

Identifying and understanding construction risks

# Lessons Learnt in Construction Projects



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## Foreword

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Welcome to the first in a series of publications from Swiss Re Corporate Solutions, entitled Lessons Learnt in Construction Projects. The loss case studies provided in this brochure are based on Swiss Re Corporate Solutions' practical experience of construction projects and aim to provide project owners, contractors and brokers with loss prevention best practices and focused risk management recommendations. Some of the losses highlighted in this brochure caused shutdowns of 20 weeks and costs of USD 2 million.

With lengthy delays and costly damages to repair, CFOs, principals and contractors know that risk management is an important and continuous activity during construction projects to ensure they are delivered on time, on specification and on budget.

Some exposures are inherent to the type of project, however some risks are common to many construction project activities, and are a constant source of loss for project owners. Based on our experience, these typically include construction area fires, natural hazard events, particularly flood and windstorm, liability exposures and poor or defective workmanship.

Insurance protection can offer a viable method of reducing the impact of a loss on an organisation's balance sheet. However appropriate risk management and loss prevention practices can prevent losses and reduce their impact and severity. This of course minimises unexpected project costs and schedule delays. Just like insurance, risk prevention is a crucial element of any project in managing and mitigating project risks.

We've chosen four case studies that demonstrate what can happen when risks are not properly identified and controlled. I hope you find the inaugural part of this series insightful and the practical advice helps you de-risk your own construction projects.

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# Case studies

**Hot work permit  
Fire at a crushing plant**

**Hot work permit  
Gas plant construction fire**

**Emergency response  
Petrochemical plant construction fire**



## Hot work permit Fire at a milling plant



When attempting to troubleshoot problems that inevitably occur during plant commissioning or maintenance, sometimes the solution to the problem can result in unexpected consequences. Working with high energy equipment has inherent dangers, but those dangers are amplified without proper safety management procedures and processes in place.



### Overview

In many cases removal of metal objects, such as bolts, can only be done using an oxy acetylene torch. A contractor needed to remove a bolt inside a mill and an oxy acetylene torch was used to cut out the bolt. Although a hot work permit would need to be issued for any welding, the permits only address the specific area, rather than the hazards associated with the job.



## The problem

Sparks from the cutting torch ignited a flammable liquid which was spilt nearby. The burning liquid set light to the machinery and the conveyor belts causing the fire to spread throughout the mill liner and plant. This was exacerbated by the chimney effect inherent in the mill design, causing fire and hot fumes to travel up through the system. The fire burned for a number of hours before it was brought under control.



## Impact

**Delays, damage and costs:** There was major fire damage to the milling equipment, chutes, screens, conveyor belts and auxiliary equipment. The fire caused a shutdown of operations at the milling plant of several weeks.

“The fire caused a shutdown of operations at the milling plant of several weeks.”

## Risk improvement



### Hot work permit

Hot work permits, although usually company-specific, are more or less similar around the world. The procedure requires that any hot work is properly authorised and carried out under strictly controlled conditions with appropriate risk control safeguards in place. However unless a permit is issued for each and every hot work job, there is a danger that the specific hazards for each job are not identified and controlled. In this case the permit issued was not sufficiently specific.



### Signage

Clear labelling, prohibiting hot work without a permit for working in a defined area or on a specific item of equipment, would have prevented the work from being carried out without the appropriate risk control precautions in place.



### Checks before conducting the work

The procedures laid out in the hot work permit should have required that the workplace would be inspected before the hot work was started to ensure that there were no combustible materials near the work site, that oil spillages were cleaned up and that equipment was protected by non-combustible tarps.



### Fire watch

The presence of a fire watch equipped with appropriate fire-fighting equipment would have controlled and limited the spread of the fire.



### Training

Training and monitoring of contractors safe work practices would have been of benefit in ensuring that the required hot work procedures and safe work practices were followed.



### Equipment

Fire retardant belts would have inhibited the progress of the fire. Although more expensive, they are readily available.

## Hot work permit Gas plant construction fire



An effective hot work permit, is of course essential in plants handling flammable liquids and gases, but is also vitally important in construction areas even when only combustible materials are present.



### Overview

All hot work on a gas plant construction site require a permit to work for each specific job due to the presence of combustible materials in the construction area. This typically requires a fire watch to be present during the work and for 30 minutes after completion. Hot work was to be carried out on a compressor package in a utilities area. A hot work permit was issued and the welder started work.



## The problem

Before the job had been completed a fire broke out on the compressor package. The welder had left the hot welding equipment in the work place to go to lunch. Thinking that it was in a safe location, he covered the equipment with plywood to protect it from the wind and dust.

Although a fire watch was on hand, he also went to lunch with the welder, instead of remaining at the work site for a further 30 minutes, as required by the hot work permit.

Attempts to suppress the fire were only partially successful. The fire was made worse by the amount of combustible materials nearby, including wood and a plastic tarpaulin.

The fire was reported to the emergency services fire department, who responded and the fire was extinguished.



## Impact

The fire caused damage to electrical cables and equipment at a cost of approximately USD 2 million. However, it could have been far worse but for the rapid intervention by the site fire brigade. If the equipment had been badly damaged, the loss would have been far higher and the project would have been delayed by several months.

“The fire caused damage to electrical cables and equipment at a cost of approximately USD 2 million”

## Risk improvement



### Good housekeeping

Minimising the presence of combustible materials at the work site is very important when carrying out hot work, before, during and after the work. Although smoking was not a factor in this loss, nevertheless this is a common source of ignition and should not be allowed in construction areas.



### Education and training

The fire watch needs to understand his responsibilities and the potential hazards. It is a crucial role that requires competence and good training. Our experience is that the Fire Watch can easily be distracted from this critical task if not appropriately educated and adequately trained.



### Combustible materials

Tarpaulins are frequently used in construction sites for equipment protection and to provide wind protection during welding. The use of fire retardant tarpaulins is best practice and should always be used on construction sites.



### Signage

It is best practice to post signs around vulnerable areas on site, for example around dry cooling towers, within electrical buildings under construction, and around critical equipment to ensure that any hot work carried out is appropriately controlled and managed.

## Emergency response Petrochemical plant construction fire



On construction sites, major fires sometimes occur due to the presence of combustible materials regularly used, for example wooden scaffold boards, tarpaulins and electrical cables. Responding quickly to construction area fires is therefore vital to prevent escalation. Having clear emergency response procedures, and practicing them, helps to ensure that all staff understand their role in an emergency. Furthermore, a programme of contractor site inspection, audit and monitoring is essential to verify that safe practices are being adopted.



### Overview

A fire broke out during the erection of a hydrocarbon storage tank. It engulfed the scaffolding and tarpaulins, although fortunately, the fire was extinguished before it was able to affect the integrity of the tank.



### The problem

Welding work had been carried out on the shell of a tank. At the end of the working day, after the contractors had finished work, a fire started burning through canvas tarpaulins used for wind protection. This was caused by hot halogen bulbs, used to provide lighting for the welders, which made contact with the combustible tarpaulins. Combustible electrical cables caused the fire to spread to the wooden scaffolding boards surrounding the tank.

All available local fire extinguishers had been used up in the initial, unsuccessful, attempt to fight the fire. Unfortunately there was a delay before mutual fire-fighting assistance could arrive as there was a lack of knowledge and understanding of procedures and protocols.

Neighboring plants had agreed to provide mutual aid, which is common practice. However, in this case, there was a breakdown in communication about the compatibility of the water hose connectors, which caused a further delay in accessing the available water supply. This caused the fire to burn for a prolonged period until it was eventually extinguished.



### Impact

The fire burned for much longer than necessary due to the delays caused by lack of emergency response planning, communication and fire-fighting equipment management. It was fortunate that there was no major damage to the tank and the construction site.

“The fire burned for much longer than necessary due to the delays caused by lack of emergency response planning”

## Risk improvement



### Emergency response

Ensuring that staff and contractors are prepared is key. They need to know the emergency response plans, protocols and procedures, which differ from one construction site to another. These need to be tested through formal drills, using various scenarios, involving contractors and security.



### Equipment

An important function of emergency response drills is to ensure that fire-fighting equipment and resources function as intended.



### Personnel and training

Contractors and personnel on-site, who are capable of effectively and efficiently activating the site emergency response plan, need to be trained. In our experience this is best achieved by appointing a dedicated emergency response coordination and support role within the project team.



### Review

Regular reviews of internal and external support capability is necessary to verify that site water supply systems are compatible with fire response equipment.



### Material management

Common ignition sources should be avoided, for example exposed halogen bulbs are a frequent ignition source, as is hot welding equipment and smoking. The use of combustible materials should be avoided or minimised. Best practice is to use non-combustible lighting cables, non-combustible tarpaulins and aluminium scaffold boards.



### Risk assessment

A continuous contractor site inspection, audit and monitoring programme is essential to ensure that safe practices are being adopted.



## Conclusion

In this publication we've shared just a few examples of ways that incidents can impact construction projects and lead to extensive schedule delays and additional costs. There will always be risks and challenges to construction projects, such as fires and explosions; natural disasters; liability exposures; and poor or defective workmanship – and insurance does and can play a vital role in providing protection against some of these risks.

However, insurance should not be used as an alternative to good risk management practices and a systematic way of identifying, assessing, managing and monitoring risks. After all, sound risk management practices not only help to prevent losses occurring in the first place, but can help ensure that you are buying the right levels of insurance protection for the specific risks facing your project.

In this short publication we've highlighted how proper equipment testing, the control and management of hot work, and effective emergency response plans could have saved millions of dollars and significant project overruns.

We hope that you have enjoyed the publication and that it has offered some practical guidance that will help you to eliminate or mitigate potential losses on your project.

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