Controlling Hot Work

MSC-PRAC-30487

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Topic: Safety and Health

Controlling Hot Work

PURPOSE

This practice identifies a key aspect of the Safety and Health (S&H) program, and outlines controls for safe hot work. For the purpose of this practice, hot work is defined as "high hazard," "low hazard," or "exclusion." High hazard includes electric arc, oxy-fuel gas welding/cutting operations, and heavy grinding. Low hazard includes brazing, soldering using a flame, light (portable) grinding, tig-welding, or other similar low-energy activities. Exclusion activities are those that include electric soldering, pedestal/small bench grinders, and sanders. (See Appendix A.)

SCOPE

This practice includes the following major sections:

- General Requirements
- Protective Coatings
- Permitting and Work Process
- Designated Hot Work Areas
- Gas Welding and Cutting Safety
- Arc Welding and Cutting Safety
- Hot Work on Containers

The requirements of this practice are consistent with the requirements published in the Hanford Mission Support Contract (MSC) Safety and Health virtual manual.

APPLICATION

This practice applies to Mission Support Alliance (MSA) construction personnel.

GENERAL REQUIREMENTS

Records generated during the performance of this activity are to be included in the Construction Work Package and will be managed in accordance with MSC-PRAC-30374, *Construction Work Package* and MSC-PRAC-30376, *Construction Document Control.* Refer to MSC-PRO-31697, *Controlling Exposures to Hexavalent Chromium* for additional controls when working with chrome containing metals or protective coatings.

A prejob plan identifying the known/suspected hazards associated with the work activity is completed and communicated to the workers prior to the activity commencing (see MSC-PRAC-30462, *Prejob Safety Planning*).

The safety precautions for activities that are neither high nor low hazard (as defined in this practice), such as pedestal/small bench grinders, sanders, and soldering, are determined by the job supervisor, in consultation with Safety & Health and the MSA fire protection

engineer (FPE). See Appendix A.

NOTE: *A Hot Work Permit (form A-6004-281) is not required for exclusion activities.*

If the classification of an operation is not clear, the job supervisor, in consultation with the MSA FPE, determines the hazard category (high, low, or exclusion).

The MSA FPE may delegate signature/review authority to the MSA Group Lead in matters concerning this practice.

PROTECTIVE COATINGS

In enclosed spaces, all surfaces covered with toxic preservatives are stripped of all toxic coatings for a distance of at least 100 millimeters (4 inches) from the area of heat application, or the employees are protected by air line respirators.

In the open air, employees are protected by an appropriate respirator. Stripping of preservative coatings should be performed a distance of 4 inches from the area to be heated (whether in an enclosed area or an open area) to ensure that the temperature of the unstripped metal is not substantially raised. (Artificial cooling of the metal surrounding the heating area may be used to limit the size of the area required to be cleaned.)

PERMITTING AND WORK PROCESS

Preparing the Worksite (Hot Work Outside Designated Areas)

To the greatest extent practical, hot work is performed by authorized personnel in shops using designated shop hot work areas. Where hot work must be performed outside designated areas, the area is made fire safe by removing combustibles or protecting combustibles from ignition sources, and by providing a designated trained fire watch(es).

Those performing hot work wear fire retardant/resistant (FR) personal protective equipment (PPE) (such as FR coveralls or leathers).

NOTE: *Exceptions to wearing FR PPE must be approved by the supervisor and the MSA FPE or the* Safety and Hygiene *on the Hot Work Permit.*

Prepare for hot work as follows:

Supervisor

The supervisor's responsibilities include the following:

- Survey the area to identify combustible materials and hazardous areas at the worksite and prepare the worksite for the job.

NOTE: *The most common materials likely to become involved in fire are combustible building construction such as floors, partitions, and roofs; combustible contents such as wood, paper, textiles, plastics, chemicals, and flammable and combustible liquids and gases; and combustible groundcover such as grass and brush. Any material that ignites and burns is considered combustible.*

- Do not allow welding on metal partitions, walls, ceilings, or roofs with combustible coverings or with combustible sandwich-type panel construction.

- If combustibles are present in the work area, then either

  - relocate the job

  - move the combustible materials at least 10.7 meters (35 feet) away from the work, or

  - protect the combustible materials within 10.7 meters of the work by using noncombustible/FR covers, shields, or blankets or, if appropriate, wet the materials.

NOTE: *The separation distance and protective measures for "low" hazard hot work is determined by the supervisor, in consultation with the MSA FPE (or designee).*

- Verify or have openings or cracks in walls, floors, systems, and equipment within 10.7 meters of the work covered or plugged as appropriate to prevent sparks from reaching adjacent areas or provide a fire watch below grade.

- If installed, automatic fire suppression systems must be operable.

NOTE: *Special precautions need to be taken to avoid accidental operation of the system. Consult with the MSA FPE for appropriate special precautions to avoid inadvertent actuation of fire protection system*s.

- If installed, verify the operating condition of the fire detection system. The job may require that the system be taken out of service prior to the start of the job. If so, approval is required from the building manager and the fire department having jurisdiction.

NOTE: *Depending on the operation, detectors may need to be covered or removed; on the Hanford Site, notify and coordinate with the client or the fire department having jurisdiction.*

- Verify that the worksite and/or work area has adequate ventilation.

- Where potential exists for flammable concentrations of gases, vapors, liquids, or dust in the atmosphere, appropriate monitoring is performed at the direction of Safety and Health.

- Consult with Safety and Health if materials (including welding rod and fluxes) containing zinc, lead, mercury, beryllium, cadmium, hexavalent chromium, or stainless steel are to be cut, heated, or welded for appropriate methods and controls.

- Ensure that a fire watch(es) is assigned and dedicated to each hot work job and that he/she is trained/understands the following:

  - The area to be fire watched

  - Potential fire hazards (to personnel and property)

  - Appropriate emergency procedures and actions

  - Methods for sounding the alarm(s)

  - Procedure for manually activating fire suppression systems

  - Fire watch and hands-on portable fire extinguisher training is required every 3 years

  - Fire watch has the responsibility and authority to stop “hot work” if unsafe conditions develop

Hot Work Personnel

Hot work personnel's responsibilities include the following:

- Verify that hot work equipment used (such as torches, regulators, pressure-reducing valves, and manifolds) is listed or approved by a nationally recognized testing laboratory for the intended use.
- Verify that oxygen-fuel gas systems (such as oxygen/acetylene welders) are equipped with listed and/or approved backflow valves, flash arrestors, and pressure-relief devices.
- If the hot work is performed on pipes or other metal, verify that combustibles in contact with the metal are protected from ignition caused by heat conduction through the metal or that they are too far from the heat source at risk.
- Outside designated hot work areas; the operator of the welding/cutting equipment conducts a daily inspection of the work area to determine whether the information on the permit accurately reflects the conditions at the worksite and the nature of the work to be performed.
- Upon confirming the information on the permit is accurate, the welding/cutting equipment operator signs and dates the attached hot work signoff log before proceeding with the work.

Before Starting Hot Work Outside Designated Areas

After preparing or verifying the worksite, the supervisor ensures that the necessary personnel are ready to begin work and gets the necessary approvals.

Facility/Project Representative (If Applicable)

The facility/project representative's responsibilities include the following:

- Advise personnel involved with the hot work about flammable and combustible materials or hazardous conditions of which they may not be aware.
- Authorize the hot work by approving the Hot Work Permit form.

Supervisor

The supervisor's responsibilities include the following:

- Complete form A-6004-281 before each job.

NOTE: *Facility-specific hot work permits may be required in addition to, or in lieu of form A-6004-281. MSA, subcontractor, and/or sub-tier contractor personnel required to use other permits/procedures are trained for such use before performing the work.*

- Subcontractors forward a copy to the assigned MSA construction supervisor/superintendent who will fax a copy of the completed permit to the Hanford Fire Department (HFD), fax number 373-5846 (for hazard communication purposes). .

- Verify that the required fire watch(es):

  - Has completed hands-on fire prevention/fire extinguisher training within the past 3 years.

  - Is provided with a fully charged and operable fire extinguisher and/or other extinguishing agent(s) as specified on the Hot Work Permit at the worksite throughout the entire job. (Ensure that a separate extinguisher is brought to the worksite. Do not take a permanently mounted extinguisher in the facility from its storage rack, except in case of fire.)

- If the hot work task remains inactive for longer than 1 shift after the Hot Work Permit is approved, re-verify and initial form A-6004-281 before starting work.

- Verify that employees have the appropriate PPE identified in the JSA or Hot Work Permit for hot work activities. When working with products or materials known or suspect hexavalent chromium properties use MSC-PRO-31697, *Controlling Exposures to Hexavalent Chromium* for additional guidance. Hazards include infrared and ultraviolet radiation, radiant heat, fumes, sparks, and hot slag. Workers (cutters, welders, helpers, fire watches, as well as workers or other personnel adjacent to the welding areas) are protected by removing themselves from exposure to the hazards or by using proper eye protection (refer to practice MSC-PRAC-30471, Personal Protective Equipment), protective clothing, shielding, and screens as appropriate.

During Hot Work Outside Designated Areas

Hot Work Personnel

Hot work personnel's responsibilities include the following:

- Obtain approval from the supervisor before starting hot work.
- Perform hot work only when the conditions required by form A-6004-281 are met.

Fire Watch

Fire watch responsibilities include the following:

- Monitor the work in progress. Be alert for:
  - Combustible construction materials or building contents within 10.7 meters (35 feet) of the work
  - Openings that expose combustible materials in adjacent areas within 10.7 meters (35 feet) of the work
  - Combustible materials that could be ignited by sparks (even if the material is more than 10.7 meters (35 feet) from the work)
  - Combustible materials on the interior or on the other side of metal partitions, walls, floors, or ceilings that could be ignited by conduction or radiant heating
- The fire watch conducts only those duties of the fire watch. The fire watch may not provide assistance as a welder's helper, supervisor, or perform any task that may detract from the duties of a fire watch.

Supervisor

The supervisor's responsibilities include the following:

- Maintain the fire watch after stopping hot work for a minimum 30 minutes; longer, as indicated for each situation.
- If, during the job, the shift changes or supervisors, employee(s), or fire watch(es) are relieved, have each on-coming supervisor, employee, and fire watch review and initial form A-6004-281 before starting their shift.
- After the job is completed, if any fire detectors were bypassed, covered, or removed for the work, ensure that the fire department restores the detectors to service as soon as possible.
- If suppression systems were bypassed or special precautions were taken to avoid accidental operation, restore the system to normal service.

Hot Work in Confined Spaces/Areas

The following additional steps are required for hot work in or on confined spaces/areas (such as tanks, small rooms). Refer to practice MSC-PRAC-30512, *Confined Space Entry* for confined space entry requirements.

Supervisor

The supervisor's responsibilities include the following:

- If the job requires hot work on/in piping, tanks, or similar confined spaces used for flammable/combustible liquids or gases, proceed as follows:
  - Before starting work, complete a documented job hazard analysis.
  - Complete confined space evaluation and permit. Contact Safety and Health for assistance.
  - Ensure that the interior of items is cleaned of residue.
  - Have the atmosphere monitored to ensure that the concentration does not exceed 10 percent of the lower explosive limit. Purging may be required to prevent ignition of flammable atmospheres. Have the atmosphere monitored per the confined space permit prior to entry to verify atmospheric conditions are met.

- During the work, perform atmospheric testing as directed on the confined space permit, or more frequently as required by the job hazard analysis or work package.

- Ensure that adequate ventilation is provided where personnel entry is necessary as required on the confined space permit. (Consult with Safety and Health)

- If oxidizers are involved, consult with Safety and Health and Fire Protection.

Employees

Employees' responsibilities include the following:

- If arc welding in a confined space is suspended or interrupted for any substantial period of time (such as during lunch or overnight), proceed as follows:

  - Remove electrodes from the holders.
  - Place the holders where they are not accidentally touched.
  - Disconnect or turn off/shut off the machine power supply.

- If gas welding or cutting in a confined space is suspended or interrupted for any substantial period of time (such as during lunch or overnight), shut off the gas supply (and drain the lines) at some point outside the confined area to eliminate the possibility of gas escaping through leaks or improperly closed valves. If practical, remove the torch and hose from the confined space.

DESIGNATED HOT WORK AREAS

Designated hot work areas may be any area that meets the criteria (as applicable) in this section. A fire watch is normally not required for designated hot work areas, but may be provided as determined by the supervisor.

Safety and Health and the job supervisor conduct an initial inspection of the workplace. Based on the results of the inspection, form A-6004-281 is signed by Safety and Health and the supervisor and posted at the designated hot work area. The permit is valid for a period of 6 months from the date of issue. Before the end of the 6-month period, Safety and Health and the job supervisor conduct an inspection of the workplace and reissue the permit based on the results of the inspection. (Any deficiencies related to performance of hot work must be satisfactorily corrected before the permit is issued/reissued.)

Some construction areas are temporarily designated as hot work areas until completion of the job.

The area is:

- Fire resistive or of noncombustible construction.
- Provided with noncombustible/FR barriers against hot slag and sparks if fire resistive or noncombustible construction is not provided.
- There are no combustible materials on floor, ceiling, wall, or duct openings within 10.7 meters of the designated area.

NOTE: *The separation distance and protective measures for "low" hazard hot work is determined by the supervisor, in consultation with the MSA* FPE (or designee).

- If the above requirements cannot be met, then the perimeter of the area is provided with noncombustible/FR barriers against hot slag and sparks.

The area is provided with a fully charged and serviced portable fire extinguisher (minimum 2A-10BC rating) or other extinguishing agent(s) as specified on the Hot Work Permit.

The area has adequate ventilation (consult Safety and Health if necessary). Follow section on Hot Work in Confined Spaces/Areas, if applicable.

Inside buildings, the designated area is provided with visual protection, such as surrounded by a booth or screen constructed of one of the following materials:

- Metal
- Flame-resistant fabric that is opaque to most optical radiation.
- Transparent, colored, polyvinyl-chloride material formulated with a flame retardant and UV-visible absorber in the range of 200 to 3000 nanometers

Those performing hot work wear PPE as required on the JSA and/or hot work permit (such as FR coveralls or leathers).

NOTE: *Exceptions to wearing FR PPE must be approved by the job supervisor and Safety and Health on form A-6004-281. In no case are both the dedicated fire watch and the FR PPE requirement waived at the same time.*

Supervisor

The supervisor's responsibilities include the following:

- Verify that the area has been reviewed and meets the requirements for a "designated" hot work area.
- Verify that a portable fire extinguisher is readily accessible.
- Verify that the designated work area has adequate ventilation.
- Verify that employees have the appropriate PPE in accordance with hot work permit/JSA. Hazards include infrared and ultraviolet radiation, radiant heat, fumes, sparks, and hot slag. All workers (cutters, welders, helpers, fire watches, as well as workers or other personnel adjacent to the welding areas) are protected by removing themselves from exposure to the hazards or by use of equipment, such as proper eye protection, protective clothing, shielding, and screens as appropriate.

Supervisor and Employees

The supervisor and the employees' responsibilities include the following:

- Verify that hot work equipment to be used (such as regulators, pressure-reducing valves, and manifolds) is listed or approved by a nationally recognized testing laboratory for the intended use.
- Verify that oxygen-fuel gas systems (such as oxygen/acetylene welders) are equipped with listed and/or approved backflow valves and pressure-relief devices.

GAS WELDING AND CUTTING SAFETY

Fuel-gas hoses and oxygen hoses are easily distinguishable from each other. The contrast is made by different colors or by surface characteristics readily distinguishable by touch. Oxygen and fuel-gas hoses are not interchangeable. Do not use single hoses having more than 1 gas passage.

Inspect gas welding and cutting equipment at the beginning of each shift to identify any of the following defects:

- Leaking or damaged hose or hose couplings
- Leaking or damaged fuel-gas pressure regulators and gauges and related connections
- Leaking or damaged torch heads or shutoff valves and related connections
- Clogged tip openings

Report faulty or defective equipment to the supervisor and, until repaired, tag out-of-service with a DANGER — DO NOT USE tag as specified in practice MSC-PRAC-30460, *Safety and Health Compliance Inspection and Management Walkthroughs*.

Clean clogged tip openings on torches with approved cleaning wires, drills, or other devices designed for this purpose.

Keep hoses and other equipment clear of walkways, ladders, and stairs.

Ignite torches only by friction lighters or other approved devices. Do not use matches, flame lighters, or hot work to ignite torches.

Keep oxygen cylinders and fittings away from oil, grease, and other highly combustible/ flammable materials. Keep cylinders, cylinder caps and valves, couplings, regulators, hoses, and apparatus free from oil and greasy substances, and do not handle with oily hands or gloves. Do not direct oxygen at oily surfaces or greasy clothes.

Ensure that reverse-flow gas check valves and flashback arrestors are installed on both lines of oxygen and fuel-gas setups.

NOTE: *Ensure that flashback arrestors are installed at the torch handle.*

Completely depressurize (bleed) torches and hoses before storage or at the end of each shift.

Do not store torches and hoses in enclosed areas (such as gang boxes or lockers) while connected to cylinders.

Keep cylinders far enough away from the actual welding/cutting operation to prevent sparks, hot slag, and flames from reaching them.

Open acetylene cylinder valves 3/4 of a turn or less; do not open acetylene cylinder valves more than 1-1/2 turns.

Adjust acetylene regulators so the low-pressure gauge indicates a delivery pressure of less than 100 kPa (15 psig) to the hose and torch. After the regulator and hose are connected to a "B" size acetylene cylinder, "crack" the cylinder valve and perform a leak check on the valve-packing nut and the regulator and hose connections before the cylinder is put into service. Use a commercial leak-check fluid (such as "SNOOP"). Tighten connections as required and recheck to ensure that there is no leakage.

Do not place cylinders where they may become part of an electric circuit. Tapping of an electrode against a cylinder to strike an arc is prohibited.

ARC WELDING AND CUTTING SAFETY

Ensure that exposed current-carrying parts of electrode holders are insulated in a manner that provides full protection against electrical shock for arc-welding machine operators.

Ensure that arc-welding cables are flexible, completely insulated, and capable of handling the maximum current requirements of the work.

Ensure that cables are free from repairs and splices for a minimum distance of 3 meters (10 feet) from the electrode holder.

Exception: Cables with standard insulated connectors, or splices with insulating quality equal to that of the cable, may be permitted.

If it is necessary to splice lengths of cable, use insulated connectors equivalent to that of the cable. If cable lugs are used, the resulting connection must be fastened securely to provide a good electrical contact. Completely insulate exposed metal parts of the lugs.

If electrode holders are left unattended, remove the electrodes and place the holders so that they cannot make electrical contact with employees or conducting objects.

Do not dip electrode holders in water.

Turn off the power supply to the equipment whenever the arc-welding machine operator leaves or stops work for any length of time, or when the arc-welding machine is moved.

Report faulty or defective equipment to the supervisor and, until repaired, tag out-of-service with a DANGER — DO NOT USE tag as specified in practice MSC-PRAC-30460.

Shield arc-welding operations with noncombustible or flameproof screens to protect employees and other persons working in the vicinity from the direct ray of the arc.

Some arc welding (such as tungsten inert gas, or metal inert gas) and arc cutting (such as arc air or thermocutters) can produce excessive concentrations of fumes and gases. Contact Safety and Health to ensure that adequate controls are in place based on the conditions, type of material, or rod composition.

HOT WORK ON CONTAINERS

Do not perform hot work on piping, ductwork, empty drums, barrels, tanks, or other containers until they have been thoroughly cleaned to ensure that there are no flammable or combustible materials present or any substances such as greases, tars, acids, or other materials that, when subjected to heat, might produce a hazard. Disconnect or blank off any connection to the drum or vessel.

Ventilate hollow spaces, cavities, and containers to remove gases before hot work commences. Purging with inert gas is recommended.

FORMS

Form A-6004-281**:** Hot Work Permit (Welding and Burning)

RECORDS IDENTIFICATION

Records Capture Table

Name of Document	Submittal Responsibility	Retention Responsibility
Construction Work Package	Construction Supervisor/Superintendent	Construction Document Control
Form A-6004-281**,** Hot Work Permit (Welding and Burning)	Construction Supervisor/Superintendent	Construction Document Control

REFERENCES

MSC-PRAC-30374, *Construction Work Package*
MSC-PRAC-30376, *Construction Document Control*
MSC-PRAC-30460, *Safety and Health Compliance Inspection and Management Walkthroughs*
MSC-PRAC-30462, *Prejob Safety Planning*
MSC-PRAC-30471, *Personal Protective Equipment*
MSC-PRAC-30510, Respiratory Protection
MSC-PRAC-30512, *Confined Space Entry*
MSC-PRO-31697, *Controlling Exposures to Hexavalent Chromium*

American National Standards Institute (ANSI)
ANSI Z49.1: Safety in Welding, Cutting, and Allied Processes

National Fire Protection Association (NFPA)
NFPA 51B: Cutting and Welding Process

APPENDIX A

HOT WORK PERMIT INFORMATION

HOT WORK PROCESSES	
WELDING	**HAZARD CATEGORY**
SMAW-Shielded Metal Arc Welding-Stick welding	High
GMAW-Gas Metal Arc Welding –MIG Welding (Metal Inert Gas) wire feed welding, squirt gun welding	High
FCAW-Flux Cored Arc Welding-Wire feed welding with a flux core in the wire	High
GTAW-Gas Tungsten Arc Welding-TIG welding (Tungsten Inert Gas), heli-arc welding	Low
SAW-Submerged Arc Welding-Sub-arc	Low
PAW-Plasma Arc Welding	Low
EBW-Electron Beam Welding	Low
LBW-Laser Beam Welding	Low
TW-Thermit Welding-Used in attaching grounding straps by electricians	Low
TS-Torch Soldering	Low
SW-Stud Welding-Used for attaching threaded studs to metal plate or studs for attaching insulation	Low
OAW-Oxy-Acetylene Welding	Low
TB-Torch Brazing	Low

CUTTING	HAZARD CATEGORY
CAC-A - Air Carbon Arc Cutting	High
CAC-Carbon Arc Cutting (no air)	High
PAC-Plasma Arc Cutting	High
LBC-Laser Beam Cutting	Low
OFC-Oxy-Fuel Cutting (Cutting torch)	High

GRINDING	HAZARD CATEGORY
Heavy Grinding-using Bayflex grinder, side grinder, 6” to 8” grinding wheel (disc)	High
Light Grinding-using 4” and smaller grinding wheel	High
Sanding-using above grinders with sanding disc	Low
Peanut Grinding	Exclusion
Dremmel tool grinding	Exclusion
Cut-off Saw	High
Pedestal Grinder	Exclusion
Pedestal Sander (belt sander)	Exclusion
Rotary File	Exclusion