University of Vermont

Department of Emergency Management
Fire and Life Safety

284 East Avenue
Burlington, VT 05405

HOT WORK MANAGEMENT PROGRAM

In accordance with
OSHA 29 CFR 1910 Subpart I App B
OSHA 29 CFR 1910 Subpart Q
OSHA 29 CFR 1926 Subpart J
NFPA 51B
FM Global Data Sheet 10-3

REVISED AND DISTRIBUTED BY:

THE UNIVERSITY OF VERMONT
DEPARTMENT OF ENVIRONMENTAL HALTH AND SAFETY
OCCUPATIONAL HEALTH AND SAFETY OFFICE
in collaboration with
DEPARTMENT OF EMERGENCY MANAGEMENT
FIRE AND LIFE SAFETY

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Occupational Health and Safety Manager
Occupational Health Program Coordinator
UVM Fire Marshal/Deputy Emergency Manager
Life Safety Supervisor

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EMERGENCY AND ASSISTANCE

EMERGENCY TELEPHONE NUMBERS

No work will be performed where an emergency cannot be immediately observed and/or prompt rescue assistance summoned.

A rescue plan shall be in place prior to beginning any work where a hazard exists. The rescue plan must be well thought out and documented in a Fire Emergency Response Plan. All individuals involved must thoroughly understand the plan. Prompt rescue will be provided for personnel.

FIRE – POLICE – RESCUE – EMERGENCY MEDICAL SERVICE……. 9-1-1

Dial 911 and tell them you are at the University of Vermont. Provide them with your building address, building name, and room number as well as the details of your emergency.

> CALL IMMEDIATELY FOR ANY EMERGENCY
> INCLUDING CHEMICAL SPILL, FIRE, INJURED,
> TRAPPED, OR SICK PERSON.

UVM Police Services…… …… (802) 656-3473
Fire, Police, Rescue, Emergency Medical Service

UVM and OTHER ADMINISTRATIVE OFFICES

Fire and Life Safety …….…….…….. (802) 656-8249
University Fire Marshal - Department of Emergency Management firesafe@uvm.edu

Life Safety Systems ...…….…….…….…… (802) 656-2974
Department of Facilities Management ppdlss@uvm.edu

Occupational Health and Safety Office …….…….…….. (802) 656-7233
Department of Environmental Health and Safety ohso@uvm.edu

Service Operations Support…….…….. (802) 656-2560
Facilities Management sos@uvm.edu

Department of Risk Management…….…….. (802) 656-3242
(Accident investigations, insurance services) risk.management@uvm.edu

Champlain Medical Urgent Care……. (802) 448-9370
(UVM Employee Medical Consultation and Evaluation)

PROGRAM STATEMENT

Purpose

The University of Vermont, Department of Environmental Health and Safety, Occupational Health and Safety Office is dedicated to providing safe work facilities for UVM employees (faculty/staff), students, and visitors, including contractors and consultants (UVM Personnel) and complying with federal and state occupational health and safety standards.

All UVM Personnel, including administrators and union representatives, share a responsibility to reduce the hazards associated with hot work activities.

Standards

This written program is a means to analyze elevated work tasks and determine appropriate work practices to prevent injury, loss of life, and fires or explosions that may result from "hot work" in accordance with Vermont Occupational Safety and Health Administration (VOSHA), and National Fire Protection Association (NFPA):

OSHA 29 CFR 1910 Subpart I App B - Nonmandatory Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection
OSHA 29 CFR 1910 Subpart Q – Welding, Cutting, and Brazing
OSHA 29 CFR 1926 Subpart J – Welding and Cutting
NFPA 51B - Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
FM Global Data Sheet 10-3

Provided in this document are the minimum standard requirements for all UVM employees, including hired contractors, who manage, request, authorize, perform, or supervise hot work activities.

Scope

The University of Vermont (UVM), Department of Environmental Health and Safety, Occupational Health and Safety Office's Hot Work Management Program shall apply to all UVM employees, including hired contractors, who conduct "hot work" during maintenance and construction activities on or within UVM facilities or campus grounds. For the purposes of this policy, "hot work" is defined as any temporary operation capable of providing a source of ignition, involving open flames, or producing heat and/or sparks. This includes, but not limited to riveting, welding, cutting, burning, heating, grinding, brazing, soldering, thawing frozen pipes by torch, torch applied roofing, and utilizing heat producing equipment over 1,100° F.

The most effective way to prevent a hot work fire or explosion is to aggressively pursue alternative cold work methods. Examples include Screwed, flanged, or clamped pipe, manual hydraulic shears, mechanical bolting, or pipe cutting, or compressed air-actuated fasteners.

The next best way is to relocate the work to a hot work designated area, which may be located outside of the building. If neither option is possible, then removing and/or isolating combustible, ignitable, or flammable materials located within the hot work area or equipment must be considered.

Employees will not be required, nor allowed to perform any duties which involve "hot work" without a Hot Work Permit (***Appendix A***). A hot work permit is a document issued by the designated permit authorization individual(s) (PAI) within the Life Safety Systems office for the purpose of authorizing performance of a specified hot work activity.

If hot work is performed inside of a facility or on the roof of a building, then a hot work permit is required and must be approved prior to the start of work. If the hot work can be performed outside the facility, with a minimum distance of thirty-five (35) feet (11m) from any combustible materials, a hot work permit will not be required. However, in these situations a fire extinguisher is still required to be on site. The PAI can approve alternative procedures under certain circumstances.

To mitigate the consequences of a hot work fire, a continuous fire watch shall be provided in the hot work area during work and immediately following work. Also, hot work that requires a permit should be avoided in unprotected areas whenever possible; otherwise, additional precautions will be required.

Contractors for the University of Vermont are required to comply with all applicable state and federal regulations and shall have their own Hot Work Program equal to or exceeding UVM's program. Contractors shall be provided this management program, including the "Guidelines for Hot Work" (***Appendix B***).

All hot work permits shall be returned to the Department of Emergency Management, Life Safety Systems office for record retention. Copies of Hot Work Permits (hard copies or scanned .pdf files) will be maintained for a minimum of one (1) year.

Upon receipt of the completed permit, the Life Safety Program Manager (or other designee) will review for completeness. If any deficiencies in the permit(s) are observed, the Life Safety Program Manager shall review the deficiencies with the individual(s) who submitted the permit.

Program Audits

An audit of this program shall be conducted on an annual basis, or as conditions deem necessary. The audit will be conducted by the UVM Fire Marshal, Life Safety Systems Supervisor or Manager, and the Occupational Health and Safety Office.

At a minimum, the following items shall be included in the audit:

1. Completed forms, including hot work designated area inspections, and hot work permits from different post-work categorized areas.
2. Training records for contractors and employees.
3. Incident log and investigation reports for hot work fire and explosions, as well as near misses. Determine the status of any resulting corrective actions.
4. Facility changes that may impact the hot work management program, hot work designated areas, permitting procedures, or hot work high-risk areas (e.g., physical or personnel changes).
5. Provide recommendations for changes/edits to the UVM Hot Work Management Program.

Investigations

All hot work near miss incidents, injuries, fires, and explosions, regardless of size and/or damage, will be investigated by the UVM Fire Marshal. A root cause analysis and corrective action plan resulting from the investigation will be documented, reviewed with all parties involved in the incident, and documentation maintained for three (3) years.

Roles and Responsibilities

The ultimate responsibility and authority for compliance with the UVM Hot Work Management Program rests with the UVM Life Safety Systems (LSS) Supervisor and Managers, and the UVM Planning, Design & Construction (PDC) Project Managers and Coordinators. It is their responsibility to ensure that the hot work permit program is carried out within their area of authority.

A. UVM Department Administration

1. Provide administrative and financial support for this program within individual units.
2. Ensure that the Hot Work Permit Program is implemented and maintained within the department.
3. Support disciplinary action in the event that proper procedures are neglected and/or obviously not followed.

B. UVM Occupational Health and Safety Office and Life Safety Systems

1. Designate and empower individuals who will act as competent and/or qualified person(s) who will be responsible for the preparation and implementation of the Hot Work Permit Program.
2. Ensure that employees who will act as Designated Person/Permit Authorization Individual(s) (PAI) are adequately trained and/or qualified.
3. Ensure the Hot Work Permit Program is implemented and maintained within the departments.
4. Consult with outside entities and project managers on designs as needed.
5. Review Hot Work Permit Program annually.

C. UVM Permit Authorizing Individual(s) (PAI)

1. Maintain professional certification or other requirements in their subject field.
2. Provide design, analysis, evaluation, and specification in their subject field.
3. Maintain records of their designs, analyses, evaluations, and specifications according to the requirements of the Hot Work Permit Program.
4. Shall be responsible for the safe operation of hot work activities.
5. Implement all aspects of the Hot Work Permit Program for work areas under their control.
6. Receive training for "competent person" as defined by VOSHA and NFPA for hot work.
7. Act as the "competent person" for job sites under their control that contain job tasks the involve hot work.
8. Evaluate hazards in work areas under their control.
9. Ensure that employees are informed, trained, and provided with the appropriate protection systems and equipment to be protected from potential hazards associated with job tasks.
10. The PAI shall determine the length of the period for which the hot work permit is valid.
11. Inspect the designated hot work area once per month, or as necessary to ensure that it is a fire-safe area.

D. UVM Project Managers and Coordinators

1. Ensure UVM employees have completed the UVM Hot Work Training presented by the Occupational Health and Safety Office and understand the applicable provisions of the Hot Work Permit Program and that all requirements of any hot work permit are fulfilled before and after hot work is performed.
2. Ensure an approved hot work permit is obtained from Life Safety Systems (LSS) and a copy of the properly completed and signed hot work permit is returned to the LSS upon completion of the work.
3. Ensuring precautions listed on the hot work permit are understood by the person(s) performing the permitted cutting, welding, or brazing operations.
4. Informing outside contractors and service personnel of the expectation that they will follow all OSHA, NFPA, UVM requirements, and all other applicable state and federal regulations.
5. Ensure properly trained personnel are present as needed for fire watch.

6. A pre-inspection of the area where work is to be done is the responsibility of the individual having supervisory responsibility. This is required to:
    a) Assess the risks associated with the work area (i.e., whether the work area is cluttered, houses combustible materials, or flammable liquids).
    b) Determine whether additional safeguards may be required.

E. UVM Employee Managers and Supervisors

1. Ensure that employees are informed, trained, and provided with the appropriate protection systems and equipment to be protected from potential hazards associated with job tasks.
2. Establishing designated work areas for hot work operations where the potential fire danger is limited and procedures for other areas.
3. Coordinate the correction of hazards brought to their attention by employees.
4. Complete a "First Report of Injury" and "Incident Report" and produce any additional documentation needed to investigate and work-related injuries and illnesses.

F. Employees conducting Fire Watch

1. Being aware of the inherent hazards involved in the hot work.
2. Ensuring that safe conditions are maintained.
3. Ensuring that appropriate fire extinguishers are readily available.
4. Be familiar with the facilities and procedures to report a fire or other emergency situations.
5. Maintaining the watch during hot work and for at least thirty (30) minutes after the hot work is completed.
6. Use and wear all assigned personal protection equipment.
7. Complete all sections in collaboration with the Operator of the hot work permit.
8. Shall have no other additional tasks besides fire watch. They shall not be distracted from fire watch responsibilities.

G. Hot Work Operator

1. Comply with the Hot Work Permit Program and any further safety recommendation provided by the supervisor, Life Safety Systems, and/or the Occupational Health and Safety Office.
2. Complete training requirements and request further instruction if unclear.
3. Obtain approval from the appropriate PAI and supervisory personnel for the hot work to be conducted.
4. Ensure safe working conditions in the work area, conduct assigned tasks in a safe manner, and wear all assigned personal protection equipment.
5. Ensure the hot work permit is posted in a conspicuous area onsite.
6. Use, store, and maintain equipment in safe operating condition.
7. Use and wear assigned and appropriate personal protective equipment (PPE) while performing hot work.
8. Report any changes in work conditions, unsafe or unhealthy work conditions and job-related injuries or illnesses to the supervisor immediately.
9. Maintain constant communication and adhere to Fire Watch direction, regarding safe operation.

HOT WORK HAZARDS

Workers performing hot work are exposed to the risks of fires and explosions from ignition of flammable or combustible materials in the workspace. All hot work fires and explosions are preventable. A hot work fire or explosion is the result of inadequate hot work management allowing ignition sources to come into contact with combustible, ignitable, or flammable material.

The vast majority of hot work fires occur during work or within the first hour following work completion, but more severe hot work fires occur in unprotected areas of the facility where protection systems are either not installed or impaired.

Additional to fire and explosions, other hazards include:

- Eye damage can occur when workers are exposed to flashes and arcs created during welding, arc cutting, gouging, and other activities that produce high energy light.
- Breathing welding fumes can result in harmful exposure to several metals, including hexavalent chromium and manganese, and other hazardous air contaminants, depending on the materials used in the welding rods/wires and in the base metal(s).
- Electrocution
- Asphyxiation
- Slip, Trips, and Falls
- Crushing injuries

By not abiding by safety programs and skipping required steps in the hot work permit can lead to equipment and property damage, as well as serious injury and illness or even death.

Additional UVM Safety Written Programs and state and federal regulations may apply, including, but not limited to lock-out tag-out, confined space entry, and line-breaking.

Each employee shall be responsible for inspecting potential fire and safety hazards and to have each potential hazard evaluated by a competent person. If the competent person is not able or equipped to eliminate a hazard, they should contact the appropriate manager, supervisor, and/or maintenance personnel to correct the problem.

INFORMATION AND TRAINING

For assistance, contact Life Safety Systems and/or the Occupational Health and Safety Office. Information and training will be provided or arranged by the Occupational Health and Safety Office to any unit or individual requesting guidance or training to satisfy implementation of this program.

All UVM employees and contractors involved in the Hot Work Permit Program, including permit authorization individuals, personnel performing hot work, fire watchers, and fire monitors, must complete the initial UVM Hot Work Training provided by Life Safety Systems. Training shall be completed and documented prior to conducting hot work activities. A refresher training shall be required every two (2) years. The training at a minimum will cover the following:

1. Review of the UVM Hot Work Program
2. Obtaining Hot Work Permits
3. Hot Work procedures
4. Procedures for emergency conditions
5. Inspecting the hot work area for fire-safe conditions, and if a fire is detected, notifying emergency contacts before attempting to extinguish the fire.
6. Use of fire extinguishers or firefighting hose if expected to use this equipment in response to a fire.

UVM employee training records shall be maintained with each affected department's personnel files, Life Safety Systems office, and/or Occupational Health and Safety Office.

Contact the Occupational Health and Safety Office for more information on training requirements and scheduling.

UVM Employees who Conduct Hot Work

UVM employees who conduct hot work shall be knowledgeable of the following:

1) Any manufacturer's instructions
2) How to inspect equipment and safety systems for visible defects
3) How to use equipment and safety systems properly
4) How to properly store and maintain equipment and safety systems
5) How to fill out the UVM's Hot Work Inspection Checklist (***Appendix B***)

UVM Employees who use Personal Protective Equipment

Employees who use personal protective equipment to control hazards in their work area should be knowledgeable of the following:

1) The manufacturer's instructions
2) The application limits of the equipment
3) Methods of use
4) Inspection and storage of equipment

UVM Employees Assigned Fire Watch

Employees who act as Fire Watch for a work area or job site shall be properly trained and must be knowledgeable of the following:

1) Fire extinguisher use
2) Recognizing fire hazards
3) Reporting an emergency (phone, radio, fire alarm pull stations)

Retraining

UVM employees will require retraining under any of the following conditions:

1) Changes in the workplace render previous training obsolete
2) Changes in the types of safety systems or equipment to be used render previous training obsolete
3) Inadequacies in an employee's knowledge of use of safety systems or equipment or observed behavior indicate that the employee needs retraining
4) Not following the requirements listed on the hot work permit (***Appendix A***)

HOT WORK PERMIT REQUEST

To request a Hot Work Permit, call Service Operations Support, and a Life Safety Technician will be dispatched to the site.

Plan Ahead – have available and provide:

(1) your name,

(2) phone number,

(3) work order number,

(4) inspection location, and

(5) time needed prior to hot work activities.

For additional information, questions, or concerns reach out to Life Safety Systems or the Occupational Health and Safety Office. For a sprinkler system impairment call Service Operations Support, but this should be scheduled in advance and not the day of the impairment.

HOT WORK PROCEDURES

The UVM Hot Work Permit (***Appendix A***) must be utilized by UVM personnel as well as outside contractors for conducting hot work operation(s) capable of providing a source of ignition, involving open flames, or producing heat and/or sparks. This includes, but not limited to riveting, welding, cutting, burning, heating, grinding, brazing, soldering, thawing frozen pipes by torch, torch applied roofing, and utilizing heat producing equipment over 1,100° F.
in a non-designated location.

The hot work permit shall not be valid for a period exceeding twenty-four (24) hours unless the hot work conditions remain unchanged, in which case the permit can be issued for a period not to exceed seven (7) days.

A pre-inspection of the area where work is to be done is the responsibility of the individual having supervisory responsibility, such as UVM PAI or hired contractor's site supervisor. The following are precautions and work activities required prior to and during hot work activities for which the hot work permit to remain valid:

I. Establish Work Area

Define the hot work area as thirty-five (35) feet (11m) horizontally from the hot work site and fifteen (15) feet (5m) vertically above the hot work site. The following conditions may require extending the hot work area horizontally to fifty (50) feet (15.25m) and/or vertically to thirty-five (35) feet (11m):

1. elevated hot work,
2. working in a drafty environment, such as outside on a windy day (maximum wind speed not to exceed twenty miles per hour (20mph)),
3. near a ventilation intake or exhaust louver,
4. if torch cutting, radial grinding/cutting, or electric arc welding.

If one of the following conditions exists, extend the hot work area to include the opposite side of building assembly (i.e., floor, wall, ceiling, or roof).

1. The building assembly has an opening within the hot work area. Examples of openings include penetrations for cables, piping, conveyors, or ventilation ductwork, stairways or equipment or personnel doors. Openings may allow hot work ignition sources to pass through, exposing combustible material on the opposite side of the assembly.
2. The hot work site is on or near thermally conductive materials passing through the building assembly. Examples of thermally conductive materials include metal piping or steel structural members. Thermal conduction may ignite combustible material on the opposite side of the assembly.

Demarcation and signage (***Appendix D***) shall be adequately posted to warn nearby personnel of hot work activities being performed. Barricades shall be used in conjunction with signage where it is necessary to prevent or limit employee access to work areas. Combustible barricades may not be used where they might cause a fire hazard. There shall be no barriers or obstructions in the path to exits.

Hot work shall not be attempted on a partition, wall, ceiling, or roof that has a combustible covering or insulation, or on walls or partitions or combustible sandwich-type panel construction. Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles shall not be undertaken if the work is close enough to cause ignition by conduction.

Designated hot work areas specifically located, designed, and approved for hot work operations do not require a permit. These areas are maintained fire safe, such as a maintenance shop or a detached outside location, which is of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas. A list of designated hot work areas can be found at Hot Work Program. For a workspace to be a Designated area, a Life Safety Systems (LSS) technician needs to inspect and approve the space. To request this service, please contact LSS.

II. Site Safety Inspection and Review

It is the responsibility of the Project Manager, Supervisor, or Coordinator to conduct a pre-inspection of the work area for fire hazards. This requires assessing the risks associated with the work area (i.e., whether the work area is cluttered, houses combustible materials, of flammable materials/liquids), and determining whether additional safeguards may be required.

A pre-work safety review should be conducted by the Permit Authorization Individual(s) (PAI) and individual/contractor requesting the permit to determine if an alternative cold work method can be utilized or if the hot work can be conducted in a hot work designated area.

The established work area(s) shall be inspected by the PAI once per shift, or as needed, while the hot work permit is in effect.

Additionally, the PAI shall confirm that the following activities have been completed and maintained:

A. Fire Protection Systems

1. Life Safety Systems (LSS) shall verify automatic fire protection systems (e.g., sprinkler systems) are in service, if applicable.
2. LSS shall verify onsite water supplies serving fire protection systems are in service (e.g., pumps in automatic more and suction tanks full), if applicable.
3. LSS shall verify there are no active or planned fire protection system impairments near the work area during hot work activities or fire watch and monitoring period.

4. If a permit is required and the fire protection system is impaired or not provided, the following shall occur:
    a. Delay work until the fire protection system is restored, or
    b. Treat the unprotected area as a hot work high-risk area and provide additional precautions to include extra measures to ensure,
        i. combustibles have been identified and removed or isolated,
        ii. laying charged firefighting hoses and/or garden hoses,
        iii. stationing trained firefighting personnel in the hot work area,
        iv. increasing post-work watch and monitoring periods, and/or
        v. requiring permit authorization by senior management.
5. Fully charged and operable manual firefighting equipment shall be provided, including supplemental fire extinguishers (i.e., in addition to those extinguishers required per local codes) and/or, when necessary, firefighting hose and/or garden hose laid out and connected to a closed hose valve.
    a. Fire extinguishers shall be maintained in close proximity to the hot work area, appropriate for the type of possible fire, and related and sized appropriate for the hazard(s). Inspect the equipment prior to initiating the work. Fire extinguishers shall be inspected, tested, and maintained.
    b. If existing fire extinguishing hose lines are located within the hot work area defined by the permit, they shall be connected and ready for service.
    c. If the temperatures are at or below 32 degrees Fahrenheit, then the following fire extinguisher types are required:
        i. loaded stream water entry, containing agent to prevent freezing.
        ii. stored pressure water and/or antifreeze.
6. During hot work, special precautions shall be taken to avoid accidental operation of automatic fire detection or suppression systems (e.g., special extinguishing systems or sprinklers).
    a. Sprinkler heads of the fire protection system directly above the hot work area should be operational but protected from being accidentally activated by the hot work activities. For example, a wet cloth/rag shall be laid over the sprinkler head and then removed at the conclusion of operation capable of providing a source of ignition.
    b. Smoke detectors within the work area should be isolated or covered to avoid being set off by hot work activities.

B. Work Area Conditions

1. Perform the appropriate housekeeping activities to remove combustible accumulations and pooling liquid, such as sweeping the floor.
2. Thoroughly inspect the hot work area for combustible accumulations in spaces hidden from sight such as in trenches or pits, underneath equipment, within partially enclosed equipment, and atop cable trays, ductwork, or suspended ceilings.
3. Identify and safeguard any combustible-lined equipment, piping, and/or ducts in the hot work area when the equipment has openings that could allow hot work ignition sources to enter.
4. All cracks and openings in walls, floors, and/or ducts through which hot sparks or slag may enter shall be sealed with listed fire rated or noncombustible material. As an alternate means, a fire-resistant shield or cover may be used to block the openings.
5. If hot work is done on one side of a wall, partition, ceiling, or roof, one of the following criteria shall be met:

a. Precautions shall be taken to prevent ignition of combustibles on the other side by relocating the combustibles.
b. If it is impractical to relocate combustibles, a fire watch shall be provided on the side opposite from where the work is being performed.

6. Remove combustible accumulations (debris, dust/lint, or residues) and pooling of ignitable liquid (due to spills or leaks) from the hot work area. Remove combustible equipment, storage, and similar materials from the hot work area. These shall be relocated at least thirty-five (35) feet (11m) radius from the hot work area. The PAI can approve alternative procedures under certain circumstances.
7. If combustibles are non-moveable (e.g., combustible construction), isolate non-movable combustible materials from ignition sources using one of the following options:
    a. **Do Not** use wet-down as an alternative to isolating combustible materials.
    b. Shield non-moveable combustible materials with ANSI/FM 4950 approved welding pads, blankets, or curtains using the appropriate application as discussed below:
        i. Welding pads are intended for use where the hot work exposure is severe. FM approved pads are designed to resist burn-through and thermal conduction when positioned in close proximity to the hot work site in a horizontal orientation and exposed to molten metal contact.
        ii. Welding blankets are intended for use where the hot work exposure is moderate. Blankets may not be rated to resist molten burn-through. FM approved blankets are designed to resist burn-through and thermal conduction when positioned in close proximity to the hot work site in a horizontal or vertical orientation and exposed to sparks, flames, and heat.
        iii. To prevent the entrance of sparks, the edges of covers at the floor shall be tight, including at the point at which several covers overlap where a large pile is being protected.
8. Isolate potential sources of flammable gas, ignitable liquid, and/or combustible dust/lint that may be released into the hot work area during work. Conduct a job safety analysis to identify sources of these materials, and to determine the appropriate isolation method. Typically, isolation starts with a minimum of de-energizing the equipment, but may also include blocking, draining, and purging equipment. Consider the following when isolating source of flammable gas, ignitable liquid and/or combustible dust/lint:
    a. When a more reliable blocking method is warranted, consider a double-block and vent valve arrangement, or physically disconnecting material sources by temporarily installing a pipe blank, cap, or plug.
    b. When a less-reliable blocking method is used due to a lack of available options (e.g., a single block valve), consider performing frequent checks or constant atmosphere monitoring to verify adequate isolation.
    c. When draining and purging is warranted, ensure all low points are identified and verified clear prior to work.
9. Test atmospheric conditions within the hot work area for, where other state and federal regulatory standards may apply, such as those in confined spaces or where an atmospheric hazard is known or potential to be present.
    a. Flammable vapor/gas prior to work and as needed during work. When conducting atmosphere monitoring, immediately stop work if the atmosphere exceeds one percent (1%) of the lower explosive limit (LEL) of potential or identified flammable gas, ignitable liquid, and/or combustible dust/lint.

b. Airborne combustible dust at a concentration that meets or exceeds its LFL.
c. Atmospheric oxygen concentration is below 19.5 percent or above 23.5 percent.
d. any substance for which a dose or a permissible exposure limit is published.
e. Any other atmospheric condition that is immediately dangerous to life or health.

10. Contain hot work ignition sources using FM approved welding pads, blankets or curtains using the appropriate application as discussed below:
    a. Welding pads are intended for the use where the hot work exposure is severe. FM approved pads are designed to resist burn-through and thermal conduction when positioned in close proximity to the hot work site in a horizontal orientation and exposed to molten metal contact.
    b. Welding blankets are intended for use where the hot work exposure is moderate. FM approved blankets are designed to resist burn-through and thermal conduction when positioned in close proximity to the hot work site in a horizontal or vertical orientation and exposed to sparks, flames, and heat. Blankets may not resist molten metal burn-through.
    c. Welding curtains are intended for use where the hot work exposure is mild. FM Approved welding curtains are designed to resist burn-through or deformation when oriented vertically and positioned distant from sparks and flames.
    d. Ensure seams between multiple pads, blankets, and/or curtains overlap sufficiently and openings at the bottom of curtains are covered to prevent hot work ignition sources from escaping.
11. Ventilation and conveying systems in the hot work area shall be protected and/or shut down. These systems may contain combustible material or transport hot work ignition sources outside the hot work area to downstream combustible accumulations or filters. If ventilation is needed for an enclosed hot work site, provide the following safeguards:
    a. Use temporary ventilation systems constructed of noncombustible components and remove air filters. If particulate filtration is needed, use an FM approved Class 1 air filter.
    b. If negative ventilation is used, extend the hot work area to include the area around the fan discharge.
    c. If positive ventilation is used, ensure the airflow does not disperse hot work ignition sources outside the hot work area or compromise the arrangement of hot work blankets and curtains.
12. Treat hot work on thermally conductive materials at or near penetrations into combustible building assemblies as a hot work high-risk operation. In addition, take the following required precautions:
    a. Remove portions of the building assembly around the penetration and use suitable noncombustible replacements.
    b. Monitor the temperature of the thermally conductive material before penetration.
    c. Temporarily install a thermal sink on the thermally conductive material before the penetration.
    d. An infrared camera or FLIR may be used to inspect for evidence of fire or ignition, of combustible materials, which are particularly active location or start of a fire. Stop work immediately and initiate emergency action if evidence of fire or ignition is detected.
    e. Report all evidence of fire or ignition, even if extinguished, to the fire service. Smoldering may continue after extinguishment and may take place for hours before flaming begins in areas unsuspected by non-professionals.

13. Treat hot work on combustible building assemblies as a hot work high-risk operation. Examples of such hot work may include cutting through a non-FM Approved (class 2) insulated steel deck roof or insulated metal panel, or welding seams of insulated metal panels, when performing these operations, follow the guidelines of the building system manufacturer, and take the following additional required precautions:
    a. Develop a fire emergency response plan that includes conditions under which fire service should be notified and verify the fire service has access to the work area.
    b. Stop work immediately if material appears to be smoking.
    c. An infrared camera or FLIR may be used to inspect for evidence of fire or ignition of combustible materials. Stop work immediately and initiate emergency action if such evidence is detected.
    d. Report all evidence of fire or ignition, even if extinguished, to the fire service. Smoldering may continue after extinguishment and may take place for hours before flaming begins in areas unsuspected by non-professionals.
14. Non-combustible or flame screens shall be placed and positioned to protect personnel in adjacent work areas from heat, flames, radiant energy, and welding splatter.
15. No welding, cutting, or other hot work shall be performed on used drums, barrels, tanks, or other containers until they have been cleaned so thoroughly as to make absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which when subjected to heat, might produce flammable or toxic vapors. Any pipelines or connections to the drum or vessel shall be disconnected or blanked. All hollow spaces, cavities or containers shall be vented to permit the escape of air or gases before preheating, cutting, or welding. Purging with inert gas is recommended.

III. During Hot Work

Restrict the scope of a hot work permit to that defined on the authorized permit. It shall be ensured that the type of hot work operations and the location of hot work sites do not change once the permit is authorized. Changes may require redefining the hot work area and modifying the required precautions. If conditions do change, stop work, and reauthorize the permit before continuing.

In addition to the site safety inspection activities, the following shall be completed and maintained during hot work activities:

1. Where combustible materials, such as paper clippings, wood shaving, or textile fibers, are on the floor, the floor shall be swept clean for a minimum radius of thirty-five (35) feet (11m).
2. Combustible building floor material(s) shall be protected during the hot work activities by the following criteria:
    a. Combustibles floors shall be kept wet, covered with damp sand, or protected by a listed welding blanket, welding pad, or equivalent.
    b. Where floors have been wet down, personnel operating arc welding equipment or cutting equipment shall be protected from electrical shock.
3. All moved/relocated combustible items shall remain at least thirty-five (35) feet (11m) away from the hot work area during work and fire watch and monitoring.
4. Move, transport, and store acetylene and other fuel cylinders and sources in accordance to CFR 1926.350 Gas Welding and Cutting.
5. Place tools and equipment hoses so that they will not be crushed or damaged.

6. Maintain equipment in good and safe operating condition as per manufacturer's instructions. If found to be incapable of reliable safe operation, the equipment shall be repaired by qualified personnel prior to its next use or be withdrawn from service.
7. Ensure hot work equipment is properly installed and arranged prior to initiating work. For example, provide appropriate electrical grounding for work surfaces to present stray currents during arc welding; protect piping and hoses conveying flammable or shielding gases used for welding or cutting and restrain compressed gas cylinders used for welding or cutting.
8. Hot work **shall not** be attempted on a partition, wall, ceiling, or roof that has or discovered to have a combustible covering or insulation, or on walls or partitions or combustible sandwich-type panel construction.
9. Hot work that is performed on pipes or other metal that is in contact with combustible walls, partitions, ceilings, roofs, or other combustibles **shall not** be undertaken if the work is close enough to cause ignition by conduction.
10. Fully charged and operable fire extinguishers that are appropriate for the type of possible fire shall be available immediately at the work area.
11. If the temperatures are at or below 32 degrees Fahrenheit, then the following fire extinguisher types are required:
    a. loaded stream water entry, containing agent to prevent freezing
    b. stored pressure water and/or antifreeze
12. The operator and nearby personnel shall be suitably protected against dangers such as heat, sparks, and slag.

IV. Working on Roofs

Treat work on torch-applied roofing systems as a hot work high-risk operation. Work may include installing, altering, or repairing roof systems. Torch-applied roofing includes modified bitumen roof covers using an open-flame roofer's torch. When using torch-applied roofing systems, follow the guidelines of the roofing system manufacturer, and take the following additional precautions:

1. Follow guidelines within FM Global Data Sheet 1-33, Safeguarding Torch-Applied Roof Installations. Prior approval is required for any hot work activities of high-risk operation.
2. Develop a roof fire emergency response plan that includes conditions under which the fire service should be notified and verify the fire service has access to the work area.
3. It is required to have a charged water hose, i.e. a garden hose, at the location of the hot work. If it is not feasible to have a garden hose, then it is required to have a 2.5 gallon loaded stream fire extinguisher.
4. Stop work immediately if roofing material appears to be smoking. Tools should be at the ready so they can be used to open any portion of the roof if smoke or fire is present.
5. Procedures for Hot Work conducted on Roofs:
    a. Conduct a continuous fire watch over the hot work area during torch application.
    b. Conduct the post work fire-watch in accordance with the hot work permit "Construction & Occupancy Factors for Determining Post-Fire Watch and Fire Monitoring Periods" (Table 1), and adhere to the following:
        i. Where thermal imaging such as an infrared camera or FLIR is used to check all roof areas worked on for evidence of fire or ignition, if temperatures more than 250˚ F, remove and safely discard all charred or smoldering insulation and roof covering, including materials within a 4 feet radius beyond. Initiate emergency action if evidence of fire or ignition is detected.

ii. Inspect the entire top surface of the roof area worked on as well as the inside of the building for signs of fire, dripping bitumen or smoke. Pay particular attention to areas around roof expansion joints and other roof penetrations.

6. Conduct fire monitoring in accordance with Table 1.
7. Report all evidence of fire or ignition, even if extinguished, to the fire service. Smoldering may continue after extinguishment and may take hours before flaming begins in areas unsuspected by non-professionals.
8. When using an asphalt kettle:
   a. locate the kettle to a minimum of twenty-five (25) feet from the building and combustible yard storage,
   b. ensure the kettle is attended at all times while in operation, and
   c. provide an appropriate fire extinguisher nearby.
9. Close all valves supplying fuel-fired equipment when unattended.

V. Hot Work on/in Equipment and Piping

The following procedures and precautions shall be implemented if work is conducted on or in equipment and/or piping:

1. Identify and isolate interconnected equipment and piping that contains flammable gas, ignitable liquid, or combustible dust/lint.
2. Drain ignitable liquid and purge flammable gas/vapor from equipment and interconnected piping in accordance with Data Sheet 7-59, "Inerting and Purging Vessels and Equipment". When draining equipment, identify low points of equipment and/or piping that may contain trapped liquid.
3. Test equipment and/or piping for flammable gas/vapor prior to work and as needed during work. Consider conducting routine checks or continuous atmosphere monitoring during work if a less-reliable isolation method is employed or other high-risk factors are present in the work area.
4. When warranted by facility conditions, test for flammable gas/vapor or conducting atmosphere monitoring in enclosed equipment, piping, and/or ductwork, even if the equipment does not normally contain flammable gas or ignitable liquid. Flammable materials can contaminate nonflammable process streams, or flammable decomposition products can be produced by decaying organic materials. For example, contamination can occur in waste-water collection and treatment equipment due to upset operating conditions or loss of mechanical integrity of a heat exchanger.
5. Remove combustible debris, dust/lint and residue from equipment and interconnected piping. Inspect equipment and piping internals for combustible materials perform the appropriate housekeeping activities to clean the equipment prior to work.
6. Treat hot work in combustible-lined equipment, piping, or ductwork as a hot work high-risk operation. In addition, take the following additional required precautions when warranted by facility conditions:
   a. Use an alternative cold work method.
   b. Label combustible-lined equipment, piping, and/or ductwork with easily recognizable warning signs. Locate warning signs in high-traffic or readily visible areas (e.g., above personnel access hatches or near travel paths and walkways).
   c. Flood equipment, piping, and/or ductwork with water. Alternatively, continuously wet-down combustible surfaces with water spray during work and during the post-work fire watch period.

d. Identify access ports upstream and downstream of the hot work site and lay out hose lines at access ports.
e. Isolate equipment, piping, and/or ductwork upstream and downstream of the hot work site using an appropriate isolation method such as blanking and physically breaking equipment. Note that blanking alone may not provide a sufficient firebreak because conductions through the blank can ignite combustibles on the opposite side.

VI. Fire Watch and Monitoring

A fire watch and monitoring shall be required for any work area a hot work permit is required. Additionally, it shall be required when hot work is performed in a location where other than a minor fire might develop or where the following conditions exist:

1. Combustible materials in building construction or contents are closer than thirty-five (35) feet (11m) to the point of operation.
2. Combustible materials are more than thirty-five (35) feet (11m) away from the point of operation but are easily ignited by sparks.
3. Wall or floor openings within a thirty-five (35) feet (11m) radius expose combustible materials in adjacent areas, including concealed spaces in walls or floors.
4. Combustible materials are adjacent to the opposite side of partitions, walls, ceilings, or roofs and are likely to be ignited.

During hot work, a continuous fire watch shall be performed over the hot work area and for at least a half an hour (0.5hrs) after the completion of hot work operations, or as indicated in Table 1. The following responsibilities are included in the fire watch:

1. Continuously supervise the hot work area and the person performing the work to ensure fire-safe conditions are maintained.
2. A fire watch must be maintained within the hot work area continuously from the start of work to completion of work, even during breaks if the watch needs to leave the hot work area, assign a temporary or permanent in order to maintain a continuous watch.
3. Ensure hot work ignition sources are confined within the defined hot work area.
4. The fire watch is responsible for stopping hot work if unsafe conditions are identified.
5. Ensure the required precautions are in place.
6. Ensure continuous fire watch supervision, through the end of monitoring time. Monitoring time is determined by the type of hot work being performed (soldering, brazing, welding, grinding, etc.).
7. In the event of a fire, notify emergency contacts prior to attempting to extinguish the blaze, regardless of size.

A second fire watch shall be provided if any of the following conditions exist:

1. The hot work area and person performing the hot work are not visible from a single vantage point.
2. The hot work area is large, multi-level, and/or congested.
3. The hot work extends to the other side of a building assembly (wall, partition, ceiling, or roof) due to an opening or thermally conductive penetration.
4. Or if deemed necessary by the PAI or the UVM Fire Marshall.

After hot work activities have concluded, perform a continuous fire watch over the entire hot work area, including areas requiring a second fire watch.

After the post-work fire watch has concluded, perform fire monitoring within the hot work area. Use one of the fire monitoring methods listed below and refer to Table 1 for the recommended fire monitoring period:

1. Automatic smoke detection system with remote alarm that sounds in a constantly attended location.
2. Operators routinely present in the hot work areas. Train operators to monitor fire-safe conditions, maintain required precautions in place, and notify emergency contacts before making any attempt to extinguish fire.
3. Personnel to intermittently patrol the hot work area for fit-safe conditions. Patrol of the hot work area will occur as determined by the PAI, but no less than every 30 minutes. Train personnel to monitor for fire-safe conditions, maintain required precautions in place, and notify emergency contacts prior to attempting to extinguish a fire, regardless of size.
4. Security video cameras with clear coverage of the hot work area. Locate camera displays in a constantly attended location. Cameras with infrared capabilities are preferred.

Provide post-work fire watch and fire monitoring periods based on the construction and occupancy factors shown in Table 1.

1. Consider modifying the post-work fire watch and fire monitoring periods based on positive factors. If appropriate discuss modifying post-work fire watch and fire monitoring periods with FM Global.
2. When conducting hot work in unprotected areas (e.g., un-sprinklered), fire monitoring becomes more critical as a primary means of protecting against hot work fires. Treat unprotected areas as hot work high-risk areas.
3. After completion of the fire watch, contractors must complete appropriate information and sign the hot permit acknowledgement. Failure to do so may result in future permits being denied.

TABLE 1
Construction & Occupancy Factors for Determining Post-Fire Watch and Fire Monitoring Periods

		Construction Factors					
		Noncombustible construction, or FM Approved Class 1 or Class A building materials		Combustible construction without concealed cavities		Combustible construction with unprotected concealed cavities	
		Watch	**Monitor**	**Watch**	**Monitor**	**Watch**	**Monitor**
Occupancy Factors	Noncombustible with any combustibles within closed equipment (e.g., ignitable liquid in piping)	30 Minutes	0 Hours	1 Hour	3 Hours	1 Hour	5 Hours
	Office, retail, or manufacturing with limited combustible loading	1 Hour	1 Hour	1 Hour	3 Hours	1 Hour	5 Hours
	Manufacturing with moderate to significant combustible loading except as noted below	1 Hour	2 Hours	1 Hour	3 Hours	1 Hour	5 Hours
	Warehousing	1 Hour	2 Hours	1 Hour	3 Hours	1 Hour	5 Hours
	Exceptions: Occupancies with processing or having bulk storage of combustible material capable of supporting slow-growing fires (e.g., paper, pulp, textile fibers, wood, bark, grain, coal, or charcoal)	1 Hour	3 Hours	1 Hour	3 Hours	1 Hour	5 Hours

When performing torch-applied roofing, apply additional precautions and conduct a minimum 2 hour fire watch and 2 hours fire monitoring. If infrared camera is utilized, reduce to a 1 hour fire watch and 1 hour fire monitoring.

When performing hot work on/in equipment containing nonremovable combustible linings or parts, apply additional precautions and conduct a minimum 1 hour fire watch and 3 hours fire monitoring with the equipment, and in the surrounding areas per above.

VII. Emergency Conditions and Alternative Procedures

If conditions warrant, waivers or alternate procedures to hot work requirements may be granted. Requests for alternate procedures must be provided in writing to Life Safety Systems and approved by the Life Safety Systems Manager and the UVM Fire Marshal prior to the start of hot work activities.

In instances where the scope of work and tools used to conduct hot work are known to be incapable of generating slag, sparks, spatter, or similar mobile sources of ignition capable of leaving the immediate area of the applied hot work, the PAI shall be permitted to do the following:

1. Reduce the distances and areas addressed in NFPA 51B to distances and areas that the PAI considers fire safe for the intended operation.
2. Describe those distances and areas on the hot work permit.

VIII. Prohibited Work Areas

The following are areas hot work is prohibited:

1. Areas not authorized by management.
2. Areas equipped with sprinkler systems and other fire protection systems that are out of order.
3. In or near areas known or potential to have explosive atmospheres, including those with confined spaces, where atmospheres of explosive gases, vapors, or dusts exist or could accumulate.
4. On containers where flammable liquids, solids, or vapors may be present.
5. In or near areas known or potential to have one or more combustible particulate solids such as dust.

IX. Record Keeping

All hot work permits shall be returned to the Life Safety Systems office for their record retention. Records of hot work permits shall be maintained for one (1) calendar year. Hot work permits on file should be reviewed for program improvement or modification purposes prior to disposal.

ENGINEERING CONTROLS

Each work site shall have a competent person determine if engineering controls can eliminate or lessen the hazard of the work area or job site. Engineering controls shall be provided where possible to minimize hazards.

Engineering controls of hazards consist of the following:

1. Mechanical Ventilation shall discharge contaminated air exhaust from a working space into the open air or otherwise clear of the source of intake air. All air replacing that withdrawn shall be clean and respirable.
    a. general mechanical ventilation systems shall be of sufficient capacity and so arranged as to produce the number of air changes necessary to maintain welding fumes and smoke within safe limits.
    b. local exhaust systems shall consist of freely movable hoods intended to be placed by the welder or burner as close as practicable to the work. This system shall be of sufficient

capacity, arranged as to remove fumes and smoke at the source, and keep the concentration of them in the breathing zone within safe limits.

2. When sufficient ventilation cannot be obtained without blocking the means of access, employees in the confined space shall be protected by airline respirators in accordance with the requirements of CFR 1926 subpart E, and an employee on the outside of such a confined space shall be assigned to maintain communication with those working within it and to aid them in an emergency.
3. When welding, cutting, or heating the following metals in an enclosed space, activities shall be performed with either general mechanical or local exhaust ventilation, and/or protected by airline respirators. If operations are conducted in the open air, employees shall be protected by air purifying aka filter-type respirators.
    a. Zinc- bearing base or filler metals or metals coated with zinc-bearing materials
    b. Lead base metals
    c. Cadmium-bearing filler materials, or -coated base metals
    d. Chromium-bearing metals or metals coated with chromium-bearing materials
    e. Metals coated with mercury-bearing metals
    f. Beryllium -containing base or filler metals

PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment (PPE) shall be used to minimize hazards where engineering controls do not eliminate the hazard or in conjunction with engineering controls.

Any other PPE deemed necessary for the task under the UVM Personal Protective Equipment Program must be worn by employees. This includes but is not limited to hard hats, gloves, safety glasses, and steel toed boots. Employees conducting hot work operations shall wear the following PPE:

- Flameproof skullcap
- Helmet with appropriate filter lens
- Eye safety shield and safety glasses or vented goggles
- Leather or approved rated apron
- Clean, fire-resistant clothing, to include collar buttoned shirt, full sleeves, full length pants/trousers with no cuffs
- Fire protection gloves
- Safety shoes
- Respirators as necessary

Specific assigned PPE by type of hot work can be found at Hot Work PPE.

Any assumed, apparently impacted, or damaged PPE shall be immediately removed from service. Visual equipment inspections shall be conducted by personnel prior to each use. If, upon inspection, a piece of equipment shows any signs of wear it must immediately be removed from service and the supervisor notified. Stow equipment in clean areas, away from strong sunlight and extreme temperatures which could degrade materials. Check the manufacturer's recommendations for cleaning, maintenance, and storage information.

The following Table 2 and Table 3 indicate filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation:

Table 2			
Filter Lenses for Protection Against Radiant Energy			
Operations	**Electrode Size 1⁄32 in.**	**Arc Current**	**Minimum* Protective Shade**
Shielded metal arc welding	Less than 3	Less than 60	7
	3-5	60-160	8
	5-8	160-250	10
	More than 8	250-550	11
Gas metal arc welding and flux cored arc welding		less than 60	7
		60-160	10
		160-250	10
		250-500	10
Gas Tungsten arc welding		less than 50	8
		50-150	8
		150-500	10
Air carbon	(Light)	less than 500	10
Arc cutting	(Heavy)	500-1000	11
Plasma arc welding		less than 20	6
		20-100	8
		100-400	10
		400-800	11
Plasma arc cutting	(light)**	less than 300	8
	(medium)**	300-400	9
	(heavy)**	400-800	10
Torch brazing			3
Torch soldering			2
Carbon arc welding			14

* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation.

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.

Table 3			
Filter Lenses for Protection Against Radiant Energy			
Operations	**Plate thickness - inches**	**Plate thickness - mm**	**Minimum* Protective Shade**
Gas Welding:			
Light	Under 1/8	Under 3.2	4
Medium	1/8 to 1/2	3.2 to 12.7	5
Heavy	Over 1/2	Over 12.7	6
Oxygen cutting:			
Light	Under 1	Under 25	3
Medium	1 to 6	25 to 150	4
Heavy	Over 6	Over 150	5
* As a rule of thumb, start with a shade that is too dark to see the weld zone. Then go to a lighter shade which gives sufficient view of the weld zone without going below the minimum. In oxyfuel gas welding or cutting where the torch produces a high yellow light, it is desirable to use a filter lens that absorbs the yellow or sodium line in the visible light of the (spectrum) operation. ** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the workpiece.			

RESCUE PLANS AND EQUIPMENT

The following must be established and are important components of a rescue plan:

- Competent person(s) must be onsite and understand the physical environment.
- A rescue team of trained personnel, or 9-1-1, must be determined, and estimated response time known, such as is the team onsite or on standby.
- The team understands the type of rescue that may be necessary in case of an injury or fire.
- A Job Hazard Analysis (JHA) of the rescue must be performed.

Rescue equipment that needs to be available onsite when hot work activities occur include:

- First Aid Kit – required onsite.
- Defibrillator – refer to uvm.edu/map for nearest locations.
- Fire Extinguisher(s) – required onsite.

A fire emergency response plan must be developed and implemented. All affected UVM Personnel shall review the plan prior to the start of hot work activities. ***Appendix C*** provides an example of a fire emergency response plan.

DEFINITIONS

Designated Hot Work Area	A specific location designed and approved for hot work operations that is maintained fire safe, such as a maintenance shop or a detached outside location, which is of noncombustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas
Permit-Required Area	Any location other than a designated area that is approved for hot work and is made fire-safe by removing or protecting combustibles from ignition sources.
Fire Emergency Response Plan	Procedures for reporting a fire or other emergency. There are preferred procedures for reporting emergencies such as dialing 911, or an internal emergency number, or pulling a manual fire alarm but there are many other possibilities. [29 CFR 1910.38(c)(1)]
Fire Monitoring	Provisions implemented to provide early warning of smoldering fire conditions in the hot work area following completion of the established fire watch time period.
Fire Protection System	Any fire alarm device or system or fire-extinguishing device or system, or combination thereof, that is designed and installed for detecting, controlling, or extinguishing a fire or otherwise alerting occupants, or the fire department, or both, that a fire has occurred
Fire Watch	A person or persons responsible for continuously observing the hot work area, maintaining fire-safe conditions, and responding to and reporting emergencies during hot work operations and in the established period following
Forward-Looking Infrared (FLIR)	The detection of heat energy radiated by objects to produce a "thermal image." This thermal image is converted by electronics and signal processing into a visual image that can be viewed by the operator.
FM (Factory Mutual) Approved	Reference to 'FM Approved' means the product or service has satisfied the criteria for Approval by FM Approvals. Refer to the Approval Guide, a publication of FM Approvals, for a complete list of products and services that are FM Approved
Hot Work	Work involving burning, welding, or similar operation that is capable of initiating fires or explosions, including cutting, welding, brazing, soldering, grinding, thermal spraying, thermal welding, thawing pipe, torch-applied roofing, or any other similar activity
Hot Work Permit	A document issued by the designated permit authorization individual(s) (PAI) within the UVM Life Safety, for the purpose of authorizing performance of a specified hot work activity
Hot Work Operator	The authorized person who starts, controls, or stops hot work equipment
Permit Authorizing Individual (PAI)	Shall be responsible for informing Fire Watch and Hot Work Operator of the hazards involved and subsequent expectations during the hot work operation. Permit Authorizing Individual will also issue the hot work permit the Hot Work Operator.

Portable Fire Extinguishers	Apply an extinguishing agent that will either cool burning fuel, displace or remove oxygen, or stop the chemical reaction so a fire cannot continue to burn. When the handle of an extinguisher is compressed, agent is expelled out the nozzle.
UVM Personnel	UVM employees (faculty/staff), students, and visitors, including contractors and consultants
Welding Pads	are intended for use where the hot work exposure is severe. FM approved pads are designed to resist burn-through and thermal conduction when positioned in close proximity to the hot work site in a horizontal orientation and exposed to molten metal contact.
Welding Blankets	are intended for use where the hot work exposure is moderate. Blankets may not be rated to resist molten burn-through. FM approved blankets are designed to resist burn-through and thermal conduction when positioned in close proximity to the hot work site in a horizontal or vertical orientation and exposed to sparks, flames, and heat.

University of Vermont

APPENDIX A

HOT WORK PERMIT

University of Vermont

HOT WORK PERMIT

STOP!
Avoid hot work when possible! Consider using an alternative cold work method.

This Hot Work Permit is required for any temporary operation involving open flames or producing heat and/or sparks conducted outside a Hot Work Designated Area. This includes, but is not limited to brazing, cutting, grinding, soldering, torch-applied roofing and welding.

Part 1

Instructions for Permit Authorizer

1. Specify the precautions to take.
2. Fill out and keep **Part 1** during the hot work process.
3. Issue **Part 2** to the person doing the job.
4. Keep **Part 2** on file for future reference, including signed confirmation that the post-work fire watch and monitoring have been completed.
5. Sign off the final check on **Part 2**.

HOT WORK BY
☐ Employee
☐ Contractor _____

DATE | JOB NUMBER

LOCATION OF WORK (BUILDING/FLOOR/OBJECT)

WORK TO BE PERFORMED

NAME OF PERSON PERFORMING HOT WORK

NAME OF PERSON PERFORMING FIRE WATCH

I verify the above location has been examined, the Required Precautions have been taken, and permission is authorized for this work.

PERMIT AUTHORIZER (PRINT AND SIGN)

THIS PERMIT EXPIRES ON (LIMIT AUTHORIZATION TO ONE SHIFT):

DATE: TIME: ☐ AM ☐ PM

Note: Emergency notification on back of form.

Additional FM Global Resources:
Property Loss Prevention Data Sheet 10-3, *Hot Work Management*
Hot Work Permit form (F2630) via fmglobalcatalog.com
Online training at training.fmglobal.com
FM Approved equipment via fmapprovals.com

FM Global

Required Precautions

Y	NA	
☐	☐	The fire pump is in operation and switched to automatic.
☐	☐	Control valves to water supply for sprinkler system are open.
☐		Extinguishers are in service/operable.
☐		Hot work equipment is in good working condition.

Requirements within 35 ft. (10 m) of hot work

- ☐☐ Shield combustible construction using listed (e.g., FM Approved) welding pads, blankets and curtains.
- ☐☐ Remove or shield nonremovable combustibles using listed (e.g., FM Approved) welding pads, blankets and curtains.
- ☐☐ Isolate potential sources of flammable gas, ignitable liquid or combustible dust/lint (e.g., shut down equipment).
- ☐☐ Remove ignitable liquid, combustible dust/lint and combustible residues.
- ☐☐ Shut down ventilation and conveying systems.
- ☐☐ Remove combustibles and consider a second fire watch on opposite side of floor, wall, ceiling or roof when openings exist or thermally conductive materials pass through.
- ☐☐ Is work on a combustible building assembly (e.g., torch-applied roofing)? If yes, provide **ADDITIONAL REQUIRED PRECAUTIONS** below.

Hot work on/in closed equipment, ductwork or piping

- ☐☐ Isolate equipment from service.
- ☐☐ Remove ignitable liquid and purge flammable gas/vapor.
- ☐☐ Prior to work, and/or during work, monitor for flammable gas/vapor. LEL reading(s): _____
- ☐☐ Remove combustible dust/lint or other combustible materials.
- ☐☐ Is work on/in equipment with nonremovable combustible linings or parts? If yes, provide **ADDITIONAL REQUIRED PRECAUTIONS** below.

Fire watch/fire monitoring the hot work area
Times listed are sufficient for majority. Use Table at back of permit for guidance for combustible concealed cavities, roof work or favorable factors.

- ☐ Perform a continuous fire watch during hot work.
- ☐ Perform a continuous fire watch post-work for
  ☐ 1 hour or Other _____ hours.
- ☐☐ Perform fire monitoring for
  ☐ 3 hours or Other _____ hours.

ADDITIONAL REQUIRED PRECAUTIONS:

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WARNING

HOT WORK IN PROGRESS! Watch for fire!

Instructions

Person performing hot work: Record time started and display permit at hot work area. After hot work is completed, record time and leave permit displayed for fire watch.

Fire watch: Watch area during hot work and after work completion. Prior to leaving area, perform final inspection, sign, leave permit displayed and notify Fire Monitor or Permit Authorizer.

Fire monitor: Monitor area after post-work fire watch completion. Perform final inspection, sign and return to Permit Authorizer.

HOT WORK BY
☐ Employee
☐ Contractor _____

DATE	JOB NUMBER

LOCATION OF WORK (BUILDING/FLOOR/OBJECT)

WORK TO BE PERFORMED

NAME OF PERSON PERFORMING HOT WORK

NAME OF PERSON PERFORMING FIRE WATCH

I verify the above location has been examined, the Required Precautions have been taken, and permission is authorized for this work.

PERMIT AUTHORIZER (PRINT AND SIGN)

THIS PERMIT EXPIRES ON (LIMIT AUTHORIZATION TO ONE SHIFT):

DATE:	TIME:	☐ AM	☐ PM
Hot Work Date:	Start Time:	☐ AM	☐ PM
	Finish Time:	☐ AM	☐ PM
Post-Work Fire Watch	Finish Time:	☐ AM	☐ PM
Name			
Fire Monitor ☐ Person ☐ Other	Finish Time:	☐ AM	☐ PM
Name/Other			
Final Check	Time:	☐ AM	☐ PM
Name			

Part 2

Required Precautions

Y	NA	
☐	☐	The fire pump is in operation and switched to automatic.
☐	☐	Control valves to water supply for sprinkler system are open.
	☐	Extinguishers are in service/operable.
	☐	Hot work equipment is in good working condition.

Requirements within 35 ft. (10 m) of hot work

☐	☐	Shield combustible construction using listed (e.g., FM Approved) welding pads, blankets and curtains.
☐	☐	Remove or shield nonremovable combustibles using listed (e.g., FM Approved) welding pads, blankets and curtains.
☐	☐	Isolate potential sources of flammable gas, ignitable liquid or combustible dust/lint (e.g., shut down equipment).
☐	☐	Remove ignitable liquid, combustible dust/lint and combustible residues.
☐	☐	Shut down ventilation and conveying systems.
☐	☐	Remove combustibles and consider a second fire watch on opposite side of floor, wall, ceiling or roof when openings exist or thermally conductive materials pass through.
☐	☐	Is work on a combustible building assembly (e.g., torch-applied roofing)? If yes, provide **ADDITIONAL REQUIRED PRECAUTIONS** below.

Hot work on/in closed equipment, ductwork or piping

☐	☐	Isolate equipment from service.
☐	☐	Remove ignitable liquid and purge flammable gas/vapor.
☐	☐	Prior to work, and/or during work, monitor for flammable gas/vapor. LEL reading(s): _____
☐	☐	Remove combustible dust/lint or other combustible materials.
☐	☐	Is work on/in equipment with nonremovable combustible linings or parts? If yes, provide **ADDITIONAL REQUIRED PRECAUTIONS** below.

Fire watch/fire monitoring the hot work area

Times listed are sufficient for majority. Use Table at back of permit for guidance for combustible concealed cavities, roof work or favorable factors.

☐ Perform a continuous fire watch during hot work.
☐ Perform a continuous fire watch post-work for
☐ 1 hour or Other _____ hours.
☐☐ Perform fire monitoring for
☐ 3 hours or Other _____ hours.

ADDITIONAL REQUIRED PRECAUTIONS: _____

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WARNING

HOT WORK IN PROGRESS!
Watch for fire!

In case of emergency, call the contacts listed below before attempting to extinguish the fire.

Contact	Number

Construction and Occupancy Factors for Post-Work Fire Watch and Monitoring Periods

		Construction Factors					
		Noncombustible construction, or FM Approved Class 1 or Class A building materials		Combustible construction without concealed cavities		Combustible construction with unprotected concealed cavities	
		Watch	**Monitor**	**Watch**	**Monitor**	**Watch**	**Monitor**
Occupancy Factors	Noncombustible with any combustibles contained within closed equipment (e.g., ignitable liquid within piping)	30 minutes	0 hours	1 hour	3 hours	1 hour	5 hours
	Office, retail or manufacturing with limited combustible loading	1 hour	1 hour	1 hour	3 hours	1 hour	5 hours
	Manufacturing with moderate to significant combustible loading except as noted below	1 hour	2 hours	1 hour	3 hours	1 hour	5 hours
	Warehousing	1 hour	2 hours	1 hour	3 hours	1 hour	5 hours
	Exceptions: Occupancies with processing or having bulk storage of combustible materials capable of supporting slow-growing fires (e.g., paper, pulp, textile fibers, wood, bark, grain, coal or charcoal)	1 hour	3 hours	1 hour	3 hours	1 hour	5 hours

When performing torch-applied roofing, apply additional precautions and conduct a minimum 2-hour fire watch and 2 hours fire monitoring. If an infrared camera is utilized, reduce to a 1-hour fire watch and 1 hour fire monitoring.

When performing hot work on/in equipment containing nonremovable combustible linings or parts, apply additional precautions and conduct a minimum 1-hour fire watch and 3 hours fire monitoring within the equipment, and in the surrounding areas per Table above.

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APPENDIX B

GUIDELINES AND CHECKLISTS

DEPARTMENT OF EMERGENCY MANAGEMENT
FIRE AND LIFE SAFETY

284 East Avenue, Burlington, Vermont 05405

GUIDELINES for HOT WORK

To Whom it May Concern:

All Contractors hired by UVM who will be conducting hot work, using open flame or spark producing equipment, must meet or exceed UVM's Hot Work Management Program and in accordance with the National Fire Protection Association (NFPA) 51B, Standard for Fire Prevention During Welding, Cutting and Other Hot Work. This requirement encompasses all "hot work" as defined as any temporary operation capable of providing a source of ignition, involving open flames, or producing heat and/or sparks. This includes, but is not limited to riveting, welding, cutting, burning, heating, grinding, brazing, soldering, thawing frozen pipes by torch, torch applied roofing, and utilizing heat producing equipment over 1,100° F.

Any operation which uses an open flame, electrical arch, or produces sparks requires a hot work permit. Any operation which produces unusually high heat in close proximity to combustible materials requires a hot work permit. Hot work permits are not required for working outdoors thirty-five (35) feet (11m) from a building or combustible materials unless the work is on a roof or other part of a structure.

To obtain a permit contact the UVM Project Coordinator and/or Project Manager. Permits will be issued by UVM Life Safety Services provided the conditions set forth on the permit are met. Please be advised that such permits are not issued on an around-the-clock basis. Rather, Hot Work permits will only be issued Monday-Friday 7:00am - 3:00pm unless there is an emergency condition or pre-arranged agreement. Please be further advised that separate Hot Work permits for all work occurring on weekends or holidays will be required. Under normal circumstances a permit will be written to expire daily. If work has not been completed a new permit shall be issued. Please contact the UVM Project Coordinator/Manager.

The following are basic UVM requirements for hot work:

- Always try to do the work using a safer method
- Remove or protect all combustibles and openings within thirty-five (35) feet (11m) of hot work
- Inspect and keep equipment is good operating condition
- Sweep floors clean, shut down air handling when necessary
- Fire watch with extinguisher to be provided during work and 30 minutes after
- Area monitored including breaks for at least 30 minutes after work
- Hot work permits issued for no more than 24 hours, with some exceptions
- Impaired sprinkler systems and smoke detectors are restored to normal, operating condition prior to leaving the site
- All permits must be signed before returning them to the issuing office

Ensure that a fire watch, equipped with appropriate fire extinguishment equipment, is assigned and is present during hot work activities. Those people assigned as fire watch must be trained in the use of fire extinguishers and know all appropriate emergency procedures. Properly inspected fire extinguishers must be provided by the contractor prior to the issuance of a Hot Work permit. UVM owned fire extinguishers shall not be removed from their location and shall not be used by the contractor. Maintain a fire watch at least 30 minutes after the job is completed for the day or as specified by the Contract Documents or by Life Safety Services.

Thank you for your assistance in preventing hot work fires in our UVM Facilities.

UVM Fire Marshal/Deputy Emergency Manager
Email: firesafe@uvm.edu

Life Safety Systems Supervisor
Email: ppdlss@uvm.edu

DEPARTMENT OF EMERGENCY MANAGEMENT
FIRE AND LIFE SAFETY

HOT WORK INSPECTION CHECKLIST

- All UVM employees and contractors hired by UVM who will be required to use hot work must follow UVM's Hot Work Management Program and have a Hot Work permit issued by the Life Safety Systems by contacting Service Operations Support.
- Hot work requires a permit at UVM: “hot work” is defined as any temporary operation capable of providing a source of ignition, involving open flames, or producing heat and/or sparks. This includes, but is not limited to riveting, welding, cutting, burning, heating, grinding, brazing, soldering, thawing frozen pipes by torch, torch applied roofing, and utilizing heat producing equipment over 1,100° F.
- Include and submit checklist(s) to UVM Project Manager(s) and Supervisor(s), and Life Safety Systems ppdlss@uvm.edu.
- To be completed by a competent person.

Project Number	**Description**	
Department	**Building**	**Location**
Inspection Completed By		
Business/Company Name		Date
Print Name	Email	Phone
Hot Work Description		

University of Vermont

DEPARTMENT OF EMERGENCY MANAGEMENT
FIRE AND LIFE SAFETY

HOT WORK INSPECTION CHECKLIST

Item #	Item	YES	NO	N/A
1	The UVM Hot Work Management Program has been provided and reviewed?	☐	☐	☐
2	Is there another way to complete this job without using the Hot Work process?	☐	☐	☐
3	Is the Hot Work conducted inside, on or close to a building, roof, walls, and/or adjoining spaces?	☐	☐	☐
4	Can you take your work to a safe distance (35ft/11m) outside of the building?	☐	☐	☐
5	Is it determined that a Hot Work Permit is required? (If yes, continue to Item 6 & 7)	☐	☐	☐
6	Has Service Operations Support (SOS) (802) 656-2560 been called?	☐	☐	☐
7	Have you provided SOS with your name, company, phone number and location for where you need the permit. Remember not to call until you are ready to do the work. A Life Safety Technician will come to visit your work site and determine whether to issue a permit and if other precautions are needed before you begin.	☐	☐	☐
8	Has the designated work area been prepared? (see Item #9-15)	☐	☐	☐
9	Remove and keep all combustible/flammable materials a safe, reasonable distance away from your work (Material within 35ft/11m)	☐	☐	☐
10	Keep your area clean. Sweep the floors and remove any unnecessary material or objects away from your immediate work area.	☐	☐	☐
11	Use a fire blanket, curtain, or shield around your work to protect walls, floors, ceilings, and openings.	☐	☐	☐
12	Shut down and/or cover any ducts, air intakes, etc. Provide ventilation by fan, window, or other means.	☐	☐	☐
13	Remove any liquid and purge vapors from any vessel or container. Isolate piping or other connected equipment, vessels, or containers. Follow Lock-Out/Tag-Out Procedures.	☐	☐	☐
14	Cover or have a UVM electrician disable smoke and/or heat detectors in the area. Cover any sprinkler heads close to your work with a welding glove or fire blanket.	☐	☐	☐
15	Have an additional fire extinguisher dedicated to hot work. Do not rely on fire extinguishers located in the building.	☐	☐	☐
16	Is Hot Work being conducted on a roof? (if yes, continue to Item #17-18)	☐	☐	☐
17	Is a charged garden hose at the location of the Hot Work and if that cannot be accomplished you will need a 2 ½ gallon loaded stream fire extinguisher.	☐	☐	☐
18	Are tools present at the location so they can be used to open any portion of the roof if smoke/fire is present.	☐	☐	☐
19	Fire watch and monitoring provided? (see Item #20-25)	☐	☐	☐
20	A dedicated fire-watch must be present when any hot work is being performed. This person is provided by the contractor doing the Hot Work.	☐	☐	☐
21	A fire-watch must be performed for 30/60 minutes after finishing any hot work. The Life Safety Technician will determine the length of the	☐	☐	☐

Item #	Item	YES	NO	N/A
	required fire-watch time. This 30/60-minute watch can be performed by yourself or the dedicated fire-watch person.			
22	You must maintain the watch for at least 30/60 minutes after the work is completed.	☐	☐	☐
23	A one-hour fire watch must be performed in any area where there is welding/grinding or if there is exposed combustible construction.	☐	☐	☐
24	Any Hot Work on a roof requires fire-watch during the Hot Work and an hour fire-watch after.	☐	☐	☐
25	There will also need to be an additional one hour of onsite monitoring.	☐	☐	☐
26	Person Assigned Fire Watch can complete the following: (see Item #27-29)	☐	☐	☐
27	Should be able to view areas where sparks, slag or heat may land. If this is not possible, more than one fire-watch may be needed.	☐	☐	☐
28	Needs to know how to use a fire extinguisher and be ready to use it.	☐	☐	☐
29	Must be able to report an emergency (phone, radio, fire alarm pull station). Have two means of communication when possible.	☐	☐	☐
30	Other (*specify):*	☐	☐	☐

Item #	Describe Corrective Actions Taken	Date Completed

Other Comments:

APPENDIX C

FIRE EMERGENCY RESPONSE PLAN

University of Vermont

Department of Emergency Management
Fire and Life Safety

Fire Emergency Response Plan

Although the University of Vermont takes precautions to prevent them, emergencies do occur. When they do, they require quick, correct, and decisive responses. Employees have been informed of the company's planned response to emergency situations, and they are expected to adhere to these guidelines for the duration of this project.

The elements of this plan, as required by 29 CFR 1910.38 and 1926.35, are as follows:

I. Emergency evacuation plan
II. Critical operations
III. Methods to account for [company name] employees
IV. Rescue and medical duties
V. Means of reporting emergencies
VI. Company representative(s) responsible for plan

Project Number	**Description**	
Department	**Building**	**Location**
Completed By (Signature):		**Date:**
Print Name	Email	Phone

1. Emergency Evacuation Plan

On a typical project, [company name] will prepare an emergency evacuation plan, as applicable for two areas: the roof and ground.

Roof evacuation procedures are as follows: _____

_____

_____

_____

_____

_____

_____

Ground evacuation procedures are as follows: _____

_____

_____

_____

_____

_____

_____

2. Critical Operations

If any emergency occurs on a project involving propane, combustion engine equipment or electrical tools, [company name] employees will shut off propane sources at the cylinders and turn off all equipment before evacuating, provided employee safety is not jeopardized by doing so.

Does this project involve the use of propane? Yes _____ No _____
Does this project involve the use of combustion engine equipment? Yes _____ No _____
Does this project involve the use of electrical tools or other ignition sources? Yes _____ No _____
Does this project involve the use of other critical operations not listed? Yes _____ No _____

Explain: _____

_____

_____

If our employees are not able to shut off propane supplies or other fuel sources, the fire department or other responding emergency agency will be notified of the presence and locations of the propane or fuel tanks or cylinders.

List locations of propane or other fuel source on this site: _____

3. Methods to Account for [Company Name's] Employees

Employees have been instructed to meet at a designated location so that they can be accounted for on the project. If it is determined that any employees are missing, the responding emergency agency will be notified. The agency will also be informed about the last approximate whereabouts of missing employees.

The meeting location will be chosen based on the type of emergency involved. The project manager will account for wind direction and potential hazards in determining the meeting place.

The meeting location for this project will be: _____

4. Rescue and Medical Duties

This crew has been specifically trained to rescue and/or attend to injured employees.

Yes _____ No _____

If "No" has been checked, our employees will rely on paramedics or other emergency rescue teams.

If "Yes" has been checked, those employees trained in rescue operations will perform duties according to the training they have received. The remaining employees will meet at the designated meeting area.

5. Means of Reporting Emergencies

When a fire or emergency occurs, it is our intention to notify all employees, affected contractors, building owners, and homeowners about the crisis.

The first call will be made to the local fire department by using 911. If 911 is unavailable in the job's area or there is an on-site fire department, such as on military installations, that emergency telephone number will be used instead. Emergency telephone numbers are included in this plan.

If there are ten (10) employees or fewer in the area, a human voice will be used to notify those on the job. For projects involving more than ten (10) employees, airhorns or similar equipment will be used.

6. Company Representative(s) Responsible for Plan

The job supervisor is the responsible person to contact with any questions regarding this plan. If additional information is needed, the project manager should be contacted.

EMERGENCY TELEPHONE NUMBERS

No work will be performed where an emergency cannot be immediately observed and/or prompt rescue assistance summoned.

A rescue plan shall be in place prior to beginning any work where a hazard exists. The rescue plan must be well thought out and documented in a Fire Emergency Response Plan. All individuals involved must thoroughly understand the plan. Prompt rescue will be provided for personnel.

FIRE – POLICE – RESCUE – EMERGENCY MEDICAL SERVICE……. 9-1-1

Dial 911 and tell them you are at the University of Vermont. Provide them with your building address, building name, and room number as well as the details of your emergency.

> CALL IMMEDIATELY FOR ANY EMERGENCY
> INCLUDING CHEMICAL SPILL, FIRE, INJURED,
> TRAPPED, OR SICK PERSON.

UVM Police Services……..……..……..……..…… (802) 656-3473
Fire, Police, Rescue, Emergency Medical Service

UVM and OTHER ADMINISTRATIVE OFFICES

Fire and Life Safety ……..……..…….. (802) 656-8249
University Fire Marshal - Department of Emergency Management firesafe@uvm.edu

Life Safety Systems ...……..……...……..……..……. (802) 656-2974
Department of Facilities Management ppdlss@uvm.edu

Occupational Health and Safety Office ……..……..……..…….. (802) 656-7233
Department of Environmental Health and Safety ohso@uvm.edu

Service Operations Support……..……..……. (802) 656-2560
Facilities Management sos@uvm.edu

Department of Risk Management……..……..…… (802) 656-3242
(Accident investigations, insurance services) risk.management@uvm.edu

Champlain Medical Urgent Care…….. (802) 448-9370
(UVM Employee Medical Consultation and Evaluation)

Additional Emergency Contacts

Project Telephone:

Home Office Telephone:

Local Police Telephone:

Local Fire Telephone:

Local Paramedics Telephone:

Directions from Job Site to Nearest Hospital

Local Hospital Address:

Local Hospital Telephone:

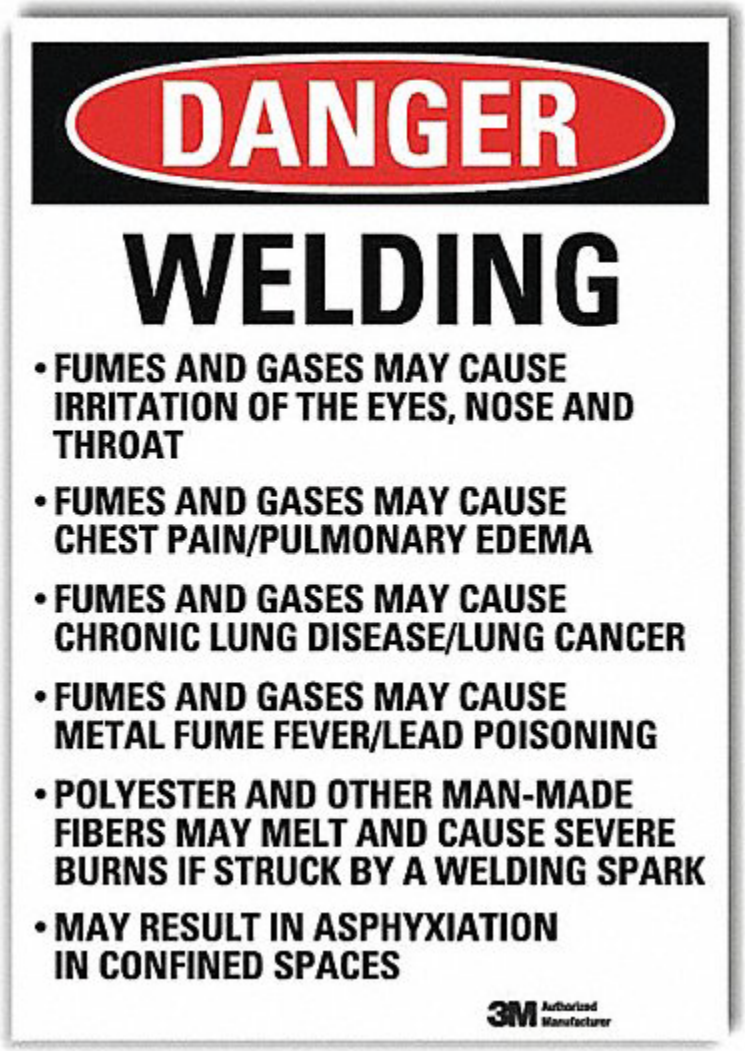
Use the space below to draw directions to the hospital.
Be sure to include the north arrow.

University of Vermont

APPENDIX D

EXAMPLES OF SIGNAGE

University of Vermont



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