NEW CONSTRUCTION

INTRODUCTION

New construction, remodeling or renovation involves hazardous work. As such, it introduces additional elements of risk to an existing facility. Application of loss control principles during design will improve reliability and maintainability of the completed work. Proper supervision of a loss prevention and control program at construction sites can reduce the number of fires and other losses during construction. An effective loss prevention and control program requires the cooperation of the architect, contractor, management and AXA XL Risk Consulting. In fact, AXA XL Risk Consulting welcomes the opportunity to consult with management whenever a construction project is planned.

POSITION

To achieve reasonable loss prevention and control at the construction site, management should:

- Incorporate loss control into the design and planning by submitting specifications and plans to AXA XL Risk Consulting for review prior to the letting of bids and contracts. Incorporate Management of Change principals in new construction projects. (See PRC.1.0.2.) Design the building or structure to the anticipated live and dead loads in accordance with ASCE Standard 7 or equivalent. Refer to the PRC.2 section of the Property Risk Consulting Guidelines manual. (See also PRC.1.1.0, PRC.1.2.0 and PRC.1.9.0.)
- Schedule installation of protection features to keep pace with the progress of construction.
- Designate an individual to coordinate loss prevention and control aspects of the construction project with the construction manager and other appropriate personnel. See PRC.1.5.0.A, PRC.1.5.0.B and PRC.1.0.4 for additional guidelines for loss prevention and control features.
- Appoint a Fire Brigade Chief or Emergency Team Coordinator. (See also PRC.1.7.0.)
- Appoint a person responsible for security and surveillance measures during construction. (See also PRC.1.11.0.)

DISCUSSION

A critical examination of the plans for facility construction or renovation can permit loss prevention attributes to be built into the very foundation. Arranging the electrical distribution system with redundant sources and feeds and providing extra cables in major wire ways can minimize downtime. Avoiding the placement of machinery in areas without overhead cranes large enough to move it or without sufficient headspace for mobile equipment can reduce delays in repair and replacement in case of breakdown.

Analysis of hazards (see PRC.1.13.0) should begin long before ground is broken so that all areas of serious loss potential can be minimized as much as possible. In fact, if loss control is considered sufficiently early in the design process, considerable savings in loss prevention equipment may be realized. Substituting a noncombustible solvent for a flammable one in an extraction process may considerably reduce fire protection system expenses. Relocating electrical equipment may reduce the need for hazardous-location-rated switchgear. Providing stronger pressure vessels may reduce the number of relief valves required. The term “inherent safety” has been applied to this line of inquiry.

Project management can plan to minimize loss as well as expense by taking care to avoid delivery of sensitive equipment before it can be protected or to plan temporary shelter when such delivery is necessary or prudent. Also, some activities such as boiler, pressure vessel and piping installation may require periodic formal inspection to meet legal (jurisdictional) requirements.

During construction, buildings are more vulnerable to such perils as fire, explosion, windstorm, collapse due to snow or water load, hail, vandalism and incendiarism. If not already established, this is the time frame in which training (see PRC.1.4.0) and preventive maintenance (see PRC.1.3.0) programs for new processes and equipment must be finalized.

Fire can be caused by hazardous construction operations. These include welding, cutting and other hot work; asphalt heating; woodworking; and the use of temporary electric wiring and heating equipment. Accumulations of combustible materials and their packaging spread a fire. Proper housekeeping is important. See PRC.1.14.0. In addition, carelessly discarded smoking materials can start fires. Smoking must be adequately controlled. See PRC.1.2.0.

Operations that are not hazardous in themselves may increase the exposure to various perils. For example, care must be exercised when excavating to keep from undermining adjacent foundations or disrupting utilities. A ruptured gas main could result in a fire or explosion beyond the capability of manual or automatic fire protection equipment. Damage to utility services can also interrupt the operation of heating or process equipment elsewhere in the facility.

The wind resistance of a building depends upon the proper interaction of its various structural components. Thus, the potential for wind damage and collapse is greatest during construction before all the components have been put in place and firmly fastened together. Similarly, this lack of structural integrity may lead to collapse when subject to excessive snow or water loads.

During construction, surfaces such as exposed roof or tank insulation are particularly susceptible to damage from hail.

Excavations for foundations are particularly susceptible to flooding, whether from rising streams or from heavy rainfall. Installation of machinery and equipment in such excavated areas before drainage or dewatering facilities are available can lead to substantial and unnecessary loss.

Control of personnel not in the employment of the facility is usually made much more difficult during periods of construction. Nevertheless, such control must be asserted in order to ensure adherence to the established principles and practices of loss prevention and control.

Because construction sites are open, they are inherently more vulnerable to vandalism and incendiarism. The number of outside personnel on such projects and the frequency and scope of access make surveillance more difficult than in completed facilities.

To make new construction less vulnerable to these perils, management must institute an aggressive program of loss prevention and control.

In spite of the significant hazards presented by a construction site, proper attention to loss prevention and control can minimize the likelihood and effect of a loss.

It is vital that communication be established between management and AXA XL Risk Consulting at the earliest planning stages of new construction or renovation. This will allow AXA XL Risk Consulting to offer loss prevention and control advice.

LOSS CONTROL DURING CONSTRUCTION

To control losses during construction, include the following points in the various management programs.

SCHEDULE PROTECTION TO KEEP PACE

Before construction begins, the following features must be scheduled for early completion:

- Installation of fire protection water supplies, such as fire pumps and reservoirs, underground piping and hydrants. Hose stream protection must be available when combustible construction materials arrive at the site. If permanent water supplies are not in service, suitable temporary supplies must be provided.
- Installation of automatic sprinklers to keep pace with construction progress. If portions of the building are to be occupied before the entire building is completed, arrangements should be made to install sprinkler protection in those portions first. This protection should be promptly connected to the water supply. Such connections may be temporary or permanent.
- Delivery of automotive fire apparatus to the site during the earliest stages of construction if such apparatus is to be a permanent part of the facility's overall fire protection. Temporary garages should be provided to protect the apparatus from the elements. Training in the use of the apparatus should also be provided.
- Delivery of combustible materials in such a way as to minimize unprotected on-site storage.

REDUCE THE HAZARDS OF CONSTRUCTION

The individual responsible for loss prevention and control must consider the following measures in order to reduce construction hazards:

- Instruct construction superintendents and supervisors in their duties and responsibilities regarding loss prevention practices.
- Keep automatic sprinkler protection in service for as long as practical in buildings that must be demolished.
- Keep combustible materials out of buildings until sprinklers are in service.
- Schedule frequent trash removal. Combustible crating and packing material should be disposed of safely. Restrict the burning of trash to areas well away from buildings and use properly arranged incinerators where practical.
- Minimize the building of temporary structures during construction. Those that are necessary should be sprinklered and located a safe distance from the construction.
- Implement proper impairment handling when altering or extending existing sprinkler systems. (See PRC.1.1.0.)
- Provide special fire protection equipment during hazardous construction operations.
- Properly distribute a sufficient number of portable fire extinguishers.
- Prohibit smoking in hazardous areas. (See PRC.1.2.0.)
- Strictly supervise all hot work. (See PRC.1.9.0.)
- Provide properly arranged temporary lighting and wiring in accordance with Article 590 of NFPA 70.

- Use only tarpaulins that have been flameproofed or made of flame-resistant material tested in accordance with Test Method 2 of NFPA 701.
- Provide safe sources of temporary heat.
- Locate bulk storage of gasoline, fuel oil, paint, solvents, welding gases and other flammable and combustible liquids or gases outside the buildings. No more than one day's working supply should be allowed inside the buildings. Only approved containers and dispensing facilities should be used.
- Keep roofers' tar kettles outside of and as far away from, buildings as practical. Suitable fire extinguishing equipment should be provided nearby.
- Take special care in the placement, operation and service of combustion engine-driven equipment. Refuel small gasoline units from listed or approved safety cans and large units from listed or approved containers in suitable refueling areas.
- Take measures to prevent collapse from windstorm. (See PRC.2.0.1.1.) These may include:
  - Providing temporary guying, cable crossbracing or other stiffening that can resist wind loading from any direction.
  - Bracing laterally unsupported masonry walls.
  - Permanently fastening roof decking, vapor barriers and insulation as they are placed upon the frame.
  - Lowering and/or securing all crane booms to appropriate anchor points at the end of each working day. (Note that a proper safety procedure on some tower cranes is to release the sluing mechanism so that the boom can weathervane with the wind.)
  - Establishing a maximum limiting wind speed for crane operations.
  - Providing wind relief panels, where appropriate to prevent windstorm damage during erection of structures.
- Take measures to prevent collapse from causes other than windstorm. These may include:
  - Maintaining a self-supporting steel framework.
  - Posting and observing instructions for the use of cranes, derricks and hoists.
  - Installing properly designed formwork and shoring for concrete construction.
  - Providing shoring, bracing or underpinning if the stability of adjoining buildings or walls is to be endangered by excavations or demolition.
  - Installing and connecting roof drains as soon as each section of the roof deck is completed.
  - Utilizing experienced riggers for all heavy lifts during construction and installation phases.
  - Implementing a test program to insure the proper curing of concrete before forms are removed or before new work is subjected to loading.
  - Providing temporary bracing for structures and equipment in earthquake-prone areas.
- Take measures to prevent damage from flood conditions created by rising streams or heavy rains. These may include:
  - Dikes or levees to protect open foundation excavations.
  - Pumps to de-water excavations.
  - Provisions to remove or protect construction equipment or newly installed equipment in excavations below ground level.
  - Providing temporary drainage facilities.
- Other loss prevention considerations should include:
  - Ensuring the availability on short notice of critical spare parts for cranes or other specialized heavy machinery.

- Winterizing all equipment, systems and machinery that will be exposed to freezing temperatures.
- Providing for additional security measures during strikes or labor unrest to prevent sabotage.
- Establishing a formal program for inspection and test of all major equipment and systems to prevent damage to electrical, heating, cooling or process equipment when initially energized or operated.

If the property under construction is a completely new facility, then it is necessary in the early stages to appoint a Fire Brigade Chief or Emergency Team Coordinator and to organize a Fire Brigade or Emergency Team in accordance with the recommendations found in AXA XL Risk Consulting's PEPlan. (See PRC.1.7.0.) However, if this is an addition or remodeling project, then all personnel should be notified that the responsibilities of the Fire Brigade Chief or Emergency Team Coordinator include the new area under construction.

While the Fire Brigade Chief's regular duties are defined in AXA XL Risk Consulting's PEPlan, any new construction creates a changing environment that requires the Chief to continually review the situation at the construction site. The fire attack plan should be updated as necessary and regularly reviewed with the public fire department.

SELECT A SECURITY DIRECTOR

The individual responsible for security and surveillance should review PRC.1.11.0. The specific duties of this individual should include:

- Instructing guards in their duties and responsibilities regarding loss prevention practices.
- Seeing that the site is enclosed with a fence where necessary. Gates should be properly monitored during working hours and secured during nonoperating hours. The construction area should be segregated from existing areas of the facility.
- Seeing that adequate lighting is provided for the entire construction area.
- Making sure combustible materials and structures are located a sufficient distance from the fenced perimeter to prevent easy ignition from outside.
- Developing identification procedures that control the access of personnel, vehicles and materials to and their travel in and about, the site.
- Providing guard stations and patrols that are designed to cover both security and fire protection surveillance during working and nonworking hours.
- Requiring the proper storage and security of construction explosives.
- Providing a temporary means of notifying the public fire department should an emergency occur.

To ensure the full benefit of AXA XL Risk Consulting's expertise, management should follow the advice of the AXA XL Risk Consulting's representative during site surveys.

DESIGN, INSTALLATION AND TESTING OF PRESSURE EQUIPMENT AND MACHINERY

The exposure to loss of production and service equipment may be reduced and the prospects for successful operation enhanced by precautions taken during installation. Special inspection of pressure equipment may also be required by law. The following items relate to past losses and/or delayed start-ups.

It is imperative that the time of acceptance and the test criteria for any equipment or machinery be clearly identified in writing before any commitment is made. Performance tests, inspection witness points and performance benchmarks should never be waived without the written agreement of all concerned parties, including the insurance carrier.

Boilers, pressure vessels and piping systems are frequently subject to jurisdictional (legal) requirements for design, fabrication, installation and for inspection during these activities. The installation of used pressure equipment may be severely restricted. The chief boiler inspector of the jurisdiction should be consulted early in the planning process to ensure that no laws are unwittingly violated. AXA XL Risk Consulting can assist in these matters.

In most parts of the world, a construction manager must keep an eye on the calendar, because the possibility of freezing will exist at some time of year. This means that arrangements must be made not only for completion of boilers and heating systems before they are needed but also for any tests and inspections required by the jurisdiction before licensing.

Air conditioning and refrigeration equipment may also involve jurisdictional requirements. For many facilities, the air conditioning equipment may be the heaviest machinery at the location. Advance planning for routine overhaul and emergency repair will reduce costs and expedite activity for the life of the facility.

Electrical distribution systems are not as passive as they might appear. In addition to considering current capacity and component protection, alternate feeds for critical equipment should be provided. A fault current analysis (also known as a relay coordination study) should be performed to insure that no fault to the system could possibly produce a current flow beyond the ability of the assigned fuse or breaker to interrupt.

Selective tripping should be employed to open, before others, the protection device nearest a fault, thus minimizing the extent of the resulting outage. On the other hand, some other tripping scheme, or perhaps electrical interlocking, may be needed for applications where loss of power to a single device results in an emergency condition if other devices continue to operate.

Before energizing any new or reworked electrical service or electrical device, an insulation resistance test and a test for a short circuit should be performed. More sophisticated testing may be in order for larger systems and certainly for major motors, generators and transformers. Not only are “smoke tests” (energizing equipment which is hopefully installed correctly, to see what happens) potentially expensive, but even if all is well, the opportunity to obtain baseline data for the maintenance record system is lost.

Construction or installation of any large or complex piece of equipment involves many types of quality control. One aspect which is frequently overlooked in the potentially bewildering activity at a construction site is tool control. It is important that access to an open machinery casing is strictly limited and that accountability of all tools and parts is maintained so that nothing is inadvertently left in the machine.

The following should be considered or accomplished prior to the initial start of any large rotating machine.

- All protective devices and systems must have been installed and tested to whatever degree is possible without machine operation.
- Supply and support systems, such as steam and lubricating oil, should be separately inspected, commissioned, flushed and reinspected before operation of the machine.
- Steam strainers, lubricating oil system fabric filters and any other precautionary devices recommended by the manufacturer or suggested by good engineering practice should be installed.
- The machine should be turned over by hand or a jacking device to ensure that no gross binding, interference or misalignment exists.

Whether the machine has a permanently installed vibration monitor or not, sufficient transducers connected to recording analysis equipment should be provided to detect flaws which may be present and to provide baseline “signatures” for the maintenance records. The initial testing may be the best opportunity in the life of the machine to collect data reflecting a variety of operating conditions.

Initial testing of almost any piece of equipment involves abnormal configurations of some sort. Examples include gagged safety valves for hydrostatic tests, blanked flanges and missing valves for flushes and the aforementioned steam and oil system filters. Great care must be taken to restore normal conditions before unrestricted operation is attempted.