continuously for oxygen, combustible gases, and relevant toxic gases.
- Wear a harness and maintain lifeline and attendant communication.
- Keep emergency rescue equipment ready and a trained rescue team on site for high risk jobs.

16. Weather and Environmental Factors

Wind can carry sparks long distances. Rain and humidity can increase electrical risk and degrade PPE. Heat stress can affect concentration and lead to mistakes.
- Evaluate weather before starting outdoor hot work.
- Use windbreaks and barriers when gusts are strong. Reschedule if sparks cannot be controlled.
- In hot conditions plan rest breaks, hydration, and shaded areas.
- In cold weather protect gas equipment from ice and ensure hoses remain flexible.

17. Training and Competency

No one may perform hot work without training and authorization. Training should cover hazard recognition, permit requirements, fire watch duties, equipment setup, cylinder handling, electrical safety, PPE, ventilation, and emergency response. Competency must be demonstrated by practical assessment.
Refresher training is required on a regular schedule and after incidents or changes in process. Supervisors and permit issuers require additional training in risk assessment and program management.

18. Roles and Responsibilities

- Hot work performer: Sets up equipment correctly, follows the permit, protects combustibles, communicates with the fire watch, and stops work if conditions change.
- Fire watch: Monitors during and after the job, has extinguishers ready, and raises the alarm immediately if a fire starts.
- Permit issuer: Inspects the area, verifies controls, authorizes work, and closes the permit after final inspection.
- Supervisor: Ensures workers are trained, equipment is available, and procedures are enforced.
- Safety Officer: Audits the program, investigates incidents, and updates procedures when hazards change.

19. Common Mistakes and How to Avoid Them

- Skipping the permit because the job is small. Even a tiny tack weld can start a large fire.
- Assuming a quick grind will not throw sparks. Grinding is one of the most common causes of hot work fires.
- Leaving the area too soon. Many fires start within an hour after hot work ends.
- Forgetting hidden combustibles in wall cavities, behind insulation, or under floors.
- Working on or near empty tanks that contain flammable residues. Clean and gas free or use cold methods.
- Disconnecting smoke detectors or sprinklers without compensating measures and authorization.
- Not checking the far side of walls, partitions, and floors.
- Using the wrong extinguisher or not knowing how to use it.
- Poor lead management creating trip hazards or tangles around cylinders.
- Failing to control fume and smoke, leading to health issues and alarms.

20. Emergency Response and First Aid

If a fire starts and cannot be put out with a portable extinguisher within seconds, pull the alarm, evacuate, and call the fire department. Do not delay. Small fires grow quickly.
For burns, cool the area with clean water for at least 20 minutes and remove restrictive clothing or jewelry. Do not apply grease or ointments. Cover with a clean dry dressing and seek medical attention.
For eye exposure to sparks or UV, report immediately for evaluation.
After any incident, stop work, secure the area, and begin an investigation to learn and improve. Update procedures and training based on findings.

21. Program Audits and Continuous Improvement

A hot work program is only as strong as its last job. Conduct periodic audits that review permits, observe work in progress, and test knowledge of fire watch and performers. Track leading indicators such as number of permits issued, number of deficiencies found and corrected, and time spent on fire watch after work. Share lessons learned across teams and contractors.

22. Case Study - Sparks Through a Wall

A maintenance crew used a grinder to remove anchors near a drywall partition. They posted a fire watch on their side, but did not check the other side of the wall where cardboard boxes were stored. Sparks passed through a gap, smoldered in the boxes, and the fire broke out 30 minutes after the crew left. The facility sprinkler controlled the fire, but damage was significant. The corrective actions were to expand the radius for removal or protection of combustibles, require checks on the far side of partitions,

and extend fire watch times in storage areas.

23. Summary and Key Messages

- Hot work is any task that generates ignition sources such as sparks, flames, or high heat.
- Plan the job, assess risks, and use the permit system every time.
- Prepare the area by removing or shielding combustibles, sealing openings, and arranging ventilation.
- Assign a trained fire watch and keep them on station during and after work.
- Handle gas cylinders and electrical equipment with respect for their hazards.
- Use correct PPE, control fume and radiation, and practice good housekeeping.
- Stop work and reassess if conditions change. Nothing is so urgent that it cannot be done safely.

By applying these practices, we prevent fires, protect people and property, and keep the job on schedule.