

Preventing Water Damage During Construction

Introduction

Although fire is considered to be the major cause of property loss during construction, water damage losses consume as many loss dollars as other builders risk perils. According to [ISO](#), excluding loss dollars for unspecified (“all other”) losses, water is responsible for about 1 of every 5 loss dollars. Claims for water damage, freezing, and mold during construction have increased significantly over the last ten years. In addition, the litigation risk from water damage resulting in mold growth has greatly affected the construction industry in recent years. Therefore, contractors must proactively work to prevent water intrusions during all phases of construction (design, installation, maintenance, and warranty). In addition, contractors should have an established plan to respond immediately when a significant water intrusion occurs during construction to minimize physical damage and avoid extensive mold contamination.

Water damage can occur from both external and internal water intrusion sources. The following are examples of water intrusion sources that cause damage and delays at construction projects.

Exterior Water Intrusion Sources

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| Rain, ice dams | Roofs and roof drains |
| Groundwater | Windows and doors |
| Irrigation systems | Siding |
| Septic systems | Foundation |
| Adjacent properties | Waterproofing |
| Exterior plumbing (i.e. city water supply) | |

Interior Water Intrusion Sources

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| Plumbing (piping, drains, fixtures, equipment, sump pumps) |
| Fire sprinklers (piping, sprinkler heads, stand pipes, control boxes) |
| Mechanical systems (heaters, air handlers, evaporators, chillers, tanks, boilers, piping, refrigerated lines, reservoirs) |
| Wet areas (shower, bath, laundry, water closet) |

Water intrusion in the form of condensation must also be considered in the design of building systems. Condensation can occur within a building whenever moisture-laden air is in close proximity to cold surfaces.

LOSS CONTROL TIPS

Indirect Costs

In addition to the direct costs associated with cleanup, material replacement, equipment repair, and mold remediation, water damage incidents also involve significant indirect costs associated with construction delays and business interruptions. Many construction contracts include liquidated damage provisions in the event the project is delayed past a predetermined date. Construction delays near the end of a project can result in loss of revenues (i.e. rental income) as well as increased taxes, interest expense, legal fees, inspection fees, and marketing expenses. Therefore, the best strategy to help ensure a successful construction project is to take proactive measures to avoid water damage and be fully prepared to take immediate action in the event of a water intrusion.

Water Damage Prevention Plan

The project construction manager and/or general contractor should develop a job-specific water damage prevention plan (WDPP) designed to prevent water damage loss during all construction phases of the project. The plan should be completed before construction commences, be documented in writing, and include the following provisions:

- Pre-planning
- Job responsibilities
- Deliveries and storage
- Inspections and surveillance
- Controls
- Training
- Offsite locations
- Reporting
- Risk transfer

The plan should be made available to all contractors working on the project and should be included in all employee orientation programs. The plan should be re-evaluated as conditions and exposures change or following any water intrusion incident.

Pre-Planning

Proper planning required to prevent water intrusions is more than just scheduling work to ensure that the building envelope is weather tight before allowing interior trades to begin work. Planning during the design stage involves locating mechanical and electrical equipment away from areas where water may collect, such as basements. Building plans should locate water lines in heated areas and away from locations that will be unrecognized during construction, such as crawl spaces or closets. A frozen water line located in an unrecognized area of a building can cause

significant water damage. Preventing water damage loss during the construction phase of a project starts with the site development or grading plan. Site topography should be designed to divert water accumulations from the site and connections to permanent sewer and storm water systems should be made before building construction begins.

Water will invariably enter the most exterior skin of a building envelope, usually at transition points such as at windows. Consequently, it is essential to design and install moisture and air infiltration barriers or retarders to allow water to exit the exterior wall systems. Ensure that external walls have appropriate drainage planes behind them with appropriate vapor barriers. The building plans should specify the types of flashing, waterproofing components, moisture barriers and retarders to be used on the external wall systems. In addition, include weatherproofing and waterproofing designs to all roofs, foundations, windows, doors, gutters, and drainage systems.

Job Responsibilities

The water damage prevention plan (WDPP) should include clearly defined responsibilities for supervisors/superintendents, employees, and subcontractors. The plan should identify personnel responsible for monitoring weather forecasts and properly securing the site in expectation of inclement weather. In addition, the plan should identify personnel having the authority to shut down an operation, delay installations, or stop all construction in anticipation of a natural event such as heavy rainfall, windstorm, flooding, or hurricane.

The WDPP should include personnel responsible for work scheduling, material deliveries and storage, worksite inspections, and employee training designed to minimize water damage loss. The plan should have an approval process for the scheduling of any water pressure testing of sprinkler or plumbing lines. Supervisory personnel should be responsible for implementing all water intrusion prevention methods such as work practice/administrative controls and engineering controls (i.e. water leak detection systems).

Deliveries and Storage

Construction materials vary considerably with regard to their susceptibility to water damage. Some materials are unaffected, while others can be completely destroyed by moisture. The WDPP should identify moisture sensitive building materials (i.e. ceiling tiles, wallboard, electrical components) to be used on the project and should specify when they are to be received and where they will be stored

prior to installation. Consult with manufactures and suppliers to determine the best materials available (i.e. least susceptible to moisture), proper methods of storage, and if deliveries can be scheduled on an as needed basis for moisture sensitive materials. Site supervisors should communicate with purchasing personnel to determine the optimal delivery schedule for moisture sensitive materials.

Inspections and Surveillance

The WDPP should specify personnel responsible for monitoring the site throughout the workday for potential water intrusion sources and to ensure the building is properly secured (weather tight) at the end of each workshift. The WDPP should be consistent with the site security plan in regards to protection during off-hours (i.e. nights and weekends). Security patrols should be responsible for detecting and responding to any water intrusion incident or inadequately heated location in the same manner as a potential security threat.

Many water intrusion incidents are caused by improper installation of weatherproofing, waterproofing, and moisture barrier systems on the exterior skin of a building. Supervisors should verify that employees and subcontractors are adhering to manufacturers' installation specifications. Poorly glued connections on plastic pipes or improperly sweated copper pipe connections are a common cause of water damage during construction. The WDPP should include a quality control plan for plumbing connections and fittings such as marking each connection with a permanent marker. A quality control plan should also be developed for the installation and testing of sprinkler systems.

Worksite inspections should verify that:

- Water accumulations from rain and groundwater are not migrating into the building.
- All door and window openings are covered at the end of each workshift and prior to anticipated inclement weather.
- Water lines and mechanical equipment are protected from freezing.
- Sprinkler or plumbing lines that are pressure tested with water are drained immediately following the test.
- Standpipe valves are closed.
- Roof drains are not blocked with leaves or debris.
- Sink drains are not clogged.
- Storage areas are dry and well ventilated.
- Material storage is raised off the floor by pallets.
- Wet building materials (i.e. wallboard, ceiling tiles, roof decking) are replaced.

Controls

The WDPP should outline preventative measures in place designed to minimize the risk of water damage. These may include administrative controls such as work rules, practices and procedures as well as engineering controls designed to monitor and prevent a water intrusion incident.

Worksite procedures designed to prevent water damage include an administrative policy to shut off the domestic water supply during off-hours (i.e. nights and weekends). Supervisory personnel should verify that no trades will be working during off-hours before shutting off the water supply. In addition, they must ensure that the domestic water line does not provide water to any operating mechanical system that requires a constant water source, such as a chiller unit. Other administrative procedures to minimize water damage loss include:

- Provide a secondary source of power (i.e. generator) whenever using sump pumps or other water pumping systems.
- Testing sprinkler and plumbing systems with air pressure to identify system leaks before charging with water.
- Leading edges of roofing materials should be sealed at the end of each day to prevent water from a storm getting under an incomplete roofing membrane.
- Provide heat during winter months in buildings with charged water lines or standpipes to protect from freezing.
- Leave a gap of at least 1/2" between the drywall and the floor to minimize water contact in the event floors become wet.

There are many leak detection systems available to help prevent water damage. Some use moisture sensors located throughout the building but most use flow sensors installed on the main water supply. Many commercially available water flow detection systems are completely non-intrusive (no cutting of pipe to install) and easy to program. Passive leak detectors monitor water flow and sound an alarm (local or connected to a centrally monitored system) when water starts to flow and the system is armed (during off hours). Active leak detectors not only generate an alarm but will prevent water leaks by automatically shutting off the water supply. The site-specific WDPP should list the leak detection systems used, identify supervisory personnel responsible for their use, and reference the operating guidelines for each system.

Training

Employee orientation training should include an overview of the WDPP as well as the site-specific measures established (engineering and administrative controls) to help prevent water damage. Employees must understand their role in helping management monitor the workplace and immediately report any potential water intrusion. In addition, this training should be reinforced during regularly scheduled training sessions (i.e. “toolbox talks”).

Since many water intrusion incidents are caused by improper weatherproofing/ waterproofing installations, supervisory personnel should develop a procedure to inspect all installations of building components in moisture-sensitive areas. Supervisors must ensure that all weatherproofing/ waterproofing installations adhere to the building plans, manufacturers’ specifications, industry standards, and all relevant building codes.

Offsite Locations

Construction projects often utilize offsite storage locations or trailers to store building materials. Ideally, moisture sensitive materials should be delivered on an as needed basis (“just-in-time delivery”); however, factors such as project schedule, delivery distances, and cost often make this delivery method infeasible. The longer uninstalled materials and supplies remain stored on a construction site, the greater is their exposure to water damage. Therefore, potential exposures at offsite storage locations must be considered in the WDPP, and these areas must be held to the same standards as the main construction location.

Another source of exposure is the transportation of moisture sensitive materials to the job site, including transportation from distant manufacturers, suppliers, or other sources in vehicles of the general contractor, subcontractor, common carrier, independent carrier, or the supplier. The WDPP should require all shipments of moisture sensitive materials be properly sealed and/or covered to avoid water damage in transit. The unloading of moisture sensitive materials should be delayed during inclement weather.

Reporting

The WDPP should outline appropriate response actions to a water intrusion incident and include personnel responsible for implementing the cleanup/remediation procedures. All reports of water intrusion should be treated as an emergency and with the same urgency as a fire or security breach. An immediate response and quick cleanup (completed within

the first 24 hours) of a water intrusion will result in significant cost savings compared to a delayed response. All reports of water intrusion should be investigated and the results documented in writing. Photographs of the damaged areas should be included in the investigative report.

Whenever feasible, leak detectors should be connected to a centrally monitored system. All employees, subcontractors, and security personnel on the site should be provided with 24 – hour emergency contact information in the event that a water intrusion occurs.

Risk Transfer

In addition to provisions for planning, prevention, training, and response, the WDPP should also include risk transfer and contract management provisions. Since subcontractors are often hired to install building components in moisture-sensitive areas, proactive risk transfer methods and hold-harmless language should be included in every subcontractor agreement. For more information on contract management, refer to The Hartford’s Loss Control TIPS *Managing Contracts Improves Your Risk Management*.

Renovations

Renovation projects and new construction with partial occupancies (i.e. tenant build-outs) involve unique challenges in preventing water damage. Engineering and administrative controls that work well in new construction projects must be modified whenever a building, or portions of a building, is occupied during construction. The WDPP should address the following concerns for any renovation project and/or building that will be occupied during construction:

- Inspect renovation sites prior to construction and document (i.e. photos) any wet building materials or signs of mold growth.
- Ensure that the domestic water line does not supply occupied portions of the building before considering shutting it off during off-hours.
- Water flow leak detectors should be installed on water lines that supply construction zones (unoccupied) only.
- Moisture sensors should be used, instead of water flow leak detectors, when water lines supply both construction and occupied zones.
- Establish a procedure to receive and address complaints or concerns from building occupants regarding water intrusion during construction.
- Develop a plan for relocating occupants in the event of a water intrusion involving occupied areas.

Cleanup and Mold Prevention

Whenever water damage has occurred, immediate actions should be taken to eliminate the source of water intrusion (i.e. repair the leak), thoroughly dry all materials, and remove moisture from the air to prevent widespread mold growth. Rapid germination or reproduction of fungi occurs when fungal spores, which are naturally present in or on building materials (wood, drywall, ceiling tiles, carpet, insulation, etc.) are exposed to moisture. As long as the moisture is present the fungi will continue to reproduce.

As molds grow, some species will produce potentially toxic byproducts called mycotoxins. The [U.S. Environmental Protection Agency \(EPA\)](#) estimates greater than 200 mycotoxins from common molds have been identified, and many more remain to be identified. The amount and types of mycotoxins produced by a particular mold depends on many environmental and genetic factors. Some mycotoxins are known to affect people, but for many mycotoxins little health information is available. Exposure to mycotoxins can occur from inhalation, ingestion, and skin contact. It is prudent to avoid unnecessary inhalation exposure to mold, thus mold should be properly removed when it first becomes visible. Since mold thrives in environments where there is a lack of ventilation (i.e. wall cavities, sub-floors, beneath wall or floor coverings, behind vapor barriers, behind ceiling tiles), it is critical to investigate all areas after a water damage incident.

All reports of water intrusion must be treated immediately. Generally, building materials must remain wet for more than 24 – 48 hours for mold to develop. A water problem handled in the first 24 hours usually involves significantly less resources to correct than those with a more delayed response. The EPA has published cleanup strategies based

upon the response time to a water damage incident. [Table 1](#) guidelines are designed to help avoid the need for remediation of mold growth by taking quick action (within 24-48 hours) before growth begins. [Table 2](#) guidelines are for building materials that are likely to have mold growth or materials which have been wet for greater than 48 hours. The four methods of remediation included in the table 2 guidelines are as follows:

- **Method 1:** Wet vacuum (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.
- **Method 2:** Damp-wipe surfaces with plain water or with water and detergent solution (except wood – use wood floor cleaner); scrub as needed.
- **Method 3:** High-efficiency particulate air (HEPA) vacuum after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.
- **Method 4:** Discard – remove water-damaged materials and seal in plastic bags while inside of containment, if present. Dispose of as normal waste. HEPA vacuum area after it is dried.

The table 2 guidelines include recommended personal protective equipment (PPE) and containment designs to protect the health of occupants and cleanup personnel during remediation. Refer to the EPA's [Mold Resources](#) for additional information and guidelines.

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford's Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

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