Title: Hot Work Program	Document No.: OCS-401 Revision No.: 02 Date: March 20, 2023
	Approved By: Avraham Boruchowitz, CSP, CHMM

1.0 Purpose

All hot work creates conditions which increase the probability for fire-related injury or property loss. Hot work includes but is not limited to brazing, cutting, grinding, soldering, torch-applied roofing, pipe thawing and welding. Each type of hot work presents specific hazards depending on the methods used, the materials used, and the environment involved. The Hot Work Program establishes the minimum safe working procedures and guidelines for the operation of cutting, welding, brazing, grinding, and any other similar operation. This program is designed in compliance with NFPA 51B, 29 CFR 1910 Subpart Q and 29 CFR 1926 Subpart J.

2.0 Scope

The objective of this Hot Work Program is to reduce the potential for injury, fire and/or explosion resulting from the performance of the work. The procedures contained in this Program are applicable to all employees, property managers and outside contractors working at Radford University. Environmental Health and Safety (EHS) provides oversight for this Program.

These procedures are intended to protect life, health, and property from fire and the products of combustion which might result from hot work activities and the program applies to all hot work activities on Radford University property. This includes, but is not limited to: welding, cutting, soldering, brazing, grinding, thawing pipes, or any form of torch operation that will introduce sparks or open flames to the work area. All Radford University employees and outside contractors or service companies involved in the use of flame or spark-producing equipment on Radford University premises are required to adhere to this program.

The following operations do not require a Hot Work Permit:

- Bunsen burners in laboratories,
- Small electric soldering irons used for repairing electronics only,
- Authorized grills on campus,
- Sterno products for University events, and
- University glass shop activities.

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3.0 Definitions

Designated Area – An area that has been designated to perform hot work operations such as welding, torching, grinding, cutting, etc. A hot work permit is not needed in a designated area if it meets the following requirements:

- Ensure that combustible materials such as paper clippings, wood shavings or textile fibers are swept clean for a radius of 35 feet in the welding shop. 29 CFR 1910.252(a)(2)(v)
- Provide welding screens/curtains and place around the area where hot work operations will be performed. The screen/curtain shall completely enclose the area.

Fire watch – A trained individual stationed in the hot work area who maintains awareness for the presence of fire or hazardous conditions within the hot work area before and for at least 60 minutes after the hot work. The individual will monitor the area for the beginnings of potential unwanted fires both during and after hot work.
The fire watch personnel shall be trained in the following items:

- Hazards of the work site in correlation with the hot work
- Use of an appropriate fire extinguisher
- Procedures for initiating the fire alarm and calling 911
- Practices to safely extinguish any small fire using the extinguisher or welding blankets at the job site – **use of an extinguisher is voluntary; personnel should not use an extinguisher unless they are comfortable doing so and are adequately trained. If you are not comfortable using or trained to use a fire extinguisher, consideration should be given to reassign the task to a more qualified individual.**
- Develop a checklist, similar to the hot work permit checklist, and have employees complete before hot work operations begin. The checklist should at least include the date/time of the hot work operations.

Hot Work - Hot work is defined as any temporary maintenance, renovation or construction activity using gas or electrically powered equipment, which produces flames, sparks, or heat that is sufficient to start a fire or ignite flammable/combustible materials.

Hot Work Permit – A specific permit, which authorizes “hot work” activities at a specific location and time. This permit must be completed properly and displayed at the worksite until hot work is complete; and must be retained on file by the supervisor. Permits contain a written checklist of procedures to be implemented before performing hot work in a hot work hazard area. Permitted hot work shall be done in accordance with the details on the permit. If conditions change, the permit must be modified or reissued by the hot work’s responsible person. Copies of

completed permits must be forwarded to Environmental Health and Safety (EHS) within 24 hours.

Permit Administrator – The department/shop supervisor or their designee (i.e. shop foreman), is responsible for all hot work operations, program compliance, and for issuing the Hot Work Permit.

Responsible Person – A person with training, experience and judgment to oversee hot work operations and who has the authority to direct changes or stop the work if necessary. Responsible Person reviews the site(s) prior to issuing permits as part of the hot work permit program and following up as the job progresses. Responsible person shall determine the hazards present or likely to be present at the work location and the precautions necessary to prevent an incident.

4.0 Responsibilities

Supervisor/Permit Administrator's Responsibilities

- Ensure that all employees that perform hot work activities are properly trained in the significance, purpose, and use of this program.
- Administer and approve hot work permit for all operations in which it is required.
- Perform site-specific inspections of the hot work area to identify flammable materials, hazardous processes, or other potential fire hazards that could be present.
- Ensure the protection of combustibles from the ignition by meeting the following criteria:
    - Moving hot work to a location free of combustible materials.
    - If work cannot be moved, combustibles must be moved to a safe distance from the operation or shielded from ignition sources.
- Provide appropriate fire extinguishing equipment in the hot work area or locate one in the building that is reasonably accessible for the duration of the hot work and for at least 60 minutes following the task.
- Ensure all employees that perform hot work activities receive the appropriate level of training and that these employees are provided with the proper equipment and personal protective equipment (PPE) to perform the job safely.
- Forward the completed hot work permit to Environmental Health and Safety (EHS) within 24 hours of the completion of hot work activities.
- Ensure hired contractors have their own Hot Work Program and provide EHS with completed permits.

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Employee/Hot Work Operator's Responsibilities

- Attend EHS Hot Work Program training.
- Use work practices developed in accordance with this program to prevent injuries that could result from improperly performed hot work activities.
- Remove all flammable or combustible materials within a thirty-five foot radius of the hot work area.
- Remove all combustible debris (e.g. paper clippings, wood shavings, or textile fibers) from the hot work area.
- Shield combustibles that cannot be removed in the hot work area with non-combustible blankets or other non-combustible materials.
- Seal all cracks and openings through which hot sparks or slag may enter. A fire resistant shield may be used to block openings.
- Place non-combustible or flame resistant screens to protect personnel in adjacent work areas from heat, flames, UV radiant energy, and weld splatter.
- Ensure smoke/fire detection devices and HVAC precautions have been addressed.
- Ensure all cutting and welding equipment is in satisfactory condition and good repair.
- Ensure the safe handling of cutting or welding equipment and safe use during the process.
- Cease hot work operations if unsafe conditions develop, and shall notify their supervisor and/or permit administrator for reassessment of the situation.
- Ensure a fire watch is present, when required.
- Attend refresher training every three years, or more frequently due to incident, observation of unsafe work practices, update of requirements, or changes to operating guidelines.

Contractors

- Contractors shall possess their own written Hot Work Program that fulfills all regulatory requirements.
- Contractors working in occupied Radford University buildings shall notify EHS prior to hot work being performed and provide copies of all hot work permits to EHS.
- Contractors working on new construction or renovating unoccupied University facilities shall follow their own hot work policies and procedures, which shall fulfill all regulatory requirements.

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Environmental Health and Safety (EHS)

EHS is responsible for developing, implementing, and administering the Hot Work Program. These responsibilities include:

- Assisting Facilities Management and other departments on campus who perform hot work activities to interpret the standards and regulations as they apply to the work being performed.
- Training all employees who perform hot work in the associated hazards, general safe work practices, and program requirements.
- Maintaining centralized records of training, inspection data, and reports.
- Conducting an annual review of each department that conducts work within the scope of this program.

5.0 Hot Work Permit

Hot work should not be performed if the work can be avoided or performed in a safer manner. When practical, objects to be welded, cut, or heated, should be moved to a designated area (i.e. maintenance shop). Under this program all hot work activities conducted in a non-designated location require a Hot Work Permit (Appendix A). The procedures for the permits are:

1. The supervisor/permit administrator will inspect the area before authorizing a hot work permit.
2. Once the permit has been authorized, the supervisor will inform EHS of the following in regards to the hot work activities being performed:
    A. Location
    B. Date
    C. Time
    D. Description of work
3. The employee/hot work operator will post the hot work permit at the job site until completion of the job or the duration of the permit (not to exceed the work shift). **The Hot Work Permit shall be valid for the day and the operation for which it is issued. Jobs requiring more than one day shall require a separate permit for each day's work.**
4. The employee/hot work operator will sign the Fire Watch Release section of the Hot Work permit no earlier than 60 minutes after hot work activities have ceased and the area has been deemed fire safe.

5. The employee/hot work operator will return the hot work permit to the supervisor after the task is complete or at the end of the work shift.
6. The supervisor will then give the completed permit to EHS for recordkeeping.

6.0 Fire Prevention and Protection

When practical, objects welded or cut will be moved to a designated safe location. If the object cannot readily be moved, all movable fire hazards in the vicinity will be taken to a safe place. If possible, combustibles will be relocated at least 35 feet from the work site.

If the object welded or cut cannot be moved and if the fire hazards cannot be removed, then guards will be used to confine heat, sparks, and slag, and to protect immovable fire hazards.

If there are floor openings that cannot be closed, precautions will be taken to prevent combustible materials on the floor below from being exposed to sparks which might drop through the floor. The same precautions will be observed with cracks or holes in walls, open doorways and open or broken windows.
Suitable fire extinguishing equipment will be readily available.

Fire watchers are required whenever welding or cutting is performed in locations where any of the following conditions exist:

- Appreciable combustible materials are closer than 35 feet to the point of operation.
- Appreciable combustibles are more than 35 feet away but are easily ignited by sparks.
- Wall or floor openings within a 35-foot radius expose combustible material in adjacent areas including concealed spaces in walls or floors.
- Combustible materials are adjacent to the opposite side of metal partitions, walls, ceilings, or roofs and are likely to be ignited by conduction or radiation.

Fire watchers will have fire extinguishing equipment readily available and be trained in its use. They will be familiar with the procedures for sounding an alarm in the event of a fire.

The fire watch will be maintained for at least one hour after completion of welding or cutting operations to detect and extinguish possible smoldering fires.

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Where combustible materials such as paper clippings, wood shavings, or textile fibers are on the floor, the floor will be swept clean for a radius of 35 feet. Combustible floors will be kept wet, covered with damp sand, or protected by fire-resistant shields. Where floors have been wet down, personnel operating arc welding or cutting equipment will be protected from possible shock.
Cutting or welding will not be permitted in the following situations:

- In areas not authorized by management, such as occupied office space.
- In sprinkled buildings, while such protection is impaired.
- In the presence of explosive or potentially explosive atmospheres.
- In areas near the storage of large quantities of exposed, readily ignitable materials such as bulk sulfur, baled paper, or cotton.

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

Where cutting or welding is done near walls, partitions, ceiling or roof of combustible construction, fire-resistant shields or guards will be provided to prevent ignition.

If welding is done on a metal wall, partition, ceiling or roof, precautions will be taken to prevent ignition of combustibles on the other side, due to conduction or radiation, preferably by relocating combustibles. Where combustibles are not relocated, a fire watch on the opposite side from the work will be provided.

Welding will not be attempted on a metal partition, wall, ceiling or roof having a combustible covering nor on walls or partitions of combustible sandwich-type panel construction.

Cutting or welding on pipes or other metal in contact with combustible walls, partitions, ceilings or roofs will not be undertaken if the work is close enough to cause ignition by conduction.

Before cutting or welding is permitted, the area will be inspected by an authorized individual. This person will designate precautions to follow and will grant authorization to proceed, preferably in the form of a written permit.

University Project Managers will advise contractors about flammable materials or hazardous conditions at the University.

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7.0 Welding or Cutting Containers

1. Welding, cutting, or other hot work will not be performed on used drums, barrels, tanks or other containers until they have been cleaned thoroughly to make certain there are no flammable or toxic materials present. Any pipe lines or connections to the drum or vessel will be disconnected or blanked.
2. All hollow spaces, cavities or containers will be vented to permit the escape of air or gases before preheating, cutting or welding. Purging with inert gas is recommended.

8.0 Confined Spaces

Appropriate mechanical ventilation will be provided for welders in a confined space.

When welding or cutting is performed in a confined space, gas cylinders and welding machines will be left on the outside. Before operations are started, heavy portable equipment mounted on wheels will be securely blocked to prevent accidental movement.

Where a welder must enter a confined space, means will be provided for quickly removing the worker in case of emergency. An attendant will be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.

After welding operations are completed, the welder will mark the hot metal or provide some other means of warning other workers.

When arc welding is suspended for any substantial period of time, such as during lunch or overnight, all electrodes will be removed from the holders and the holders carefully located so that accidental contact cannot occur. The machine will be disconnected from the power source. In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, torch valves will be closed and the gas supply to the torch shut off outside the confined area whenever the torch is not used for a substantial period of time, such as during lunch hour or overnight. Where practicable, the torch and hose will also be removed from the confined space.

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9.0 Protection of Personnel

9.1 General

- A welder working on platforms, scaffolds, or runways will be protected against falling. This may be accomplished by the use of railings, safety harnesses, life lines, or other equally effective safeguards.
- Welders will place welding cable and other equipment so that it is clear of passageways, ladders, and stairways.

9.2 Eye Protection

- Helmets or hand shields will be used during all arc welding or arc cutting operations. Helpers or attendants will be provided with proper eye protection.
- Goggles or other suitable eye protection will be used during all gas welding or oxygen cutting operations. Spectacles without side shields and with suitable filter lenses can be used for gas welding operations on light work, torch brazing or for inspection.
- All operators and attendants of resistance welding or resistance brazing equipment will use transparent face shields or goggles to protect their faces or eyes.

- Eye protection will meet the following specifications:
    - Helmets and hand shields will be made of a material which is an insulator for heat and electricity.
    - Helmets, shields and goggles will not be readily flammable and will be capable of withstanding sterilization.
    - Helmets and hand shields will be arranged to protect the face, neck and ears from direct radiant energy from the arc.
    - Helmets will be provided with filter plates and cover plates designed for easy removal.
    - All parts will be constructed of a material which will not readily corrode or discolor the skin.
    - Goggles will be ventilated to prevent fogging of the lenses as much as practicable.
    - All glass for lenses will be tempered, substantially free from striae, air bubbles, waves and other flaws.
    - Lenses will bear a permanent distinctive marking by which the source and shade may be readily identified.

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- The following is a guide for the selection of the proper shade numbers. All filter lenses and plates will meet the test for transmission of radiant energy described in ANSI Z87.1.

Welding Operation	Shade Number
Gas-shielded arc welding (nonferrous) 1/16, 3/32, 1/8, 5/32-inch electrodes	11
Gas-shielded arc welding (ferrous) 1/16, 3/32, 1/8, 5/32-inch electrodes	12
Shielded metal-arc welding: 3/16, 7/32, 1/4 inch electrodes	12
Shielded metal-arc welding: 5/16, 3/8-inch electrodes	14
Carbon arc welding	14
Soldering	2
Torch brazing	3,4
Light cutting, up to 1 inch	3,4
Medium cutting, 1 inch to 6 inches	4,5
Heavy cutting, 6 inches and over	5,6
Gas welding (light) up to 1/8 inch	4,5
Gas welding (medium) 1/8 inch to 1/2 inch	5,6
Gas welding (heavy) 1/2 inch and over	6,8

NOTE: In gas welding or oxygen cutting where the torch produces a high yellow light, the operator should use a filter or lens that absorbs this light.

9.3 Protection from Arc Welding Rays

- If possible, the welder should be enclosed in an individual booth painted with a finish of low reflectivity or enclosed with noncombustible screens similarly painted. Booths and screens will permit circulation of air at floor level.
- Workers adjacent to the welding areas will be protected from the rays by noncombustible screens or shields or will be required to wear appropriate goggles.

9.4 Protective Clothing

Employees exposed to the hazards created by welding, cutting, or brazing operations will be protected by appropriate protective clothing depending on the size, nature and location of the work performed.

10.0 Ventilation for General Welding and Cutting

10.1 General

- Mechanical ventilation will be provided:
  - In a space of less than 10,000 cubic feet per welder.
  - In a room having a ceiling height of less than 16 feet.
  - In confined spaces or where the welding space contains partitions, balconies, or other structural barriers to the extent that they significantly obstruct cross ventilation.
- The ventilation will be at the minimum rate of 2,000 cubic feet per minute per welder, except where local exhaust hoods and booths are provided.

10.2 Local Exhaust Hoods and Booths

- Local exhaust or general ventilating systems will be provided and arranged to keep the amount of toxic fumes, gases, or dusts below the permissible exposure limit.
- Mechanical local exhaust ventilation may be by means of either of the following:
  - Freely movable hoods placed by the welder as near as practical to the work and provided with a rate of 100 linear feet per minute in the zone of welding when the hood is at its most remote distance from the point of welding. The rates of ventilation required to accomplish this control velocity using a 3-inch wide flanged suction opening are shown in the following table:

Welding Zone	Minimum air flow - cfm	Duct Diameter - Inches
4 to 6 inches	150	3
6 to 8 inches	275	3 1/2
8 to 10 inches	425	4 1/2
10 to 12 inches	600	5 1/2

- A fixed enclosure with a top and at least two sides which surround the welding or cutting operations and with a rate of airflow of at least 100 linear feet per minute.

10.3 Ventilation in Confined Spaces

- All welding and cutting operations carried on in confined spaces will be mechanically ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency.
- In areas immediately hazardous to life, a full-facepiece, pressure-demand, self-contained breathing apparatus or a combination full-facepiece, pressure-demand supplied-air respirator with an auxiliary, self-contained air supply approved by NIOSH will be used.
- Oxygen will not be used for ventilation.

10.4 Specific Compounds

10.4.1 Zinc

Indoors & Confined Space: Welding or cutting involving zinc-bearing base or filler metals coated with zinc- bearing materials will be done in a local exhaust hood or booth.

Outdoors: No restrictions.

10.4.2 Lead

Indoors & Confined Space: Welding involving lead-base metals will be done in a local exhaust hood or booth. Exceptions include when lead is present as an impurity, or when metals are coated with lead-bearing materials such as paint.

Outdoors: Must be done using respirators.

10.4.3 Beryllium

Indoors & Confined Space: Welding or involving beryllium-containing base or filler metals will be done using local exhaust ventilation unless atmospheric tests established that the workers' exposure is within acceptable concentrations.

Outdoors: Welding or involving beryllium-containing base or filler metals will be done using local exhaust ventilation unless atmospheric tests established that the workers' exposure is within acceptable concentrations.

10.4.4 Cadmium

Indoors & Confined Space: Welding or cutting operations involving cadmium-bearing or cadmium-coated base metals must be done using local exhaust ventilation unless atmospheric tests show that employee exposure is within acceptable concentrations.

Outdoors: Must be done using respirators.

10.4.5 Mercury

Indoors & Confined Space: Welding or cutting operations involving metals coated with mercury-bearing materials, including paint, must be done using local exhaust ventilation unless atmospheric tests show that employee exposure is within acceptable concentrations.

Outdoors: Must be done using respirators.

10.4.6 Cleaning Compounds

Indoors, Confined Space, and Outdoors: Because of their possible toxicity or flammability, appropriate precautions such as manufacturer's instructions will be followed. Operations involving chlorinated hydrocarbons will be located so that vapors from these operations will not be drawn into the atmosphere surrounding the welding operation. In addition, trichloroethylene and perchloroethylene should be kept out of atmospheres penetrated by the ultraviolet radiation of gas- shielded welding operations.

10.4.7 Stainless Steel

Indoors, Confined Space, and Outdoors: Oxygen cutting, using either a chemical flux or iron powder or gas-shielded arc cutting of stainless steel, will be done using mechanical ventilation adequate to remove the fumes.

10.5 First-aid equipment

First-aid equipment will be available at all times. All injuries will be reported as soon as possible for medical attention. First aid will be rendered until medical attention can be provided.

11.0 Employee Training

11.1 – Initial Training

EHS will provide initial and refresher training to all employees that perform hot work activities. The supervisor is responsible for ensuring that all new employees receive training before conducting a task that meets the criteria of hot work operations as outlined in this program.

The initial training should include the following topics:

- Written program
- Hot work procedures, including how to obtain a permit
- Proper equipment operation
- Handling and storage of welding materials
- Compressed gas cylinder safety
- Fire watch
- Fire precautions
- Fire extinguisher training

- Physical and chemical hazards
- Hazard recognition and control including:
  - Safe equipment operation
  - Control of combustibles
  - Protection of area processes
- PPE selection and use

11.2 – Refresher Training

Employees will receive refresher training pertaining to this program and hot work safety at least three years after the initial training. The refresher training will include the topics set forth in the initial training as well as providing updates or new requirements, if applicable.

11.3 – Training Records

Training records should be maintained by the employing department in the employee's employment file. Records for training provided by EHS will be maintained by EHS but should also be kept in the employment file.

12.0 Program Evaluation

The Hot Work Program shall be evaluated on an annual basis. The EHS Specialist will define the scope of the evaluation and coordinate the audit with the affected shops/departments. The deficiencies identified will be documented and corrective action plans developed. The evaluation should at least include the following:

- Written Program
- Permit System
- Designated Areas
- Individual Shops
- Training/Retraining

13.0 References

1. National Fire Protection Association (NFPA) 51B "*Hot Work Guidelines*"
2. International Fire Code Chapter 26 "*Welding and other Hot Work*"
3. OSHA 1910.252
4. OSHA 1926.352

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14.0 Appendix

- Appendix A – Hot Work Permit

15.0 Document Revision History

Revision	Section(s) Changed	Change(s) Made:	Date	Reviewer(s)
00	All	Initial Draft	Unknown	N/A
01	All	Format changes and update.	04/27/2017	Nathan Tripp Avraham Boruchowitz
02	All	Document review; NFPA 51B update incorporated; 60-minute fire watch.	03/20/2023	Avraham Boruchowitz Trevor Stark

16.0 Document Author(s): John Crocker, CSP & Nathan Tripp EHS Specialist

RADFORD UNIVERSITY

ENVIRONMENTAL HEALTH & SAFETY

HOT WORK PERMIT

GENERAL INFORMATION		
Date:	Permit begins:	Permit ends:
Location of work:		
Equipment to be used:		
Person performing hot work:		
Description of work:		

FIRE SAFETY PRECAUTIONS CHECKLIST					
Hot work equipment in good repair.		Fire watch provided during and for at least 60 minutes after work.		Combustibles on other side of wall moved.	
Fire extinguisher within 30 feet.		Fire watch trained in use of fire extinguishers.		Exposed construction is noncombustible or covered.	
Combustible materials within 35 feet removed or protected with fire resistive material		Available sprinklers are operable.		Conduction of heat into other areas is guarded.	
Floor and wall openings covered..		Combustibles floors wet down or covered.		Means to contact fire department readily available.	
Smoke detectors covered.		Containers purged of flammable liquids/vapors.		Floors are kept clean.	

AUTHORIZATION

I verify the above location has been examined and the appropriate safety precautions have been taken to prevent fires.

Signature:

Print Name:

Comments:

FIRE WATCH RELEASE

The work area and all adjacent areas where sparks and heat may have spread were inspected at least 60 minutes after the hot work ceased and were found to be fire safe.

Signature:

Print Name:

Comments: