HARVARD
Campus Services
ENVIRONMENTAL HEALTH & SAFETY

CONSTRUCTION ENVIRONMENTAL HEALTH & SAFETY EXHIBIT
FIRE PREVENTION AND PROTECTION

I. Definitions

A. Heating Device: Any device, whether electric, fuel, or gas-fired used to provide heat to an area within the construction project.
B. Hot Work: Any activity or process that involves open flames or that generates sparks or heat and includes but is not limited to: welding and allied processes, heat treating, grinding, thawing pipes, powder-driven fastener, hot riveting, torch-applied roofing, and any similar applications producing or using sparks, flames or heat.
C. Temporary Enclosure: An enclosure used for construction purposes that will not become a part of the permanent condition. Temporary enclosures include, but are not limited to: office trailers, shanties, shacks, tarpaulin enclosures, poly-sheeting enclosures, break areas, etc.

II. General Requirements

A. In buildings under Construction, Alteration, or Demolition a minimum of two (2) adequate means of egress and escape facilities shall always be maintained for the use of construction workers. Escape facilities shall consist of doors, walkways, stairs, ramps, fire escapes, ladders, or other approved means or devices arranged with the general principles of NFPA 101 and Massachusetts Building Code 527 CMR 1.00.
Under certain conditions the general contractor can, with the written permission from the Harvard University Project Manager, HUEHS, and the governing local fire department, reduce the minimum exits to one if less than 12 workers occupy the area on one floor level with a maximum travel distance to outside the building of 75 feet (for a predetermined limited time and a site-specific Emergency Egress Plan).
Additional exits may be required depending on the number of occupied floors and the total number of project workers anticipated to occupy the project. This will be determined by the Harvard project assigned safety representative and the contractors representative.
The exits should be identified with the appropriate signs as defined by the Commonwealth of Massachusetts Fire Prevention Code (527 CMR 1:00) and in the posted building emergency evacuation plan.
B. Anyone who performs, supervises, or delegates hot work shall have completed NFPA Hot Work Safety Training approved by the State Fire Marshall per 527 CMR 1.00:41.7.
C. Work and practices on projects shall comply with the applicable parts of OSHA29CFR Part 1926, NFPA 241 – Safeguarding Construction, Alteration, and Demolition Operations, NFPA 1 – Fire Code, 527 CMR 1:00, the requirements outlined in this Standard, and the manufacturer's requirements and recommendations for any equipment and tools used. Where conflicts exist between standards, the more stringent shall apply.
D. Prior to the commencement of construction activities, the General Contractor shall develop and implement a fire prevention and protection program, specific to that project's operations, which meets or exceeds the requirements of the Authority Having Jurisdiction. This program shall be submitted to the HUPM upon completion. At a minimum, the following items shall be addressed and incorporated into project fire prevention and protection plan:
    1. Responsibilities relating to fire prevention and protection for Contractors;
    2. Coordination requirements with local Fire Department, including permit requirements for construction projects and requirements for flame resistant tarpaulins, polyethylene sheeting and coverings;

3. Fire protection requirements for the construction and use of temporary offices, trailers, shanties, storage, and break areas;
4. Fire rated separations from occupied portions on buildings;
5. Temporary fire detection and suppression equipment to be installed and utilized during construction;
6. Description of Contractor requirements regarding the storage and accumulation of combustible materials, debris, and trash;
7. Floor plans showing the egress routes and proposed and/or actual locations of fire-fighting equipment including standpipes, fire hydrants, fire extinguishers, etc.;
8. Identification of designated storage areas for flammable/combustible liquids and gasses;
9. Procedures for use and storage of flammable and combustible liquids and gasses;
10. Fire alarm system impairment procedures and permits;
11. The location and contents of the project Knox Box;
12. Training requirements for Contractors of all tiers;
13. Temporary heating requirements and restrictions;
14. Procedures for hot work operations and project-specific permits, and;
15. Refueling operations.

E. The Safety Representative shall ensure that all Employees potentially exposed to hazards associated with fire prevention and protection, hot work operations, and handling of flammable or combustible liquids or gasses shall possess the knowledge and skill required to perform the duties for which they are assigned. In addition, a hazard analysis shall be completed prior to any operation, any fire prevention/protection hazards shall be clearly identified, and hazard controls defined. The hazard analysis shall be reviewed with the work crews prior to the start of work, and where conditions change.

F. Smoking is prohibited on all University construction projects. Where applicable, the General Contractor shall designate a smoking area, outside of the building or structure, where smoking is allowed. Ashtrays and/or cigarette butt containers shall be provided by the General Contractor, and the accumulation of trash or debris shall not be allowed in designated smoking areas.

G. Refueling of motorized vehicles and heavy equipment shall not take place within twenty (20) feet of the building or structure. Refueling of other equipment (e.g. portable generators, pumps, etc.) shall be done only when the equipment is off and allowed to cool down. A twenty (20) pound ABC dry chemical fire extinguisher shall be present at all refueling operations.

H. For new construction and substantial (gut-type) renovation of unoccupied buildings (or portions thereof), the General Contractor shall coordinate with the local fire department having jurisdiction to determine the need to procure and install a Knox Cabinet at the main entrance to the project. If a Knox Cabinet is not required by the fire department expectations for providing access to the site and providing project details, including those outlined below, shall be discussed.
   1. Site map(s) showing the locations of support offices, trailers, project entrances, building entrances, fire hydrants, standpipes, fire extinguishers (typical location), flammable storage areas, spill kits, and any special conditions (i.e. location of demolition areas). These maps shall be updated as conditions change, and at least every six months.
   2. A utility plan showing the shut-off locations for project electrical, water, natural gas/fuel, and process chemical supply lines. This plan shall be updated whenever changes are made to the actual location of the shut-offs.

3. Project-specific keys that allow fire department entry into project access gates, project offices, buildings under construction, and project trailers. NOTE: Where lower-tier Contractors do not opt to place project keys in this cabinet, it shall be conveyed by the General Contractor to the lower-tier Contractor that in the event of a fire or other emergency, fire department access could cause damage to the locked/barricaded area.
4. Project Emergency Contact Information including the 24-Hour phone numbers for the project's key personnel (Project Manager(s), Superintendent(s), Project Safety Manager(s), and Subcontractor Foremen), the project chemical inventory, as well as a detailed description of the location of the actual project SDS files and HASP. Note: If this information is contained in the project HASP, the project HASP may be placed in the cabinet to meet this requirement.

I. For new construction and renovation of unoccupied buildings, or where the project is separated from the public by fencing or barricades that surround the site, the General Contractor shall prominently display the physical address number of the project at the project's main and secondary entrances. This display shall be plainly visible from all streets that the fire department may use to access the site.
J. Open fires are prohibited.
K. All tarpaulins and poly-sheeting used on construction sites shall meet the requirements of NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films. All tarpaulins and poly-sheeting shall be stamped and marked as Flame Retardant. No hot work operation, other than temporary heating, shall take place within thirty-five (35) feet of tarpaulins or poly-sheeting, unless protected by fire blankets or other suitable protective devices.
L. Any materials used for temporary protection of floors, walls, finishes, elevators, etc. shall be flame retardant or shall have a minimum one-hour fire resistance rating (i.e., fire treated lumber and paneling, drywall, etc.).
M. Exit signs shall be located at each exit stairway or ladder opening.

III. Accumulation and Disposal of Trash and Debris

A. Combustible debris and general trash shall not be allowed to accumulate on the project. It is the responsibility of the General Contractor to enforce this requirement, as well as the requirements outlined in the HUEHS Housekeeping Exhibit. Debris shall be removed from all areas of the worksite daily, at a minimum.
B. Combustible debris and general trash shall be disposed of in a dumpster or trash cans outside of the building. No dumpster or trash cans shall be placed/or stored within twenty-five (25) feet of the building. Where dumpsters must be placed within twenty-five feet of the building (i.e. due to site constraints or where chutes are used), the dumpster shall be covered with a flame resistant or fire-retardant netting or a solid, non-combustible cover.

IV. Compressed Gas Cylinders

A. All cylinders shall be marked with the name and CAS identification number of their contents.
B. Cylinders, when in use, shall be positively secured in the upright position. Where carts are used, the retaining device or chain shall be used. Twenty (20) and thirty (30) pound liquefied petroleum gas (propane) tanks and acetylene 'B' tanks shall be secured in a cart,

case, or placed into a milk crate to prevent tipping. Propane tanks larger than thirty (30) pounds shall be secured in a cart or against a solid structure.

C. Cylinder Storage:
   1. Shall consist of manufactured cages (open-ventilation type) with roofs.
   2. Cages shall be stored in the area designated by the General Contractor for compressed gas storage and shall be no closer than twenty-five (25) feet from the building. Cylinder storage areas shall be protected against physical damage from vehicles and equipment.
   3. Cylinders shall be separated according to their hazard classes, and signs shall be posted at each storage area, warning employees of the hazards (i.e. no smoking, flammable gas storage, non-flammable gas storage, etc.). Oxygen and flammable gasses shall be separated by at least twenty (20) feet.
   4. Cylinders shall be stored upright, positively secured, and valve caps shall be on.
   5. All cylinders shall be removed from the work area and returned to the cylinder storage area after each work shift. Under no circumstances shall cylinders be stored in gang boxes, shanties, trailers, etc.
   6. The General Contractor shall provide a minimum of one twenty (20) pound ABC dry chemical fire extinguisher at each cylinder storage area.

D. Cylinders shall not be hoisted using slings, chains, ropes, or by the valve cap. Use only carts or racks specifically designed for hoisting.

E. The use and storage of liquefied petroleum gas (propane) gas shall comply with the requirements listed in 29CFR Part 1926.153, as well as local fire department regulations.

V. Coordination and Permitting with Local Fire Department

A. Prior to the commencement of new construction or substantial (gut-type) renovation projects, the General Contractor shall coordinate and chair, through Harvard University Fire Group liaison, a meeting with the local Fire Department. This meeting shall be documented, and the meeting minutes shall be retained in the project files. At a minimum, the following items shall be reviewed and addressed during the meeting:
   1. General scope and phasing of the construction project;
   2. Site layout including location of support areas and project access points;
   3. Review of the General Contractor's approved Emergency Management Plan;
   4. Review of the General Contractor's approved Fire Prevention & Protection Program;
   5. The proposed or actual locations of fire hydrants, standpipes, and fire extinguishers;
   6. Permit requirements for the use and storage of flammable and combustible materials, liquids, and gasses, dumpster placement, hot work operations, demolition, construction, alteration, fire alarm system impairment, temporary heating, etc.;
   7. Fire department requirements for fire alarm system impairment, including the necessity and use of fire department fire watch details;
   8. Any special considerations or requests made by the fire department.

B. For new construction or substantial (gut-type) renovation projects, the General Contractor shall coordinate meetings and walkthroughs of the project with the fire department at regular intervals throughout the course of construction to ensure that the fire department is aware of phasing, access, fire-fighting equipment, and construction hazards that would pose a particular threat to fire-fighting crews (i.e. demolition, deep excavations, etc.).

C. Any visits, walkthroughs, or emergency responses by the fire department shall be documented, and the HUPM and HUEHS shall be informed immediately.

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VI. Fire Alarm and Suppression System Impairment

A. Where fire alarm and/or sprinkler systems must be impaired, serviced, repaired, or otherwise altered from their full operating state, the General Contractor shall complete an impairment plan. The impairment plan shall be submitted to the HUPM at least one week prior to the anticipated work. The HUPM (or designee) shall forward to the Harvard Building/Facility Manager and the Harvard Fire Group for approval and coordination. In addition, the General Contractor is responsible for obtaining impairment permits and coordinating fire watch details with the local fire department.
B. Fire alarm and suppression systems undergoing modifications shall be returned to service at the end of each workday, unless otherwise approved by the fire department and HUPM.
C. Fire alarm and suppression system impairments shall be coordinated by the General Contractor to minimize the duration and extent of the impairment. Systems shall be maintained where possible.
D. The General Contractor or his designee shall inspect all systems and areas where fire alarm and suppression system impairments have taken place immediately following completion of work to ensure that the system(s) has been restored to service. This includes suppression control valve positions, fire protection water main charge gauges, standpipe valves and charges, smoke detectors, heat detectors, etc.

VII. Fire Protection Equipment

A. Fire protection equipment use, and placement shall comply with 29CFR Part 1926.150, at a minimum and NFPA 241
B. General project fire protection is the responsibility of the General Contractor. Where the General Contractor contracts this service to another Contractor or entity, the General Contractor shall verify in the field that the requirements of this Exhibit are met.
C. Portable Fire Extinguishers.
    1. In unoccupied buildings where construction is taking place, and University fire extinguishers are present, these extinguishers shall not be used by any Contractor. The University fire extinguishers shall be removed by the General Contractor, stored in a dry, safe location designated by the building owner or facility manager, and re-installed following completion of construction operations.
    2. Multi-purpose dry chemical portable fire extinguishers (for general use) shall be provided.
        a. Outdoors - for each three-thousand (3,000) square feet of working space on the project, exterior and configured so that the travel distance from any point in the working area does not exceed one-hundred (100) feet. The minimum size for general use extinguishers is ten (10) pound.
        b. Indoors – Fire extinguishers shall be located so that travel distance to a fire extinguisher does not exceed 15 m (50ft).
    3. General use fire extinguishers shall be mounted to a stand or permanent building element. The mounting height of the top of the fire extinguisher shall not exceed five (5) feet above the finished floor. Fire extinguisher locations shall be marked with fire extinguisher signs that are visible from the work area.
    4. Multi-purpose dry chemical portable fire extinguishers shall be provided at each compressed gas and flammable/combustible liquid storage area, at each exit from a support office/construction trailer/shanty/shed, at each temporary heating operation,

and at each hot work operation. The minimum size for fire extinguishers used in these applications is twenty (20) pound.

5. The General Contractor shall ensure that each shift on the project is staffed with employees trained and knowledgeable in the use of fire extinguishers for fighting incipient fires.

D. Temporary (Construction Use) Standpipes.
   1. For above and below grade construction projects, temporary standpipes shall be installed and maintained no more than one floor away from the permanently decked level.
   2. Where charged standpipes are installed for construction purposes, they shall be maintained in the charged condition, and shall be protected against damage and freezing.
   3. Standpipes shall be conspicuously marked with at least a two foot by two-foot (2' x 2') sign. The sign shall state 'Fire Department Connection' or 'Fire Department Standpipe'. The lettering shall be red, and the background white.
   4. Standpipes shall be installed with a two and one-half (2-1/2) inch fire department connection on each floor or as directed by the local fire department.

E. Temporary (Construction Use) Fire Alarm System
   1. Where fire alarm systems (smoke detectors, heat detectors, strobes, horns, etc.) are required by local code, design documents, or for insurance purposes (i.e. for wood structure renovations), the system(s) shall always be maintained and operational during construction activities.
   2. Temporary fire alarm systems, when required, shall be continuously monitored by an alarm company, or shall be connected to the city fire alarm system. Typically, the University Operations Center.
   3. Where impairment of the temporary fire alarm system is necessary, the requirements outlined in Section VI shall apply. Any fire alarm system monitored by the University Operation Center is under the full control of Fire Safety Services. Any impairments must be submitted through the Harvard University Online Portal.

VIII. Flammable and Combustible Liquids

A. Flammable and combustible liquids use, and storage shall comply with 29CFR Part 1926.152 and the manufacturer's recommendations and requirements, except where noted below. Flammable and combustible liquids include, but are not limited to: gasoline, diesel fuel, kerosene, oil, spray paints, solvents, paint thinners, etc. When not in use, liquids shall be stored in cabinets.

B. Flammable and Combustible Liquid Container Storage:
   1. Shall consist of UL-listed metal storage cabinets. No more than sixty (60) gallons of flammable liquid or one-hundred and twenty (120) gallons of combustible liquids shall be stored in any single cabinet.
   2. Cabinets shall be stored in the area designated by the General Contractor for flammable/combustible storage and shall be no closer than twenty-five (25) feet from the building. Flammable/combustible storage areas shall be protected against physical damage from vehicles and equipment.
   3. Secondary containment in the form of spill control, diking, and drainage control shall be provided at each flammable and combustible liquid storage area. The secondary containment shall be sized to contain the amount of liquid stored in the storage area.

Rain water or snow shall not be allowed to accumulate within the secondary containment. A spill kit shall be provided adjacent to each storage area.

4. Signs shall be posted at each storage area, warning employees of the hazards (i.e. no smoking, flammable liquid storage, etc.).
5. Only metal containers (safety can as defined by 29CFR Part 1926.155) shall be used to handle flammable and combustible liquids. The cans shall be color coded (red = gasoline, yellow = diesel fuel, blue = kerosene) according to their product, and shall be labeled with their contents.
6. Where storage tanks or drums are used for dispensing flammable and combustible liquids, the tank or drum shall be electrically grounded, and a bonding wire shall be attached from the tank/drum to the container into which the liquid is being dispensed.
7. Flammable and combustible liquids shall be removed from the work area and returned to the storage area after each work shift. Under no circumstances shall flammable and combustible liquids be stored in gang boxes, shanties, trailers, etc.
   The General Contractor shall provide a minimum of one twenty (20) pound ABC dry chemical fire extinguisher at each storage area.

IX. Hot Work Operations

A. The General Contractor shall implement a Hot Work Permit Program on the project in accordance with 527 CMR 1.00. All Contractors conducting hot work operations on the project shall first obtain a Hot Work Permit from the Project Safety Manager or his designee prior to commencement of hot work activities.
B. The Hot Work Permit shall not be issued by the General Contractor until an inspection of the hot work area has been completed and ALL of the following conditions have been verified:
   1. The area within thirty-five (35) feet of the hot work operation, and all areas below the hot work operation where sparks and slag may drop have been cleared of all personnel, combustible materials, compressed gasses, and flammable or combustible liquids. Where this is not possible, protection shall be provided for non-essential personnel and combustibles shall be covered with fire blankets;
   2. An individual, trained and knowledgeable in identifying hazards associated with hot work operations and the use of portable fire extinguishers, is designated as the fire watch, and will remain present for the duration of the hot work operation, and one-half hour after the completion of the hot work. NOTE: The fire watch shall hold no other duties or responsibilities during his or her service as fire watch. Where sparks and slag cannot be contained in the immediate work area (i.e. fall to another level), a fire watch shall be posted at each area. The Contractor may elect not to provide a dedicated fire watch for grinding, chop saw and soldering activities, provided that the area is free of combustible materials, and the sparks from the operation can be contained to the immediate area;
   3. At least one twenty (20) pound multi-purpose dry chemical fire extinguisher is present with each fire watch.
C. Hot Work Permits shall be valid for one shift or one operation only, whichever is shorter.
D. Pressure regulation valves on oxygen/acetylene/propane tanks shall be inspected and tested prior to each use. Defective or damaged equipment shall be immediately removed from service.
E. Oxygen and acetylene tanks shall have flashback arresters installed on both the torch and regulator ends.

F. Hoses and leads shall not be routed through doorways unless the door is blocked open and the hoses are protected from damage.
G. Welding screens shall be provided, placed, and moved as necessary by the Contractor to prevent radiation injury and arc flash exposure to project Employees.
H. Welding lead terminal lugs shall be covered with non-conductive material.
I. Electric welding operations shall be grounded as close to the point of operation as possible.
J. Welding leads shall be inspected prior to use each day. Damaged welding lead insulation shall be repaired or sealed with epoxy or vulcanizing insulation with an insulation value at least equal to that of the conductor. Electrical tape shall not be used to repair lead insulation.
K. Stingers shall not be laid or rested on conductive material.

X. Temporary Heating

A. Temporary heating operations shall comply with 29CFR Part 1926.154, the Commonwealth of Massachusetts – Board of Fire Prevention Regulations – Use and Maintenance or Temporary Portable Space heating Devices and Equipment Used in the Construction Industry, and the manufacturer's recommendations and requirements, at a minimum.
B. The Contractor shall obtain a Temporary Heating Permit from the local Fire Department prior to commencement of temporary heating activities.
C. Temporary heating devices shall comply with Hot Work Permit requirements and shall be continuously monitored by a fire watch. Continuous monitoring may not be required for natural gas-fired heaters where the flame is fully enclosed, the unit is located outside of the building, and the heated air is discharged through metal ductwork.
D. All temporary heating devices and units shall have a warning label or tag permanently affixed. This tag must describe the firing or start-up procedure, emergency shut-down procedure, and minimum clearance distances from all sides of the unit or device.
E. Fuel or gas-fired temporary heating devices shall have safety devices that eliminate the flow of gas/fuel upon extinguishment of the flame. These safety devices shall be tested prior to each use. Devices or equipment found to be defective or damaged shall be immediately removed from service by the person inspecting the unit.
F. Where natural gas-fired heaters are used, the supply piping shall be welded or threaded steel piping, and shall be designed, installed, and tested in accordance with permanent installation building code requirements. Natural gas piping shall be painted yellow, conspicuously labeled as natural gas at least every twenty (20) feet, and protected from damage by vehicles, equipment, and construction activities.
G. Air monitoring for oxygen, lower-explosive limit, and carbon monoxide shall be conducted in all spaces heated by fuel or gas-fired heaters at least once per hour. A log shall be maintained in each space that denotes the date, time, monitor name, and monitoring results of each round. The following are considered action levels:
    1. Oxygen (O2): Below 20.5%
    2. Lower Explosive Limit (LEL): Equal to or Greater than 2%
    3. Carbon Monoxide (CO): Equal to or Greater than 17 ppm (½ the NIOSH REL)
H. Where these action levels are exceeded, the area shall be evacuated, and ventilation, either natural or forced, shall be introduced. No personnel are allowed back into the area until safe levels have been reached. Ventilation shall be maintained so as to ensure levels remain below the prescribed action levels.

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I. Where temporary heating enclosures are constructed of tarpaulins or poly-sheeting, the materials used shall be flame retardant, and shall meet the requirements of NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films. All tarpaulins and poly-sheeting shall be stamped and marked as Flame Retardant.
J. Temporary heating enclosures shall be fastened securely or guarded by construction, so it cannot be blown by the wind against heaters or other sources of ignition.

XI. Temporary Enclosures

A. Temporary offices, other than mobile office trailers, including general break areas, shall be constructed of materials having a minimum of one-hour fire resistant rating (i.e. fire-treated lumber and paneling, drywall, etc.).
B. Where temporary heating enclosures or isolation barriers are constructed, they shall be constructed of the materials list in Section X of this Exhibit.
C. Exit doors or flaps shall be placed at all temporary enclosures constructed of tarpaulins or poly-sheeting. Doors or flaps shall be spaced so that no employee must travel greater than fifty (50) feet to reach the exit. For large spaces, the exit doors or flaps shall be placed every fifty (50) feet along the enclosure. Exit signs shall be placed at each door or flap, or the word 'EXIT' shall be spray painted above the door or flap.
D. Directional arrows leading to the exit door or flap shall be spray-painted, using high visibility paint, every ten (10) feet of each wall of a temporary enclosure constructed of tarpaulins or poly-sheeting. The height of the arrows shall be no greater than two (2) feet above the finished floor.
E. Portable heating devices used in temporary enclosures shall not be left unattended. Heating of temporary enclosures shall comply with the requirements outlined in Section X of this Exhibit.
F. Temporary enclosures shall be equipped with a minimum of one (1) multi-purpose dry chemical fire extinguisher at each exit door, at a minimum.
G. Receptacles for trash and debris shall be provided at each temporary enclosure. Trash and debris shall be removed from the temporary enclosure at least daily and disposed.
H. No trash or debris shall be allowed to accumulate within any temporary enclosure.

XII. References

29 CFR 1926 Subpart F, Fire Protection and Prevention
NFPA 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations (2019)
527 CMR 1.0 (2015)