Session No. 504

The Power of Water: Assessing Your Risk of Water Related Perils and Formulating a Response Plan

Angela Fuqua, P.E., CSP, CPCU, CFPS
Chubb & Son, a division of Federal Insurance Company
Dallas, Texas

Introduction

Safety professionals are charged with the responsibility to protect **people, property** and the **environment,** however most loss prevention efforts only focus on protecting **people** and the **environment**.

Though the responsibility of protecting **property** is often overlooked; as a Safety Professional, you should focus attention on property protection, because protecting property also means protecting people, the environment, and your company's bottom line.

Most safety professionals are experienced in assessing the risk of loss from fire, and understand the controls that must be in place to control ignition sources, minimize the continuity of combustibles, and provide an appropriate response to a fire emergency. What they may be less familiar with is the risk of property loss from water related perils.

Water intrusion losses have become a key "cause of loss" for property claims, in fact, the risk of property damage from water release or intrusion is often greater than the risk of fire in some facilities.

Safety professionals are often tasked with creating Emergency Response Plans that outline the company's response plan for fire, tornado, medical emergency, bomb threat, chemical spill, hurricane, earthquake and many other emergency scenarios. Unfortunately, a formal response plan for "water related incidents" is often not considered or included in these emergency response plans.

Safety professionals must have a good understanding of their facility's vulnerability to water- related damage and implement controls and develop a response plan that will reduce the risk of loss and minimize the severity of any loss that may occur.

Loss data tells us it's a matter of WHEN not IF! With water damage, seemingly minor incidents can potentially render a building uninhabitable (from mold) with significant business

interruption. However, with a little preparation and an appropriate response, the overall impact of a water-related incident can be minimized.

This paper will outline a framework for **performing a risk assessment** on the potential for water intrusion/release from a variety of sources, both internal and external to a facility.

The goal is to help safety professionals **recognize and quantify the risk of water damage** in their facility, and be able to identify whether additional controls or changes are warranted based on an assessment of the exposures present and the controls currently in place.

This paper will also outline a framework for developing a **Flood and Water Related Perils Response Plan** to mitigate the effects of any water related loss event by including it as a new hazard category in your company's Emergency Response Plan.

How Well Are You Managing All Property Exposures?

Most companies do a good job of maintaining their fire protection equipment and have a good response plan for fire and other emergencies, but many have never appropriately evaluated how to control the risk of water intrusion/release.

The point of inspections, testing and response planning is that when something does go WRONG (i.e. you have a fire) then you want everything else to go RIGHT.

In the event of a fire, to minimize the extent of a loss, one needs a number of events to go right. You want the detection system to notify someone of the fire and shut down HVAC to prevent smoke migration throughout the building. You want the sprinklers to control or extinguish the fire. You want the mag release doors to close and cut off the spread of fire and smoke. You want the fire department to be notified and have an efficient response to the fire so that the damage is minimized.

The same is true with water damage prevention. If there is a release or intrusion of water in the building, you want to detect it immediately, notify someone of the issue, and have an immediate and appropriate response from someone to stop the flow, contain the spill and clean it up to minimize the damage.

So What's the Big Deal with Water?

<u>Definition</u>
Liquid: A state of matter, neither gas nor solid, who's atoms move freely, and take the shape of its container.

In the case of a building, the building IS the "container", which means uncontained liquids will flow and expand until they reach a barrier that stops the progressive propagation of the spill. Gravity causes the uncontained liquid to flow downward causing damage on multiple floors.

Even a small leak that goes undetected over time can quickly spread down through a building causing damage far away from the original source.

Benefits of a Water Damage Mitigation Program

Having a water damage mitigation strategy in place can:

- Reduce direct property damage to buildings (Frequency & Severity)
- Prevent the need for time-consuming remediation efforts after a loss
- Increase retention & attraction of customers and tenants (By preventing interruption of operations)
- Improve facility appearance (No smell of mold or discoloration on interior walls)
- Create a better reputation in the market place (No comments on websites saying "the elevators in this building have been out of service for months after water damage from the hurricane")

Lessons from the Losses: (Case Studies)

Lessons from Losses-Water Damage Loss #1
A large hospital had basement level mechanical room with boilers chillers, sterile medical supplies, elevator pits, and maintenance shop.

One Sunday morning about 2:30 AM, the security guard heard a noise when walking rounds at the hospital and looked in the basement mechanical room and noted that water was rising in the basement mechanical room. Since he did not know the location of any shut-off valves, he called the maintenance manager at home to tell him there was a "leak".

The maintenance manager received a call from the security guard at the hospital saying "there is a leak in the basement level of the hospital". To be accurate, the security guard should have said "there a very LARGE leak that has already filled much of the basement to the 4 foot level!"

The maintenance supervisor, not realizing the seriousness of the situation, unhurriedly drove to the hospital to find the basement filled with about 6 feet of water, with more water pouring in from a six inch main that entered the hospital at the basement level. He immediately went out to the road and shut the main water valve for the entire building in front of the hospital, which stopped the flow of water. Due to the delay in shutting the valve, the damage was already significant.

What precipitated this loss was the installation (3 months before) of a new water meter by the city water department in the basement level where the domestic water entered the building.

The water meter was installed on the incoming 6 inch line, and socket clamps and flange lugs were installed, but the required tie rods (bolts) were never installed to stabilize the connection to prevent separation at the joint.

About one month after the new meter was installed there was a small leak at the joint between the meter and the discharge side of the meter into the supply piping. The city was called and they came out and tightened the joints to stop the leak. This should have been a wake-up call to have a knowledgeable person take a look at the installation, which would have revealed the

need for installing the required tie rods; but no one knew, resulting in a "ticking time bomb" for a water related disaster.

Three months after the installation of the new water meter, and two months after the relatively small leak noted above, the joint catastrophically separated between the meter and the supply piping allowing unrestricted flow of water from a 6 inch water line coming into the basement level of the hospital. Thousands of gallons of water flooded the basement level, including the boiler room, telecommunications room, elevator pits, material supply department, security office, hot and cold water pumps/motors, a restaurant (tenant), laundry storage, and the main electrical feed into the building and the switchgear. Additionally, many of the controllers for this equipment were damaged by the water and had to be replaced. The loss was over $800,000.

With even a basic evaluation of exposures to water damage, the resulting severity of the loss could have been minimized through improvements in the planning and response to the water release incident.

Water damage can be minimized when good controls are in place to notify of the presence of water (or other liquid), allowing for a quick and appropriate response to a release.

The appropriate response to water release/intrusion is to isolate the source of the leak, contain the liquid already spilled (to prevent spread of the liquid into unaffected areas), followed by immediate efforts to dry out and clean up and tear out unsalvageable finish materials like flooring and drywall.

This loss was certainly preventable, and the extent of the water damage in this loss could have been minimized if on-site personnel would have been knowledgeable about the location of shut-off valves once the leak was detected. Unfortunately, the personnel on-site at the time of the leak (night-time security personnel) did not know the location of the main water isolation valves for the building, so the water kept flowing into the basement until the maintenance manager could drive from his home to the hospital and shut off the water.

From a management of change perspective, the immediate cause of the loss could have been eliminated by assessing the exposures associated with the change-out of the water meter by the city. A look at the potential for loss could have identified the need for an independent third party to verify the installation, which would have resulted in the realization that tie rods were needed for the unsecured joint. (See photo below which shows the rods added *after* the loss occurred.)

Exhibit1. Piping Assembly

Exhibit 2. Close-up of Piping Assembly

Exhibit 3. Overall Piping Assembly

Lessons Learned/Additional Controls Added:
In an effort to prevent a reoccurrence and to improve their response to any future event, a Valve Labeling Project was initiated to provide information on the location of isolation valves to make it easier for personnel to locate the appropriate valve and isolate any leak.

A valve list and location diagrams were posted on the door (inside) each mechanical room numbering and listing all the valves in the room, their location in the room, and the system/area the valve isolates.

All valves were labeled with a valve ID corresponding to the valve ID on the list and indicated on a diagram showing the location of valves in the room so that any responding person can cross reference the appropriate valve, find it in the room, and close the valve to isolate a leak.

Lessons from Losses-Water Damage Loss #2

A church with lower (basement) level below the sanctuary. The finished basement houses the choir room, orchestra room, storage of costumes, and practice rooms.

Remnants of a tropical storm came through and dumped several inches of rain in the area in a short period of time along with high winds and thunderstorms.

The basement was equipped with a single stage sump pump in a pit to handle water from some of the roof drains, which flowed to this sump versus the outside, and surface water from exterior drains around the perimeter of the church. When water entered the pit, the float valve would rise to a point and turn on the sump pump to remove the water from the pit to the municipal storm drains.

In this case, as designed, water entered the pit and the pump came on and began to pump water out of the pit. Unfortunately with the high winds, power lines in the area were blown over causing a power outage. Upon loss of power, the sump pump was no longer removing water from the pit and it filled up and overflowed into the basement area, damaging the costumes, carpet, and fixtures and furnishings throughout the basement area.

This was a preventable loss, had someone taken a closer look at the exposures and controls in place to prevent a loss. A risk assessment of this scenario would have started by asking the questions:

- Do I have any below grade spaces in this facility, since water always finds its way to the lowest point?
- Do I have a sump pit (and sump pump) to pump out the water that collects in the pit?
- Do I have redundant sump pumps in case one fails?
- Are the sump pumps on emergency power in case of power loss?
- Is there an alarm on-site and off-site (paging) to notify someone when the sump pump kicks on so facilities staff can come and check to make sure everything is working correctly when the sump pump is needed?
- Are we maintaining the sump pumps to be sure they will be reliable?

Lessons Learned/Additional Controls Added:

After the loss, the church added three additional sump pumps (2 dual stage pumps) to the pit (for a total of four) to ensure redundancy if a pump fails. They also put the sump pumps on a regular testing and maintenance schedule to ensure they will be reliable when needed to prevent a re-occurrence.

Exhibit 4. Sump Pit with 4 Pumps

Exhibit 5. Piping for 2 Dual-Stage Sump Pumps

They also added a small emergency generator to provide emergency power to the sump pumps, magnetic locks on the doors (that would unlock upon loss of power), and to the computer room servers.

Exhibit 6. Small Emergency Generator

They added a building management system that would page the facilities director when there is a loss of power, when the sump pumps come on, when the sump pumps fail to operate and water is rising in the pit or when there is a loss of power and the generator starts or fails to start.

Now that we have learned a few lessons from the losses of others, let's examine how to create an emergency response plan for water damage exposures in your facility.

Emergency Response Planning

Emergency response planning involves evaluating potential emergencies and disasters based on the risks posed by likely hazards. It drives the implementation of controls aimed toward reducing the impact of loss events. It identifies risks that cannot be eliminated and prescribes the actions required to address the consequences of loss events, and offers steps for recovery from those events.

Emergency Management is divided into five phases that form a cycle. The phases of the cycle are: Identification, Mitigation, Preparedness, Response, and Recovery.

Identification/Quantification (Risk Assessment): A Risk Assessment helps to identify:

- What events can occur in your facility
- The likelihood that an event will occur
- The severity of the consequences in terms of casualties, destruction, disruption to critical services, and costs of recovery

Mitigation (Risk Control): Risk Control involves taking action to reduce or eliminate risk to people and property from hazards and their effects. The goals of mitigation activities are to protect people and structures and to reduce the costs of response and recovery.

Mitigation efforts include implementing **Engineering Controls** or **Management Controls** that will reduce the frequency or severity of any loss event that occurs. These controls may involve changes to policies, procedures, or work rules, or may involve adding additional physical hazard controls to prevent a loss or reduce the severity of a loss.

Identifying the resources, equipment and supplies that will be needed for an emergency response is also a crucial part of effective mitigation efforts. Any equipment and supplies needed for an effective response should be purchased and staged at appropriate locations so they are available when needed for emergency response.

Preparedness (Pre-Incident Planning): Because it is not possible to mitigate completely against every hazard that poses a risk, **preparedness** initiatives can help to reduce the impact of the remaining hazards by taking certain actions before an emergency incident occurs. Proper planning will help employees respond effectively to, and recover from, loss events resulting from any identified hazard.

During planning activities for an emergency or disaster response, facilities, security, and property management personnel should be assigned to the role they will perform in an emergency situation.

These personnel must be trained for their response role *before* an emergency incident occurs. Whenever possible, these persons should be included in training and testing exercises that enable them to practice their response role under simulated emergency conditions so that, when an actual emergency occurs, they are ready to respond appropriately and effectively.

Standby contracts with providers of critical equipment and supplies should be made in advance for timely response after a loss event. Under a typical standby contract, the contractor agrees to provide a response crew within a given time period after notification of a loss, and agrees to a specified cost per hour for clean-up and emergency restoration efforts.

Good planning, training, and testing of a response plan before an event occurs can help reduce cascading events and their effects. Cascading events are events that occur as a direct or indirect result of an initial event. Maintaining the discipline to follow the plan during response operations also reduces the effects of cascading events.

Response (During Incident): Response efforts begin when an emergency incident is imminent or immediately after an event occurs. The goal is to protect people and property and to reduce the extent of the loss. In other words, response involves putting preparedness plans into action. The process involves the following steps:

- Conducting a situation assessment to: prioritize response activities, allocate scarce resources, and request additional assistance if needed
- Providing emergency assistance to victims
- Restoring critical infrastructure (e.g., lights, heat, utilities)
- Ensuring continuity of critical operations, equipment and services

Recovery (Post-Incident): Recovery involves cleaning-up, rebuilding, and restoring basic critical business services and functions. The goal of recovery is to return your company's systems and activities to normal as quickly as practical in order to minimize your company's losses. Recovery begins immediately after the emergency, and some recovery activities may be concurrent with response efforts.

Following the emergency, take the time to assess the exposures, controls, and response plan to see if changes are needed for the future. From experience, companies can learn how to better identify and mitigate their exposures and prepare, and respond more effectively to future emergencies. As new exposures are identified, additional physical hazard and management controls may be needed, and response and recovery plans can be revised, and the cycle repeats.

Now let's apply the Emergency Planning process outlined above to specifically address Flood and Water-Related Perils.

Phase 1: Identification—Water Damage Risk Assessment

There are three steps in the risk assessment process for water damage in your facility.

- Identify Sources of Water
- Evaluate Site Specific Features
- Assess Operational Exposures

Identifying Sources of Water in Your Facility

The first step in the risk assessment process for water damage mitigation is to identify all the sources of water in your facility. There are five broad categories to consider in creating a list of all water sources in a given facility.

1. *Facility Service Water:* Domestic water, chilled water, hot water, sprinkler systems, and Computer Room Air Conditioning (CRAC) Units are some common sources of water in a facility.

   There are four principal causes of water loss from pipes and tanks – mechanical damage, corrosion, freezing and overflowing (tanks). Water pipes serve domestic, industrial and fire protection systems and there is a possibility that any part can leak.

All facility service water piping in the facility should be regularly inspected. Are there valves that appear corroded? Are you exercising these valves at least annually to make sure they will close in the event of an emergency? Do you have drains in mechanical rooms that can handle a potential leak from hot water heaters and other mechanical equipment?

Do you have a fire pump supporting sprinklers? If so, do you have pressure reducing valves for the lower floors? Are inspections made to ensure that the pressure of the water entering the sprinklers on the lower floors is below 175 psi after the pressure-reducing valve (PRV)? (Sprinkler components such as sprinklers are rated for a maximum 175 psi.)

Do you have water detection for CRAC units in computer rooms (Often a part of the Liebert AC unit)? Does the alarm go off-site or page someone?

2. *Grey/Black* Water: (Waste Water from sinks, showers, toilets) Do you know the location of valves to isolate water to and wastewater from these fixtures? How old are the fixtures and valves? Is corrosion evident on some isolation valves indicating a need for replacement?

   Does your building utilize a drainage system that combines the drain and vent lines into one pipe? This can significantly increase the potential for water damage losses from back-up of waste water in your facility.

3. *Rain/Surface Water Runoff:* (Water from roofs, French drains, exterior terrain) Take note of how the water from the roof is removed. Where do the drains go? Are the drains clear of debris? Are roof drain covers in place to prevent foreign material from going into and clogging the roof drains? Is there a program in place to inspect the roof to seasonally remove leaves and look for clogged drains that could cause ponding on the roof? Are exterior French drains provided in landscaped areas to handle surface water before it can enter the building? Are drains inspected to ensure they are not clogged? Where do the drains take the water? Does the exterior terrain direct water towards the building or away from it?

4. *Building Envelope:* (Roof, Exterior Walls, Foundation) Your facility should have an easy way for tenants and employees to submit concerns to property management and maintenance. You should respond promptly to occupant complaints of a "mustiness or a moldy smell" in an area because these complaints are often indicators of moisture intrusion from the building envelope.

   - Roof: Building roofs have HVAC equipment, vent pipes, and skylights that penetrate the roof and create the potential for water intrusion. Leaves can clog roof drains causing ponding on the roof, which can also contribute to leaks.

     Your facility should have a robust inspection program for the roof including inspections of all rooftop penetrations regularly from inside and out. You should check to be sure the seals are intact around HVAC equipment and flashing and caulking around skylights and vents are still in good condition. Preventive maintenance schedules should include periodic re-caulking.

- Exterior Walls: The exterior walls of a building can be a significant source of water intrusion. There are numerous penetrations in the exterior walls for lighting, cameras, HVAC, air intakes, exhaust vents, and joints around windows and doors. There can also be penetrations from damage to the walls, cracks due to settling, or caulking that has degraded. Regular inspections will help identify potential problems early and help minimize the costs of repairs.

  At least annually, you should check exterior walls for defects. For masonry walls, check for spalling, cracking, movement, and failed joints, all of which are potential entry points for damaging moisture. You should also look for interior water stains and immediately investigate the source and make repairs.

  At least quarterly, check all exterior wall penetrations for proper flashing and sealant integrity. Check all major wall joints at windows, doors, and electrical and plumbing penetrations. In most exterior wall construction, joints are filled with a sealant. If the wrong type of sealant was installed or if it has lost its elasticity due to exposure, it can easily form cracks, splits, or tears and allow moisture intrusion into the building.

  Buildings finished with Exterior Insulation Finish Systems (EIFS) have more rigorous inspection requirements. It is extremely important that EIFS exteriors have on-going inspection and maintenance to prevent moisture intrusion, mold, and potential delamination.

  Water that penetrates the surface of the EIFS material can cause major damage to the wall's structure that may remain hidden for years, resulting in the need for costly repairs. In most cases, water penetration comes from failed joints between EIFS material and wall penetrations, such as windows and doors.

  To limit damage, check EIFS walls at least semi-annually, paying particular attention to joints between the EIFS material and adjacent materials.

- Foundations: Unstable fill material in floors and foundations can cause settling and cracks, which can allow water to enter the building. Shifting foundations can cause walls (especially tilt-walls) to separate at the corners and between panels allowing moisture to enter the building in the cracks. Earth movement can cause leaks under the building's slab, resulting in additional damage or collapse.

5. *Flood Exposures:* (due to proximity to 100 year flood zone.): You should determine if your facility is in the 100 year flood plain or near the 100 year flood plain, or in shaded X (protected by levee from 100 year flood) or in 500 year flood plain.

   If facility is in or near 100 year flood zone, then check Finished Floor Elevation (FFE) of basement and 1st floor in relation to the 100 year Base Flood Elevation (BFE).

   The FEMA website where you can obtain the Base Flood Elevation for 100 year flood event: https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1

Evaluating Site-Specific Features That Can Increase the Potential for Water Damage

Once you have identified all the sources of water in your facility, the second step in the risk assessment process for water damage mitigation is to evaluate Site-Specific Features that may increase the potential for water damage in your facility. There are six site-specific features that can increase the frequency or severity of water damage in your facility.

1. *Below Grade Levels:* If you have below grade levels within your facility, then you should have sump pits with redundant sump pumps on emergency power with an alarm that goes off-site or is tied into a building management system to page personnel. Be careful what you put in the basement. Critical equipment in the basement is highly susceptible to damage from water.

2. *Exterior Terrain/Grading:* Take a look at how the terrain slopes around the perimeter of the building. When terrain slopes towards the building, there is the potential for surface water run-off to flow into the building, especially when there are exterior steps down to doors that enter the basement. Sometimes there is a need for flood gates to protect these exterior steps (that lead to basement-level doors) against water flowing down into the basement. At the very least, the brackets for flood gates can be installed and gates purchased and stored so they can be installed quickly upon rising water. Another possibility is adding a drain at the bottom of the stairs just outside the door to collect the water to sump and pump it to the storm water system.

3. *MIC- Microbiologically Influenced Corrosion:* Typically in dry sprinkler systems you may start to get pinhole leaks that trip the systems because of Microbiologically Influenced Corrosion. This often occurs in piping that is not properly pitched to drain the water and wherever there is an air-water interface. Sometimes it is caused by the chemical make-up of the water. In the most severe cases, the piping has to be replaced and water treatment systems have to be installed to prevent a reoccurrence.

4. *Age of Building:* The age of the building becomes a factor when plumbing, mechanical, and roofing systems are not replaced/upgraded over time. When a building is over 20 years old, wear and tear usually has occurred on the exterior envelope and interior infrastructure and piping and other systems. Because of this, older buildings are typically more prone to failure. Each facility should have a plan for replacement of key building equipment, fixtures, piping and roof, so that systems are not used beyond their reasonable lifecycle.

5. *Occupancy of Building***:** Some occupancies naturally have increased water damage potential. For instance in high-rise residential (apartments & hotels & condominiums) each unit has their own kitchen sink, bath tub/shower, toilet, washer, and dishwasher, which multiplies the opportunities for water damage within the building.

6. *Geographic Exposures:* There are also unique exposures that affect facilities in certain regions that can lead to extensive water damage (Earthquake, Wind Storms, Hurricanes, Tornados, Snowstorms). If you live in an area exposed to earthquakes, there are special bracing requirements for piping, including sprinkler piping, to reduce the potential for pipe breakage due to earth movement. If you live in hurricane prone areas, there are specific requirements for securement of rooftop equipment. Having plywood available to cover

windows is a good idea. You should consider all the natural hazard exposures to which your building is exposed, and take steps to guard against damage from those hazards.

Assessing Operational Exposures

The third step in the risk assessment process for water damage exposures is to assess the operational exposures that may increase the potential for water damage in your facility. There are five operational exposures that can increase the frequency or severity of water damage in your facility.

1. *Preventive Maintenance Schedule:* Preventive maintenance should include exercising valves at least annually to make sure the valves can be closed in an emergency. Sump pumps should have preventive maintenance, and be tested to ensure they work properly and the float valve works to turn on the sump pumps when needed. PM's should also include water treatment for service water to prevent corrosion that could lead to leaks. Deferred maintenance on roof, windows, plumbing, and HVAC can lead to catastrophic liquid damage losses.

2. *Management of Contractors:* Whenever any third party will be working on-site, facilities staff should communicate clearly with them before any work begins.

   As an example, there was a sprinkler contractor replacing a sprinkler on the 6th floor of a hospital facility, and the contractor shut the sectional control valve that he THOUGHT controlled the area in which he was working. Unfortunately he isolated the wrong section of the sprinkler system, so as he began to remove the sprinkler, water began spraying everywhere, the fire pump kicked on, and water flowed down to all the five floors below, causing extensive water damage.

   If there had been a diagram posted showing the areas controlled by that sprinkler valve, he would have known that he was not shutting the correct valve. If the facilities staff had accompanied the contractor to isolate the sprinkler system, and was knowledgeable about what valves served what areas, this loss could have easily been prevented.

3. *New construction/Renovations (ON and OFF site):* New construction or renovations within your building, on your site, and on neighboring sites can lead to water damage too.

   Pay attention to what is happening around your property. If there was previously an open dirt or grassy lot next door, and they are now building and paving the lot, resulting in a ground elevation higher than your property, there will be more run-off (because of the new paving) and the surface water run-off patterns will be different and could come straight into your building.

   During renovation work inside, it is possible for pipes to be damaged or break inside the building. With work or excavation outside the building, a water main could break causing a flow of water that could enter the building resulting in significant damage.

   For example, in downtown Dallas, there were several buildings that used to be connected by underground rail tunnels. Over time, the buildings were repurposed into hotels, and other occupancies. One of the buildings was imploded and the demolition materials filled

the tunnel under that building. The buildings that remained put up simple concrete block walls where the rail tunnel once came through the basement of the buildings.

Years later a utility contractor was working in the area and hit a 30 inch city water main flooding the tunnel. The wall of water that flowed in the tunnel was so strong that it blew out the concrete block walls that the buildings had put up to shut off the tunnel into their basement. No one had properly back-filled the tunnel with dirt between the buildings, so the basements of all these buildings flooded with water and the debris from the previously imploded building causing significant losses.

4. *Unheated Spaces subject to freezing:* If you have areas that have no heat, or inadequate heat, and are subject to freezing temperatures, the pipes (sprinkler or domestic water) could freeze and rupture causing water damage. Low temperature alarms should be installed in unheated areas (such as sprinklered attics) to notify someone when the temperature drops below 40 degrees F. During periods of cold weather, supplemental heat should be provided to prevent freezing and bursting of pipes. For smaller areas, the sprinkler system may utilize anti-freeze solutions to prevent freezing.

   Parking garages are not heated, but often have dry pipe sprinkler systems. It is especially critical to check dry sprinkler systems before cold weather to be sure the dry sprinkler system hasn't tripped allowing water into the piping, which could freeze. Also, after trip tests on the dry pipe sprinkler systems, the sprinkler contractor should be sure they have opened all the drain ports to get the water out of the system to ensure no water is left in the pipes. If pipes are not properly pitched, water will remain in the pipes and is subject to freezing.

5. *Sensitive Critical Equipment (computer rooms/MRI):* Think about areas that have sensitive, critical equipment that can be damaged by water and determine what piping could expose these areas to damage (An example would be piping overhead or nearby a restroom). Consider having water detection in these critical areas to provide early detection and notification of moisture intrusion.

Phase 2: Mitigation—Risk Control for Water Damage Prevention

Once you have completed your risk assessment and identified all the **sources of water** and **site-specific features** and **operational procedures** that can increase the frequency or severity of a water release incident, the next phase is to implement additional management or engineering controls as part of a Water Damage Mitigation Strategy.

Engineering Controls

Engineering controls are physical hazard controls that can reduce the frequency or severity of a water release incident.

1. *Exercising Valves:* As part of a planned preventive maintenance program valves should be exercised (closed and opened) at least annually to ensure they can be closed in the event of a leak. If valves haven't been exercised in some time, you may encounter difficulties. Remember the following tips:

- Don't force the valve
- Don't be in a big hurry
- Use the lowest torque (turning force) possible
- Avoid using a cheater bar (a handle extension that allows for greater torque). A cheater bar should only be used in emergencies
- Turn the valve slowly to avoid water hammer. (If you open or close a valve too fast the line could rupture.)
- Listen closely. Sometimes you can hear the flow change when operating a valve. This will help determine if the valve is moving
- Always count your turns down and up. They should match

2. *Sump Pumps:*
Emergency Power/Alarm for Notification- Sump pumps should be on emergency power and include alarm notification locally and paging through the building notification system. Sump pumps should be tested to operate under regular and stand-by power with verification that the sequenced pumps will operate in succession after failure of any previous pump to operate.

Preventive Maintenance- Due to the critical nature of sump pumps in collecting and redirecting liquids and containing overflow conditions from pipe breaks, equipment leaks etc., a formal preventive maintenance schedule should be implemented to ensure these pumps will operate as intended. Frequency of tests and inspections should be in accordance with manufacturer's recommendations.

3. *Containment Flood/Spill Control Kit:* Flood/spill control kits should be assembled and staged in critical locations for use in responding to a water related incident. These kits should be staged in different areas (security, mechanical rooms) of the buildings to allow for quick access in case of an accidental water release. The kits should include:

- High-volume wet vacuum
- Discharge hose to be used with the wet vacuum (at least 30 feet long)
- Heavy duty sorbent brooms
- Wide rubber squeegee
- Heavy duty electrical extension cord (at least 50 ft. long)
- Mobile Cart to store above items on a mobile basis
- Pig tails (to provide flexible "curb" to isolate and prevent spread of water from a leak)
- Filled sand bags

4. *Check Valves:* Consider installing check valves in building sewer traps to prevent floodwaters from backing up in sewer drains.

5. *Low Temperature Alarms:* Consider providing low temperature alarms in unheated areas of the building (such as sprinklered attics) with monitoring by central station alarm service or at another constantly attended location to prevent freezing and bursting of pipes. When alarm indicates temperatures are dropping below 40 degrees, precautions should be taken to prevent freezing of pipes.

6. Leak Detection: Consider adding water detection in mechanical equipment rooms, the bottoms of risers, in vulnerable cable trays, and around AC units and hot water heaters. In an unattended

building, these alarms should be linked to pagers, or other form of remote monitoring. The detection can also be interlocked to shut down the flow of water to reduce the extent of loss in a release incident.

Management Controls

Management Controls are human element controls that can reduce the frequency or severity of a water release incident.

1. *Valve Labeling:* Review plumbing diagrams of domestic water, chilled water, hot water, sprinkler systems, and landscape watering systems to see where piping is located and the location of isolation valves for each system. Label each sprinkler riser and sectional control valve with a diagram showing the areas it serves. A diagram should be created for each floor showing the location of all valves above false ceilings, in stairwells, and in mechanical rooms. A valve list should be posted on the door (inside) each mechanical room, numbering and listing all the valves in the room and the system/area that the valve isolates. A diagram of valve locations in the room should also be provided to allow for quick identification. All valves should be labeled with a valve ID corresponding to the valve ID on the list so that a responding person can cross reference the needed valve, find it in the room, and close the valve to isolate a leak.

Labeling should target valves in mechanical rooms, stairwells, and those located above false ceilings which may be hard to locate in an emergency. For valves located above false ceilings, the access panels should be labeled with the valve number, and what area/zone the valve isolates.

In addition to posting the valve lists on the appropriate floors, a master list and diagrams for all floors should be kept in central locations such as the management office and maintenance shop for easy reference in an emergency.

2. *Monthly Inspections:*

- Test basement flood control and sump systems
- Check all plumbing systems
- Check all drainage systems and investigate the source of any standing water
- Replace any leaking fittings and clear clogged drains immediately
- Make sure roof drain outlets are clear of debris
- Make sure downspouts release water away from the foundation

3. *Training & Education:* Once the valves are all labeled, training should be provided to all Security, Facilities, and Property Management staff regarding the location of all valves for quick isolation of leaks. Security guards, Facilities staff, and Property Management staff should be trained to provide an **early emergency response** and to manually shut down systems, where appropriate. During periods where sites are unattended water detection alarms should be linked to pagers, or other form of remote monitoring to notify and solicit a response to release incidents.

4. *Security patrols:* Security patrols should include routine checks for water leaks in mechanical rooms, restrooms, locker rooms, computer rooms, and any other areas with known water sources. Security staff should be trained in how to respond upon discovering any release incident. In case of unoccupied residential (apartments, hotels, condominiums), regular checks of plumbing,

fixtures, HVAC, and windows should be made to look for issues that could lead to water release incidents or freezing of pipes.

5. *Management of Contractors:* Contractors who will be performing work on site should sign in upon arrival at the facility. They should be escorted to their work location and facilities staff should review with them the scope of their work and show the contractor the specific shut-off valves that control the systems upon which they will be performing work. Facilities staff should also notify security and any off-site monitoring company when systems will be tested or undergo maintenance procedures to prevent activation of alarm systems during the contractors work.

Phase 3: Preparedness—Flood- & Water-Related Perils Response Plan

Experience has shown that actions taken during emergencies are usually ineffective *unless* planning has been done in advance. A well thought-out plan that is written, properly implemented, periodically rehearsed/tested, and revised as needed, will facilitate an effective response in a water release incident. The planning process should be broken down into the Pre-Incident actions, Emergency Response actions, Restoration Actions, and Post-Incident actions. A good response plan will accomplish the following key objectives.

- Establish a clear line of authority to activate the plan, direct resources, approve immediate financial expenditures, and shut down operations if necessary.
- Assign duties to Security, Engineering, and Housekeeping to coordinate effective notification and response.
- Identify appropriate actions to contain the source of the water (shut a valve, etc.).
- Identify appropriate actions to limit the spread of water on the floor and into spaces below the floor where the water release occurred.
- Create procedures to safely isolate and shut down electrical equipment.
- Determine the actions needed to relocate or protect key equipment/material.
- Identify appropriate actions to take so that restoration operations can begin as soon as the flood control phase is completed**.**
- Create a list of emergency contact information for water damage restoration companies and pursue written agreements outlining their promised response time and hourly cost information to reduce the potential for delayed response or excessive charges after an event.

<u>Mitigation</u>—<u>Pre-Incident Actions</u>:

- Assemble and place Flood Control Kits at key locations in the facility
- Map location of all shut-off valves and the areas they control for domestic water, HVAC, fire sprinklers, and lawn sprinklers. Include this map in Flood Control Kit and post list in each mechanical room to correspond to labels on the actual valves.
- Label each valve with the area it controls at the valve.
- Train all Safety, Security, and Facilities staff in the location of shut-off valves for quick isolation of leaks.
- Install Permanent Flood Control Fixtures where needed (Ex: Flood Gates)
- Install Contingent Flood Measures where needed (Ex: Brackets to which flood gates can be attached to protect entry doors, windows and exterior steps leading below grade)

- Prepare and stage Emergency Flood Measures (Ex: Sand Bags already filled with sand)

Response—Emergency Response Actions:
- Locate & isolate leak or water intrusion
- Relocate persons potentially affected
- Protect furnishings & equipment
- Move elevators to a floor above the leak
- Contain spread of water with Flood Control Kits
- Identify and shut-off electrical equipment threatened by water

Restoration Actions:
- Initiate steps (within 72 hours) to remediate the effects of water damage to prevent mold
- Telephone list of experienced outside contractors for clean-up and restoration assistance
- Vacuum water off floor
- Extract water from carpets/rugs
- Exchange or replace water damaged supplies, fixtures, furnishings and equipment

Post Incident Actions:
- Keep records of costs incurred to prevent further damage, to repair damage and to replace damaged equipment and contents
- Submit claim to Risk Management Department
- Provide receipts and cost data to accounting for recovery costs from insurance company.

A flood- and water-related peril emergency response plan that provides the necessary structure for managing critical incidents is of vital importance to any organization. However, an emergency response plan will not work properly unless realistic training is provided and it is thoroughly tested prior to implementation in an actual emergency. Training and testing activities help to identify areas in need of improvement and enhance communication and coordination among key personnel.

Conclusion

Water damage is a leading cause of property loss and is often overlooked in emergency planning activities. Get a handle on your exposure to water related loss events by taking specific steps to address the hazards in your facility.

1. Perform a **Risk Assessment** of the sources of water in your facility and the site-specific features and operational exposures and that increase the potential for water damage in your facility.

2. Determine if existing controls are adequate, and if they are not, implement additional **Risk Control Measures** (management and engineering controls) to reduce the frequency or severity of a water-related loss event.

3. Improve your **Preparedness** by creating a formal Flood & Water Related Perils emergency response plan.

The key to emergency preparedness for any exposure is an accurate understanding of the risks and challenges you face. Underestimating or not identifying your exposure leads to complacency and failure to prepare effectively. Do not underestimate the power of water and the damage it can leave in its wake. Be proactive and formulate your plan today.

Bibliography

Institute for Business & Home Safety (IBHS). (2002) "Protect Your Commercial Property From Water Damage." Retrieved January 13, 2012 from: http://www.giis.org/Business_Water_Damage.pdf

Institute for Business & Home Safety (IBHS). (2006) "Water Damage Prevention for Commercial Buildings; The Building Envelope." Retrieved January 13, 2012 from: http://safe-wise.com/downloads/PreventWaterDamage-Building.pdf