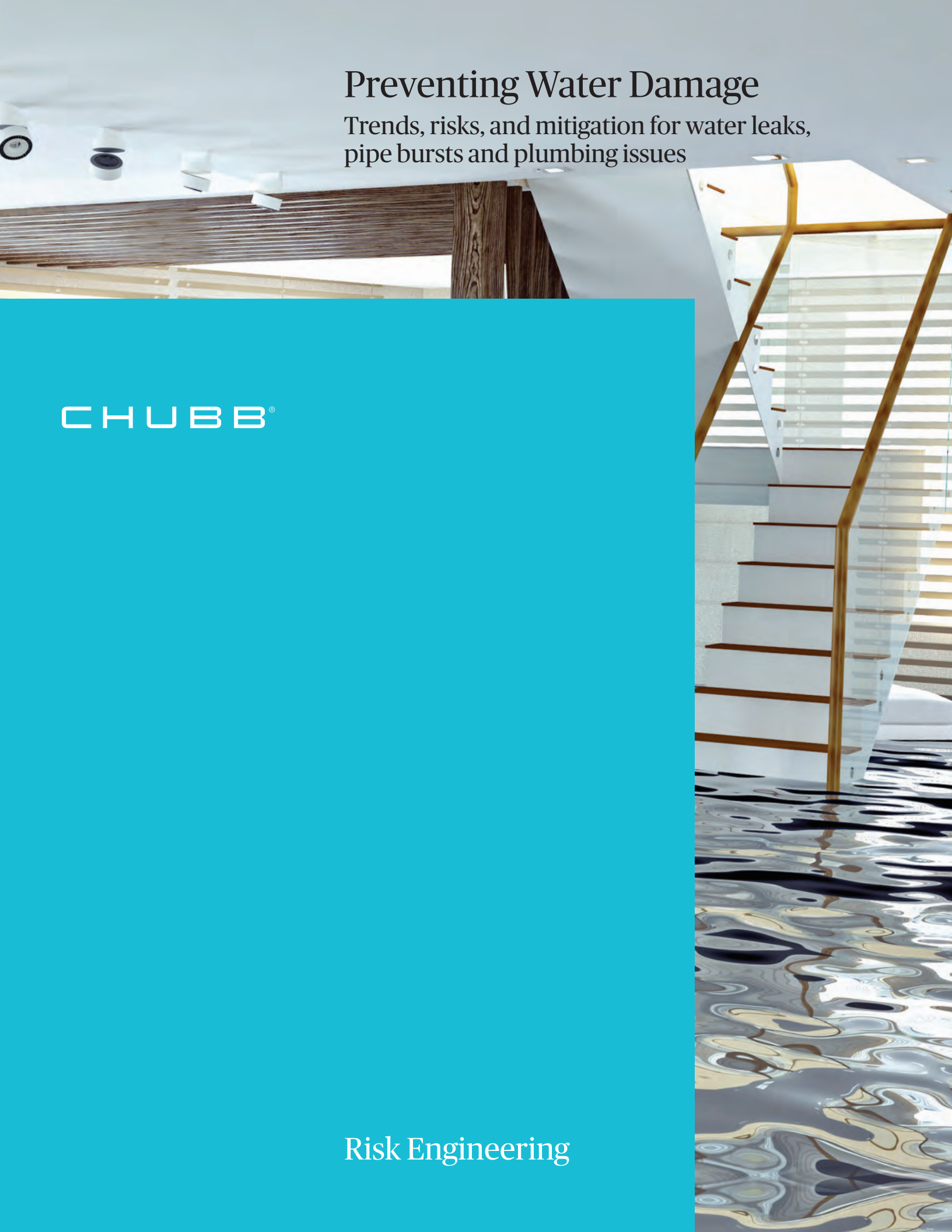


Preventing Water Damage

Trends, risks, and mitigation for water leaks, pipe bursts and plumbing issues

CHUBB®

Risk Engineering



Contents

Water Damage and How it Affects You and Your Business	4
How Chubb Can Help	9
Specific Tips for Preventing Water Damage	12



Burst pipes, roof leaks, overflowing toilets, and leaking appliances can cause significant damage, with losses ranging well into the millions of dollars. These types of water damage can also result in business interruption, relocation costs, lost rents, and can negatively impact your reputation as a business.

While Chubb is dedicated to providing exceptional claim service, we also want to help you prevent issues from happening in the first place. This white paper was developed to provide risk managers and facilities managers with the knowledge and tools to understand the risks associated with non-weather-related water damage, develop a risk mitigation plan to prevent it, and take specific and actionable measures to protect your assets and reduce the impact and costs of water damage to your business.

We will start by looking at the problem. How big is the water damage issue? How could it affect your business, as it has affected others? What is Chubb seeing in water damage loss trends based on our commercial experience? And what are the causes and sources of water damage? We will talk about how Chubb can help you assess the risks and decide on a solution, and will then provide you specific measures you can take to prevent water damage in your own business.

Water Damage and How it Affects You and Your Business

Water Damage from leaks, pipe bursts, and other plumbing issues - more costly and common than you might think

\$1.2B

USD - Chubb estimated annual non-weather water damage losses (Global)

2nd

most frequent claim for homeowner's insurance is water damage or freezing, second only to wind/hail, from 2013-17¹

\$13B

USD - in 2017, the total amount of homeowners insurance payouts from water damage¹ (North America)

Tripled - number of annual homeowners water claims costing more than

\$1M

USD - since 2015 (Chubb statistics)

#3

Water damage is the 3rd most common global claim received based on analysis of more than 470,000 insurance industry claims from 2013-2018²

\$89,000

USD - Mean loss of commercial water damage loss based (Chubb statistics)

19.5%

of homeowner's insurance incurred losses are from water damage and freezing¹ (North America)

250

gallons - amount of water that can leak from a 1/8" pipe crack in one day

8.7

years - average age of failed washing machine supply hoses³ (North America)

75%

of water heaters fail before they are 12 years old. The average age of a failed water heater is 10.7 years³ (North America)

Doubled - number of annual homeowners water claims costing more than

\$500,000

USD - since 2015 (Chubb statistics)

3,000

gallons (11,356 L) - a faucet leaking at the rate of one drip per second can waste over 3000 gallons (11,356 L) of water in a year

\$75

billion USD - estimated cost for replacing corroded piping systems in the U.S. alone, even with proper application of countermeasures⁴

\$10,234

average water damage and freezing homeowners claims cost from 2013-17¹ (North America)

Top 10 List

Water damage ranks #8 out of the top 10 global causes of loss by total value (at 3% value) based on analysis of more than 470,000 insurance industry claims from 2013-2018²

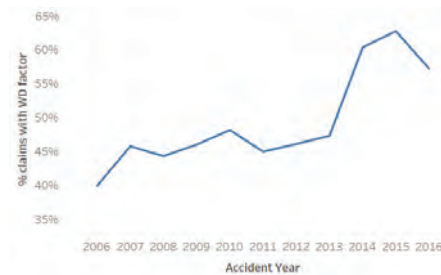
What Chubb is Seeing in Water Damage Loss Trends

Chubb is seeing more water damage claims in taller and higher valued buildings that involve leaks and pipe burst events. (North America)

According to insurance industry statistics, the frequency and cost of water damage losses are continuing to increase. While no business class is truly immune, commercial real estate (especially high rises), habitational, hotel, and health services industry classes are experiencing significant interior water damage claims. Chubb's loss experience mimics these findings.

Chubb has seen a significant increase in the number of claims involving interior water damage since 2013, especially within commercial real estate.

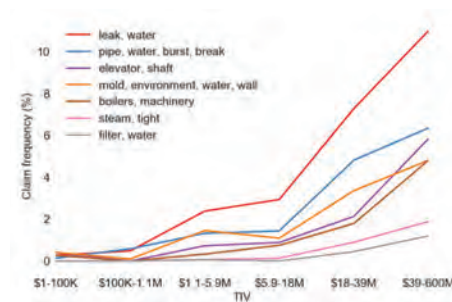
% of Total Claims that Included Water Damage



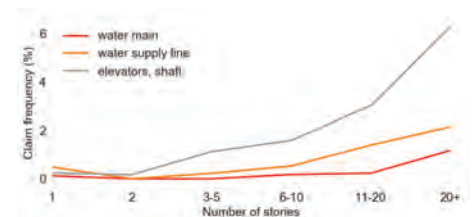
% of Claims that Included Water Damage, Based on Type of Building



Water Damage Increases in Higher Valued Buildings



Water Damage Increases in Taller Buildings



Could it happen to your business?

The short answer is yes. Consider the following real claims scenarios:

Hospital pipe freezes and bursts, forcing patients to nearby facilities

An unusual cold snap in January caused a pipe to freeze on an upper floor of a medical building. The pipe burst, sending over 200,000 gallons (757,082 L) of water onto several floors below. The water damage affected numerous departments, including Pediatrics, OB/ GYN, NICU, Maternity, and L&D, causing hundreds of patients – including infants – to be transferred to neighboring hospitals. The event made the news on all major TV

outlets. Staff members worked around the clock for three weeks to restore operations, though work to complete repairs took over a year. The business interruption loss was well over \$1 million USD and the total loss was over \$4 million USD. The size of the loss directly impacted their insurance and ability to attract carriers.

Valve coupling failure caused water damage to 16 floors of office high rise

A major water leak was reported when a pressure relief valve coupling failed on the 16th floor of a 21 story multi-tenanted office high rise. The water flowed for at least an hour from the 16th story all the way down to the basement causing extensive damage to the electrical feeds on most floors.



The brass and steel fittings experienced galvanic corrosion resulting in failure of the coupling. Water damage occurred on numerous floors wrecking havoc on suites, mechanical and electrical rooms, offices, and elevators. Main electric bus risers were a total loss, and would take months to replace. Carpeting was totally destroyed on most floors. Business interruption was approximately 6 months. Total loss was \$6.5 million USD.

Massive water leak in hotel/apartment complex damaged 18 floors

A pipe reducer fitting failed on the domestic water supply line in the 18th floor riser room of a 32-story high rise hotel, causing a massive water leak. The building, containing hundreds of guest rooms and apartments, had recently undergone renovations. Over 65 units were damaged from the water, as well as building common areas, corridors, main lobby, electrical riser rooms on 18 floors, and almost all elevators. The hotel lost income associated with rents for displaced tenants and limited hotel room availability during period of restoration. The total loss was \$4 million USD.

Manufacturing plant pipe burst, forcing product development elsewhere

In the middle of winter, a pipe burst in a manufacturing plant, destroying key hardware and a critical development lab, which directly impacted the schedule for a new technology product. The development lab restoration took almost a year, and alternative lab space had to be outsourced to reduce schedule delays. The business interruption loss was \$3 million USD.

Educational building loses steam pressure; pipes freeze throughout

The client had recently completed a full renovation of floors one through four of his seven-story educational building, housing offices, labs, classrooms, and conference rooms. On a frigid January evening, the building lost steam pressure for over three hours, causing pipes to freeze in multiple locations. The building's mechanical, electrical and plumbing systems sustained extensive water damage, as did interior finishes. The damage reached from the 6th floor down to basement. Losses totaled \$4.5 million USD including business income.

HVAC unit fails in life sciences plant

When a threaded coupling on a water pipe attached to an HVAC unit failed in a pharmaceutical manufacturing plant, over 12,000 gallons (45,425L) of water rained down on the first floor. Approximately 15,000 ft² was affected, including the active ingredient manufacturing area, 10 clean rooms and special equipment. The loss totaled \$4 million USD. Business income loss was contingent on the need for extensive clean up, re-validation per regulatory guidelines, and production cycles.

Galvanic corrosion is one of the most common types of corrosion

Discovering the Root Causes of Water Damage

Domestic Plumbing Leakage and Corrosion

Domestic plumbing is a primary culprit of water damage within all types of commercial buildings. Most claims involve leaking pipes caused by corrosion, pipe burst, or failure.

Contrary to popular belief, age alone is not responsible for many pipe failures. Instead, the failure to prevent and control corrosion is the root cause. Unfortunately, most corrosion is internal and is not easily identified until defects that could lead to a leak and water damage. Galvanic corrosion is one of the most common types of corrosion. The rate at which it happens is based on water pH, oxygen levels, chemistry, temperature, and velocity.

Refer to “Specific Tips for Prevent Water Damage” on page 12 for high impact, actionable recommendations to help prevent pipe leaks and burst.

Lesser Quality Pipe

Over recent years, we’ve heard increased plumbing industry chatter blaming the corrosion and water damage problem on lesser quality pipe. Contractors often report wide-spread pipe corrosion or

failure, despite material specifications meeting industry standards. Failures also happen despite well-maintained chemical water treatment programs and high priority corrosion control programs.

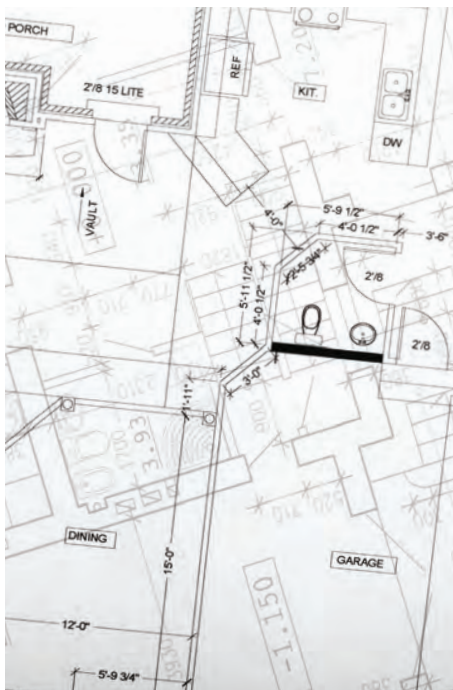
Corrosion professionals have reported older closed piping systems from the 1950s and earlier, with no history of chemical treatment, still exhibiting high and uniform wall thickness near new (ASTM) factory specifications. This is in stark contrast to the aggressive corrosion trends being verified today by those in the corrosion prevention industry.⁷

According to the plumbing trades, pipe (since around the millennium) is of lower quality—both in physical uniformity as well as in corrosion resistance. Lower quality is not only common for carbon steel pipe, but also for galvanized steel and even copper pipe.

Historically, almost all steel pipe was manufactured at or above its ASTM-defined wall thickness specification. Unfortunately, most pipe manufactured today is undersized, and often at or very near the 12.5% lower tolerance limit allowed by ASTM. Market pressures have forced pipe manufacturers to take full advantage of the wide +/- 25% wall thickness tolerance that still exists from the early 1900s.⁷



How Chubb Can Help



No matter what your business, Chubb believes the solution to water damage losses is a balance of the following three factors:

1. Risk appreciation,
2. Risk assessment (including a water damage mitigation plan), and
3. Water detection technology to address the inevitable gaps.

We've already discussed the risks associated with water damage from interior leaks, pipe bursts and other plumbing issues, and how they can affect your business continuity. Now, let's look at what you and Chubb can do to help.

Designing Your Water Damage Mitigation Plan

Even buildings with high quality water, new plumbing systems, and formal inspection and preventative maintenance programs can experience leaks. And, the newest water detection technology is only as good as where you install it. That's why it's so important to have a formal water damage mitigation plan in place. Below, we've provided a checklist to get you started:

Personnel

- Make sure senior management believes in and actively promotes the importance of the plan organizationally.
- Include organizational, employee, and contractor notification charts.
- Identify and decide how you'll quickly notify key personnel, such as risk management, engineering, maintenance, security, facilities, etc.
- Authorize and train key employees at least annually on how to shut down and isolate systems in an emergency event.
- Assign an accountable coordinator to be in charge of the water damage response program.

- Write action items (such as training needs) into the annual performance goals of the water damage coordinator.
- Add incentives to the coordinators' goals related to the plan.

Equipment

- Schedule formal inspections for older piping systems, hot water heaters, plumbing hoses, HVAC, or other systems.
- Install leak detection and/or automatic shutdown devices in susceptible equipment rooms, within or around HVAC units, laundry units, kitchens, bathrooms, hot water heaters, and other high sensitivity areas.
- Affix identification tags on critical valves, indicating what portion of the system they control.
- Review sprinkler valve closing procedures during emergency events with your local fire department. Normally, only the fire department should shut down a fire sprinkler valve upon response to a fire emergency, as fires could reignite.

Be Ready If Something Happens

- Put together emergency supply "spill control kits" equipped with materials to mitigate damage from escaped liquids.
- Explain any extraordinary measures that need to be taken to prepare for cold weather, hurricanes, micro-bursts, or flooding.

Keep the Plan Up To Date

- Update the plan at least annually.



A water leak detection system like this one will alarm if the water level gets too high.

Chubb Risk Management Assessment Tools

Chubb’s dedicated team of risk engineers can provide you with proprietary tools to assess the water damage exposures specific to your business. Chubb’s Risk Management Assessment tools can help you with:

- Risk Awareness and Assessment
- Contingency Planning
- Pre-incident actions including contracts with emergency restoration contractors
- Key equipment and below grade susceptibilities
- Domestic water systems
- Storm and waste-water systems
- Automatic sprinkler systems
- Building envelope and roof coverings
- Change management and project management
- Construction & Builder’s Risk water damage prevention

Please contact Chubb Risk Engineering for more information on these tools.

Why Water Leak Detection Technology is the Next Big Thing

The ever-growing market of Internet of Things (IoT) water detection sensors, flow sensors, and automatic valve shut off devices is the market response to the very real and costly dilemma of water damage. Experienced facilities managers and proactive building owners are installing entire residential and commercial building water detection and shut off systems and are anecdotally touting the ROI as undeniable. These systems are clearly becoming an integral part of the water damage solution when installed in concert with robust operational inspection, preventative maintenance, and water damage mitigation plans.

Water leak and shut off sensor systems are becoming smaller and easier to install, with lower prices and better capabilities. And, there are more of them available on the market than ever before.

The most effective water leak detection technology today includes the following characteristics:

- Battery powered sensors with an alarm signal and a primary powered system with battery back up
- Sensors that send an alert via email or text
- Monitoring by a third party who can then alert the appropriate people
- Systems with sensors, an alarm signal, and water shut-off capability
- Sensors that measure water flow and can detect an abnormal flow “signature” such as a leaking appliance or toilet running
- Contact and wicking sensors
- Acoustical water flow measuring devices that take continuous sound measurements from the pipe and use machine learning to transform those signals into waterflow estimates. This information can be used to monitor water usage, and alert users real time about potential leak events.

Making a case for the cost of a leak detection system

Before deploying any new technology, you’ll need to prove an adequate return on investment (ROI). Since water leaks will happen in the life span of commercial buildings, especially for longer-hold properties, resulting in large repair costs, leak detection systems present an efficient return on investment.

The installation cost for most commercial grade water detection systems today ranges from \$0.20-1.75/ft² (USD) depending on the specific type of occupancy. For example, the cost of installation for a high rise residence with many bathrooms will lean toward the higher end.



Making sure the technology is successful

To help ensure that water leak detection and shut off technology is successful, consider how your business will install, maintain, and test it.

Installation:

- Chubb recommends meeting UL standards or equivalent approvals.
- Look for proof of certification and compliance to the standards and/or approvals.

Maintenance and testing:

- Anything battery powered should be routinely checked to ensure it is still operating.
- Follow manufacturer's instructions on battery replacement. Many systems today also incorporate battery monitoring features to alert end users to low charge conditions.

- Regular testing to ensure the devices have not been moved, disconnected, or damaged is a best practice. Self-diagnostic features can help ensure the system is fully operational.
- Update software regularly on systems that are connected to the internet, in order to mitigate cybersecurity risks.
- Look for systems that have undergone cybersecurity assessment.

There are many practical considerations you may be faced with in deploying these technologies. Reach out to Chubb Risk Engineering for assistance.

Take Action Now

Contact Chubb Risk Engineering for more ideas and answers to your questions.

Specific Tips for Preventing Water Damage



To Prevent Bursting or Leaking Pipes

- Look for *visible corrosion*. For example, green on copper is an indication of cold water pitting, which normally occurs within the first four years of the installation.
- Listen and watch for *rattling, shock, or vibration* when water is turned on or off, as this can indicate a velocity or piping support issue.
- Replace piping that is over 40 years old. Start watching at 20 years.
- Look for *blue or green staining* on sinks or taps, which can indicate high concentrations of carbon dioxide or a low water pH.
- Check for *acidic water*. Low pH water (7.2 or below) can corrode pipes and fittings.
- *Treat hard water*. Hard water (with significant mineral content) can cause pitting.
- Measure your water pressure. Pressure above 80 psi / 552 kPa and velocity of more than 4 FPS (1.2 m/s) can result in pipe burst.
- Monitor the water meter for water usage. Check with your water company to get a historical baseline.

**The above list is not intended to be an all-encompassing corrosion prevention list. Consult with a water treatment professional to discuss specific corrosion treatment options.*

To Keep Roofs From Leaking

- Conduct routine inspection and maintenance to help anticipate possible problem areas and have them fixed before the intrusion of water causes a serious problem.
- Repair blisters, ridges, wrinkles, cracks, tears, open seams, punctures, pinholes or other conditions.

- Repair split, cracked, or deformed flashings, especially at edges, corners, and skylights.
- Improve drainage where ponded water remains beyond 48 hours.
- Unclog roof drains and gutters, especially from ice dams.
- Safety remove excess snow and ice from the roof
- Ensure good drainage around mechanical and HVAC units

To Prevent Bathroom and Kitchen Plumbing Issues

- Keep an eye on toilets, sinks, and other common bathroom fixtures, especially in multi-story buildings, with stacked plumbing, as they are a leading cause of water damage.
- Inspect all plumbing hoses periodically, especially their coupling connections. Hose failures from washing machines and kitchen appliances are common.
- Replace hoses that show signs of imminent failure such as blisters, bulges, bubbles, cracks, unraveling, discoloration, crimps or kinks especially near connections and turns in hose.
- Replace all hoses within the manufacturer's recommendations, even hoses that appear to be functioning normally. Chubb recommends hoses be replaced every 3-5 years.
- Install water detection sensors and/ or automatic shut off valves behind toilets.
- Consider installing water detection sensors and/or automatic shut off valves under sinks, dishwashers, ice makers, laundry washing machines, and other appliances.



Typical Lifespan of a Water Heater is 8-10 years. Do you have a Replacement Schedule?

Keep Fire Sprinkler Systems in Top Condition

- Strictly enforce compliance with NFPA 13 and 25 fire protection standards.
- Repair any physical or mechanical damage, or corrosion to sprinklers, pipe, hangers, and related equipment.
- Train your staff to know exactly what to do in the event of a sprinkler waterflow alarm. Preplan your response with your local fire department.
- Ensure that low temperature alarms are installed in any sprinkler riser room where temperatures may reach below 40°F (4°C).
- Confirm that a 5-year internal pipe inspection is conducted to ensure the sprinkler pipe itself is in good shape.
- Inspect and annually test antifreeze systems and solutions to ensure they are effective in preventing freeze ups.

Prevent Water Heater Issues

- Even if they look good on the outside, replace hot water heaters at least every 10 years, as they have a high failure rate after 7-10 years. Check the date stamp on the specification plate.
- Routinely look for signs of rust and corrosion.
- Keep water pressure no higher than 80 psi / 552 kPa.
- Install a catch pan (drip pan) under the heater to catch small leaks. Make sure it is connected to a waste line or other means of removal.
- Add a water detection sensor and/or automatic shut off valve near the heater.

Prevent Water Damage on Vacant Property

- Pay special attention to preventive measures in vacant properties because they lack the day-to-day activity that naturally mitigates common hazards.
- Ensure there is adequate heat for boilers and machinery that have not been drained.

- Drain and disconnect kitchen and other appliances that use or contain water.
- Shut off water in all areas of the building where it is not needed.
- Drain water pipes and add environmentally friendly antifreeze to any areas where water might remain, such as drain traps.
- For areas protected by wet pipe sprinkler systems, maintain adequate heat (of at least 40°F (4°C)) to help prevent freezing water in sprinkler pipes.
- Add a low temperature alarm connected to a UL Listed Central Station that detects temperatures that drop below 40°F (4°C) in any area.

Keep HVAC Equipment Working Well

- Look for clogged drains, frozen evaporator coils, and pipes not properly connected, which are primary culprits for HVAC leaks resulting in water damage.
- Change the HVAC filters regularly to keep the unit from overworking, which can cause freezing and defrosting on the evaporator coils.
- Check the condensation drain line monthly to ensure it's clear. When the unit is running, check the line to ensure water is flowing to the drain.
- Follow a formal maintenance program for the HVAC equipment that is consistent with the manufacturer's guidelines.
- Install water detection sensors in the units so they will automatically shut down if the level of water in the condensate pan is too high above normal operating levels.
- Deploy additional sensors into unheated spaces that have piping concealed spaces.



Boiler Rooms are Especially Prone to Water Damage Events

Boiler Room Exposures

- Pay special attention to multiple boilers and hot water heaters located throughout a facility (e.g. a multi-story building), as they can present more water damage exposure than those at grade locations.
- Ensure temporary heat is available in the event of a boiler outage, especially in the boiler room.
- Conduct formal preventative maintenance and inspections on boiler room pipe/trim, fittings, feed water valves, circulating pumps, pressure relief valves, and expansion joints.
- Keep floor drains clear in these areas to accommodate potential discharge.
- Install floor sills / bunds around chillers and boilers, especially when located on upper floors, along with drainage, to prevent leakage events from impacting lower floors.
- Have a qualified contractor inspect and test backflow prevention devices on main water feeds regularly.
- Install water detection devices tied to a constantly attended station.

Prevent Sewer and Waste Water System Backups

- Pay special attention during times of heavy rain, as sewers can get overwhelmed, become blocked, resulting in a back-up causing polluted water to flow directly into the building. Inundation often includes backup of sewers in this manner.
- Have an emergency plan for shutting down inflow systems.
- Conduct internal pipe inspections on waste water lines to help ensure they're not clogged.
- Building has single-stack waste, drainage and vent which are especially prone to back up issues. Install water detection systems behind these systems.
- Keep floor drains clear and fitted with check valves to keep water from flowing back into the building.
- Put a formal preventative maintenance plan in place for waste water systems to ensure they are not blocked or clogged, and repairs can be made quickly.

Keep Water Storage Tanks Secure

- Conduct internal and external inspections of all storage tanks installed atop buildings to supply domestic plumbing and fire protection systems. Any tank supplying fire protection water should comply with NFPA 25 to limit tank failure and provide a minimum standard.
- Look for visual signs of leakage, rotting, pitting, excessive corrosion, spalling, loose exterior bolts, and related items.
- Conduct and document an internal inspection of tank feeding water-based fire protection systems at least every 5 years.

Water Storage Tank Rooms, such as Fire Protection Tanks, are Common Sources of Water Damage

- Conduct an ultrasound test on metal tanks to ensure the integrity of the tank. Use a qualified tank inspection contractor and follow ASTM standards.
- Go beyond the exterior. A freshly painted tank is in no way indicative of the condition of the underlying steel or the interior condition of the tank.

Prevent Water Main Breaks

- Take special care during extreme weather conditions, as water main breaks often happen then, causing water to flow into the buildings in the area.
- Replace iron water mains, typically installed before 1980, as iron has a tendency to crack when it expands or contracts due to temperature changes.
- Look for soil erosion from a previous pipeline break, excavation or nearby construction activity. Eroded soil around water mains can cause breaks.
- Replace old water mains, as the break rate for pipes increases after 60 years.
- Work with contractors to prevent unintentional damage from hitting mains with excavation equipment.
- Ensure hydrants are opened/closed slowly to prevent water hammer.

Prevent Water Damage - by Taking Proactive Steps and Working with Chubb

The water damage problem is not going away anytime soon, and certainly not on its own. The risk and cost to your business, and bottom line, is very real.

Loss trends show the frequency and cost is only increasing. The sources of water in any building are many, and the factors that contribute to large loss events can be effectively managed with risk appreciation, good preventative maintenance, and state of the art technology.

Your business cannot afford to underestimate the risk. Secure your bottom line though:

1. Risk appreciation,
2. Risk assessment (including a real plan), and
3. Deploying water detection technology to address the inevitable gaps.

Take Action

For more ideas about how to protect your business, contact your local Chubb Risk Engineer or visit us at www.chubb.com/engineering.





Cited References

1. Facts + Statistics: Homeowners and Renters Insurance, ISO, <https://www.iii.org/fact-statistic/facts-statistics-homeowners-and-renters-insurance>
2. Allianz Global Corporate & Specialty Global Claims Review, <https://www.agcs.allianz.com/content/dam/onemarketing/agcs/agcs/reports/AGCS-Global-Claims-Review-2018.pdf>
3. Insurance Institute for Business & Home Safety, <https://ibhs.org/>
4. 21 Types of Pipe Corrosion and Failure, (<https://www.corrosionpedia.com/21-types-of-pipe-corrosion-failure/2/1484>)
5. Corrosion & Leaks in Copper or Steel Water Pipes, https://inspectapedia.com/plumbing/Pipe_Leak_Causes.php
6. History of Use and Performance of Copper Tube for Portable Water Service, <https://www.wsscwater.com/water-quality--stewardship/pinhole-leaks--corrosion-control/copper-pipe-white-paper.html>
7. Decline in Quality of Piping Making Corrosion Inevitable, <https://www.corrosionpedia.com/2/2017/corrosion/inevitable-corrosion-problems>
8. Lakomiak, Neil, Facilities Management, “Understanding New Leak Detection Technology” <https://www.facilitiesnet.com/facilitiesmanagement/article/Understanding-New-Leak-Detection-Technology--18322?source=part>

General References

NFPA 13 Standard for the Installation of Sprinkler Systems, www.nfpa.org/13

NFPA 25 Standard for the Inspection, Testing, and Maintenance of Water Based Fire Protection Systems, www.nfpa.org/25

UL 3225 Outline of Investigation for Water Leak Detection Systems, www.ul.com



Authored by
Erik Olsen
Vice President, Executive Property Specialist,
Risk Engineering Services

Chubb. Insured.SM

Chubb is the marketing name used to refer to subsidiaries of Chubb Limited providing insurance and related services. For a list of these subsidiaries, please visit our website at www.chubb.com. This document is advisory in nature and is offered as a resource to be used together with your professional insurance advisors in maintaining a loss prevention program. No liability is assumed by reason of the information this document contains. Form 09-01-0183 (Ed. 1/20)