

# Insight: Hot Work Risk and Permitting

## Recognizing the Risk

Hot work is a leading cause of fires and explosions globally across all industries, yet hot work fire losses are preventable with good risk management.

### Loss Statistics

National Fire Protection Association (NFPA) data collected between 2013 and 2017 indicates U.S. fire departments responded to an average of 4,630 structure fires each of these years attributed to hot work operation which caused \$355M USD in direct property damage. Other insurance industry statistics indicate an average gross loss of \$2.6M USD per hot work incident. And from a 10-year U.K. Fire Protection Association (FPA) study, 96 fires were recorded as directly attributable to hot work and up to 79% of construction industry fires are from improperly managed hot work

And, effective hot work management is not only critical for risk reduction, in many jurisdictions it is a legal requirement.

### Hot Work & Its Risks

Hot work operations involve some form of maintenance, repair, construction or assembly that produce heat or sparks capable of ignition. Some of these operations are more common and identifiable such as welding, burning, and grinding. However, some may be less identifiable and have hidden dangers such as brazing, soldering, hot riveting, grinding and pipe thawing. All such operations increase the potential for fire and/or explosion.

Inadequately controlled hot work can exponentially increase the odds of a serious loss event. The risks associated with hot work arise from the potential of a fire to start and develop in combustible materials. Many times, this can be an appreciable distance out of visual range or hidden from where the hot work is taking place. And due to the nature of many hot work fires, identification can be delayed, which results in significantly increased property damage and business interruption.

In one incident, contractor hot work was being conducted on roof-top HVAC systems that resulted in sparks that rolled along the roof to find a small crack in the roof-wall seal. Sparks landed inside the wall on combustible insulation. While the contractor moved to the other side of the roof, sparks smoldered for over 2 hours until igniting. When smoke emanating from the wall was finally noticed, extensive damage inside the building had already begun and manual extinguishment was no longer possible. A post-fire investigation revealed a recommended fire watch was not used due to added cost and "extensive past experience without incident." It also revealed, while a fire extinguisher was brought to the roof, it was inoperable.

It must always be recognized that, no matter how routine or rare hot work may seem, it always creates an added risk of fire and/or explosion. Too often critical precautions are not followed due to reasoning around "extensive past experience or expertise." A common comment heard, after a fire has occurred, "We do this all the time and have never had a fire... just forgot this time about all the normal precautions." Becoming too comfortable with this risk can be a critical mistake. Another common post-fire comment, "We did not have a permit procedure as we rarely do hot work at our site." Not having a well-developed, well-understood management program for sites that rarely do hot work is an equally critical mistake.

## Risk Avoidance

A critical first step when hot work operations are contemplated- **Look for ways to avoid the risk.**

Where possible, hot work should be avoided or not be performed within/on buildings or structures. If welding on equipment such as a storage rack, review if the rack section can be moved and hot work completed out of the building, away from all combustible materials and avoiding all fire risk. Alternatively, can damaged components be removed with a reciprocating saw instead of a grinder or torch? Similarly, can bolts or other mechanical attachment be used instead of welding? And, if not critical, can the work be delayed until later in the year at a time when all racks are empty of combustible materials? Potential alternatives to hot work include: Mechanical removal and relocation of frozen piping to a heated area, manual hydraulic shears, mechanical bolting, flanged or clamped pipe, mechanical pipe cutter and self-drilling or compressed air-actuated fasteners.

**If hot work cannot be avoided, all precautions must be taken each time such work is performed without short cuts or rushing operations at the risk of fire safety.**

### Designated “No Permit Required” and “No Work” Areas

If hot work is a common site occurrence, designated hot work areas can be established that are always maintained as fire-safe (i.e. low risk areas for hot work). NFPA 51B establishes requirements for such designated areas. A designated area must have noncombustible construction, be maintained free of combustible and flammable contents, have working and readily accessible fire extinguishers, and, be segregated from adjacent areas such that sparks, flame, and heat will be contained in the area. Such areas must also be regularly inspected for constant compliance. Designated areas do not require the use of a hot work permit. For hot work that cannot be carried out in a designated area, additional procedures will be required including an effective hot work permit program.

Some areas are recognized as too dangerous for any hot work under any circumstances— those areas where the fire hazard cannot be controlled or made acceptable for the duration of hot work, such as, stationary machinery where combustible vapors are persistent or walls/partitions with combustible sandwich-type panels. For areas such as these, it is recommended they be clearly listed in the site hot work management program. "No Hot Work Area" signs can also be posted in such areas.

### Hot Work on Vessels and Containers

Hot work is often required on (or in) metal vessels and containers that may have contained flammable materials or been under pressure. Vessels that have contained flammable materials must be purged prior to the commencement of hot work. Hot work must not be allowed in explosive or flammable atmospheres or on pressurized plant equipment. And work in such areas must start with confirming atmospheric explosive levels are safe.

### Fire Detection and Suppression Systems

Before hot work begins, fire detection systems may need to be isolated to prevent false activations. However, only individual detectors in the vicinity of the work or those that could detect the work should be isolated. Any activation outside of these areas suggests smoke has spread beyond the areas anticipated by the risk assessment and suggests potential fire spread. It is also a common practice to cover all detectors near hot work with bags or airtight covers to prevent activation. When this is done, a follow-up program is critical to ensure all equipment is returned to full service daily and then upon completion. Sprinkler systems should remain active throughout hot work whenever possible. And, in all cases, isolated fire detection and suppression systems must be returned to full service at the end of each shift or day. When fire protection impairments occur, AIG's Impairment Handling Program or equivalent program must be utilized.

Only under very rare conditions should any single area ever have both a hot work permit and fire protection impairment tag issued simultaneously.

### Special Concerns with Contractor Hot Work

Insurance loss history shows the risk of fire can increase by more than double when outside contractors are involved in hot work without facility oversight. Thus, it is critical that all facility hot work management programs include provisions to train and hold contractors responsible for following organization policies. It should never be assumed that contractors understand the importance of site safety. And, while they may have the technical expertise to do hot work, they might not understand the severe risk that hot work creates and requirements to manage this hazard. Many times, this is due to a reduced concern and procedures due to a large amount of hot work operations performed without any past fire losses. And, in many of these cases the lack of customer oversight has supported this behavior.

Each contractor technician doing site work, as well as the contracted company's management, must demonstrate understanding that site policies must be followed. They also must demonstrate an understanding of how to follow the policies and that there is potential contract termination if the policies are not followed. Hired contractors must demonstrate that they can conduct hot work safely. Other considerations when hiring a hot work contractor:

- 1) Get references from previous customers.
- 2) Ask to review safety records.
- 3) Review expertise and concern for work site hazards.
- 4) Make sure bids and contracts clearly state site safety policy requirements.
- 5) Confirm proper contractor liability insurance.
- 6) Do not sign any hold-harmless clause created by the contractor around hot work operations.
- 7) Do not waive company subrogation rights around hot work operations.
- 8) If AIG Hot Work Permits are not used, review those utilized for full NFPA 51B compliance.

### AIG Hot Work Permit Use

A hot work permit acts as a formal pre-work checklist for all associated activities and provides documentation of proper risk management implementation. Permits also serve as a reminder of critical risks that are elevated each time hot work is performed. Their completion, including the associated checklist review and signatures, must be completed each time hot work is performed.

An effective hot work program begins with site risk management. Management plays a key role in the hot work program by supporting and requiring permit policy adherence with associated facility risk awareness by both employees and contractors. The policy should be clearly written and documented to communicate responsibility, authority and, the consequences for failure to comply with the hot work program.

A proper hot work program requires that a hot work permit be completed prior to the commencement of any hot work task and properly closed out after the hot work task is completed. The policy should clearly state that any hot work being conducted without a valid hot work permit will be stopped immediately with defined disciplinary consequences. The hot work program should apply to all contractors and, contracts should stipulate that the facility hot work permit will be used by contractors for all hot work activities including. The hot work program should also include the permit or a copy (and preferably with a clear risk warning sign such as Page 3 of the AIG permit) be posted in the work area for reference, verification, and risk hazard warning.

The hot work permits should only be issued by qualified (trained) site managers or supervisors. The AIG permit is a three-page tag as follows:

- Page 1 should be retained by the issuing manager or supervisor as an indicator an open hot work permit is in progress.
- Page 2 should be posted at the hot work location with Page 3 as a clear warning sign of the work being done.
- Page 3 is a clearly visible warning sign that hot work is being done to be posted with Part 2 during hot work. Upon work completion, this part does not need retention.
- After work is fully completed, Part 2 should be returned to the issuing manager, supervisor, or designee and retained with Part 1 for records. After work completion, retention of Part 3 of the AIG form is not required.

### The Fire Watch

The fire watch is a person or persons (in some cases such as multi-level work requiring more than one fire watch to be posted) appointed to oversee area fire risk during and immediately after the hot work that is trained to recognize the inherent hazards of the work site and hot work operations. The fire watch is permitted to perform additional minor tasks but, those tasks must not distract them from the required fire watch responsibilities. The fire watch must:

- Be clearly empowered with the authority to stop hot work operations if unsafe conditions develop. In order to be able to stop operations in some loud environments, a quick and reliable means may need to be planned for signaling those doing hot work such as a loud horn or laser pointer, etc.

- Be familiar with the procedures to sound site alarms for a warranted potential fire event.
- Be continuous, including responsibility hand-offs during rest breaks, etc. as needed.
- Equipped with at least one fully charged and inspected fire extinguishers suitable for the environment that remains close, available, and dedicated to the fire watch (i.e. not used from another site area). Once work has commenced, should there be a need to use a fire extinguisher, work must be stopped until the full cause of the fire has been understood, appropriate action has been taken to prevent a reoccurrence and the used extinguisher(s) has been replaced.
- Remain in hot work area for a minimum of 60-minutes after work is completed.

Once planned hot work operations have been completed, the area must be cleared of associated hot work equipment and waste materials with all isolated/impaired fire detection and suppression systems reinstated to full operation. Impaired fire alarm panels must also be restored to normal operation.

The fire watch must remain for a minimum of 60-minutes after the completion of hot work to watch the area for any signs of potential fire development from the operations that had concluded. If there are no signs of a potential fire developing for 60-minutes after the hot work has concluded, the hot work permit completion signature with date and time must be entered by the assigned fire watch (lead fire watch or manager if more than one fire watch was required). After the permit completion signature and confirming area monitoring will be implemented for a minimum of three hours they may leave the area. The permit should remain in the work area until a final area check and close out signature is made (after area monitoring is completed).

### Hot Work Area Monitoring (After Fire Watch)

After the fire watch has concluded (a minimum of 60-minutes after the hot work has been completed), the area in which the hot work was done must then be monitored for an additional 3 hours. Monitoring, in this application, is defined as watching the area for any signs of potential fire development but with less strict direct requirements than those of a fire watch. Approved monitoring methods in most cases, per NFPA 51B, include:

- 1) Personnel working in the area that are made aware hot work had occurred and the risks it entailed.
- 2) Automatic smoke detection over/in the area where the hot work was conducted that can quickly detect and signal smoke development. This would require restoration of any impairment to the detection system and/or removal of protective covers intended to prevent detector operation that were made during the hot work operation.
- 3) Security or maintenance rounds, briefed on the added inherent risk, through the hot work area no more than every 30 minutes.
- 4) Area monitoring by security cameras having integrated smoke detection.
- 5) Unlike a fire watch, a specific person or persons do not need to be individually assigned for the hot work monitoring activity. However, someone must be assigned the responsibility to ensure this is properly being completed correctly and for the entire required time. This is typically the issuing manager, supervisor, or designee.

### Permit Maximum Duration

A permit should never be issued for more than one hot work operation or extend over more than a single shift. If the maximum permit period of a single shift needs to be exceeded, the appointed person must be informed, and a new permit issued by them with all sections completed and signed off by all parties. Risk is increased during shift changes as details of the operation, and inherent risks, could be lost in facility management transfer communications. This could also be increased as new workers come on unaware of the ongoing increased risks.

### Permit Form Completion Guidance

All sections under Approval & Tracking are completed by the issuer. Of special notice is the work area inspection statement in red. Checking “Yes” here implies that all needed precautions have been taken including items on the right column of the form as well as contractor awareness training.

**Permit Expiration Date & Time:** This is completed by the issuer at the time of permit issuance and shall be limited to a single shift (thus a clear time is critical). If the work is not completed within a single shift, or by the date on the form, a new permit should be issued with a new review of the work area for proper precautions. A hot work area hazard review must also be conducted in the event those doing the work changes. If this involves a change in the person(s) doing the work than those that initially signed the permit as understanding the inherent risks, a new permit may also need to be issued.

### Required Precautions Checklists

The issuing manager or supervisor should review all items in this section and check the applicable precautions that have been taken.

Where work is done in buildings with noncombustible construction, this must be confirmed and that no combustible coverings, insulation, or core material is present. In buildings where construction cannot be visually confirmed, precautions should default to those for buildings with combustible construction. Walls, floors, and roofs with combustible construction must be protected by such approved methods such as by wetting, covering floors with damp sand, fire resistive tarpaulins, metal shields or other noncombustible shields/barriers.

Construction must be confirmed to be noncombustible without combustible coverings, insulation, or core material. This is not to say hot work cannot be done in combustible buildings but, no hot work should be done in combustible buildings where the combustible building components are within 35 ft. (11m) of the hot work operation. And buildings with combustible components will require added protection such as wetting down or covering wood floors. Hot work must never be done on/in combustible buildings such as those with foam walls where sparks could lead to fire. All openings must be very closely reviewed before work is permitted.

Combustibles must be removed from “opposite sides” of walls, ceilings, roofs, and floors to prevent ignition from conductive, convective, or radiant heat transfer. There have been several fires involving the use of open flames to thaw frozen pipes (which passed through walls and floors). The walls and floors were noncombustible and cleared of ignitable material but, heat transfer of the pipe ignited building material hidden on the opposite side of the work wall/floor. In most cases, the developing fire is undetected for an extended period of time being “hidden” by the wall or floor. Fire resistive tarpaulins should be suspended beneath work areas to collect sparks where applicable as well or additional fire watch may be required.

Where required by site management programs or other regulations due to explosion risks, area atmosphere LEL readings should be taken and recorded. Work should not be permitted with unacceptable levels such as those exceeding 25% of the lower flammability/explosive limit.

### Completion Signatures

- **Person Conducting Work Signature:** The individual assigned to conduct the hot work should sign his/her name along with the date and time when hot work has been completed. This provides the one hour start time for the fire watch to monitor the work area after work has been completed. The permit should remain at the work area until the fire watch is completed and a final site check is completed by the permit issuing manager, supervisor, or designee.
- **Fire Watch Signature:** The individual assigned to fire watch duty should sign his/her name along with the date and time the fire watch has been completed- with a minimum duration of one hour after the completion of hot work. In some cases, this may be required to be extended- i.e. such as by company policy or jurisdictional requirements. Once the fire watch is completed, the permit should remain at the work area until a final site check is completed by the permit issuing manager, supervisor, or designee.
- **Final Completed Signature:** After the minimum three hour hot work area monitoring period has been completed, the permit issuing manager, supervisor, or designee should make one final area check verifying that all preceding signatures are in place and then sign off and return the form to be added with the issuing page one for document retention.

For more information, contact your local AIG Risk Engineer.

### Resources

- AIG Insight COM-CG-09-0078 Hot Work Permit
- BS 9999: Code of Practice for Fire Safety in the Design, Management and Use of Buildings
- FPA RC7 – Recommendations for Hot Work, The Fire Protection Association
- NFPA 51B – Standard for Fire Prevention During Welding, Cutting and Other Hot Work
- <https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Structure-Fires-Started-by-Hot-Work>

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