



Protecting Your Facilities from Winter Storms





Don't Underestimate the Fury of Winter

Without much warning, plummeting temperatures, gusting winds and heavy snow can create a powerful, devastating weather event capable of collapsing roofs, rupturing pipes, flooding widespread areas—and possibly wreaking havoc on your operations. And, it is not only northern locales that are vulnerable

to winter's fury. Even areas of the world unaccustomed to freezing temperature and heavy snow that often accompany a harsh winter may be at risk. That's because unusual weather changes can occur any place in the world. In fact, facilities in areas unfamiliar with severe cold and deep snow accumulation tend to suffer the greatest and most costly winter weather losses because they are not equipped to endure these conditions.



If you are not prepared for extreme weather conditions, you could find yourself confronting property damage, business interruption—even lost market share. But, there are sound loss prevention measures you can take to protect your facility and minimize the destructive impact severe weather may have on your operations. At FM Global, we have been helping organizations like yours develop defenses against unexpected, severe winter weather for more than 175 years. Our engineers work with you to identify measures that will prepare and protect your facility against the problems brought on by freezing temperature, and tailor these measures to meet your facilities' specific needs.

Assessing Your Vulnerability

To prevent a significant winter weather-related loss from unfolding at your facility, you must first determine your exposure—for example, the potential for mounding or drifting snow on rooftops—and establish an emergency plan that addresses identified vulnerabilities. Among the questions you should ask to determine your level of exposure are:

- Does your locale usually experience temperate winters?
- Would wind direction or wind chill affect your facility's ability to withstand freezing temperatures?
- Has your locale ever experienced freezing temperature or several inches' accumulation of snow or ice?

- Do you shut down operations during winter holidays or on weekends?
- Does heat generated by process equipment also supply or supplement building heat?
- Does building temperature drop when process equipment is shut off?

If you answered yes to any of these questions, you could be at risk during severe winter weather.

Loss Prevention Solutions

To ensure your facility is well-protected, you should review operations to determine key areas vital to business continuity, protect equipment against freeze, flood and similar damage when possible, and

develop and test a contingency plan that addresses such issues as loss of critical plant instrumentation, fuel curtailments and fire protection systems. Here's a closer look at some of the specific issues you need to address in order to combat your fiercest winter adversaries: collapse, freeze-up and flood.

Collapse

Whether you're hit by a single storm with heavy, wet snow and high winds or a series of smaller storms, the result is the same: deep accumulation of snow on your roof that can lead to overloading and collapse. Worse, the collapse can lead to all kinds of other problems, such as damage to or destruction of sprinkler piping, electrical conduit, and gas, oil or other flammable liquid lines suspended under the damaged roof—even the introduction of a fire hazard caused by damage to wiring, gas lines and process piping carrying flammable liquid. Add heavy rain to the scenario and the potential for significant loss becomes that much greater. Blocked drains, an inadequate number of drains, or poorly located drains may prevent the runoff of melting snow, which accumulates and freezes to a more dense layer of ice, further compounding your problems.

According to FM Global studies, snow load is the most serious cause of roof collapse. And, while the majority of these collapses have involved multilevel flat roofs where snow drifts occur due to a change in

roof elevation, other configurations also have contributed to loss statistics. They include bowstring wood-truss roofs, multi-gable roofs and sawtooth roofs. Even canopies over walkways and shipping areas, as well as steel deck, boards on joists and metal roof systems, have proven to be susceptible to collapse.

But, a collapse, in some cases, is the result of more than just one factor. Poor construction, along with excessive snow, ice and rain loads are all major contributors, regardless of whether the roof's specified design strength meets local codes. And, local building code requirements may be even less than the loads that have resulted from snow storms that have already occurred.

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To safeguard your facility from possible collapse, always keep the roof well-maintained, free of excessive snow, and ensure all drains remain clear. You also should review your roof design well before winter using FM Global Property Loss Prevention Data Sheets 1-54, *Loads for New Construction*, and 1-55, *Weak Construction and Design*. This should include a review of the drainage system, which is critical when rain falls on a snow-covered roof. Older codes usually did not include the current requirement for secondary drainage, which provides adequate drainage even when the primary drainage system is clogged. This is especially critical when there are parapets that allow snow drift to accumulate and block the primary drainage system.

The following are other measures you can take to avoid collapse:

- Inspect the roof structure for weaknesses and snow-loading capacity, especially in areas where drifting snow can accumulate, such as changes in roof elevation (older building codes did not require heavier design loads for these areas). Buildings with metal roof systems also are especially vulnerable if the purlins have not been adequately braced or otherwise designed according to the 1996 (or later) edition of the American Iron and Steel Institute Specification for the Design of Cold Formed Steel Structural Members.
- Ensure your facility's winter emergency response plan includes a section on removing snow and ice from the roof. Train your emergency response team (ERT) to properly remove snow from roads (particularly those used for fire department access, as well as those leading to fire protection equipment), control valves, hydrants, hose houses, doorways and roofs.
- Identify loads added since the building was constructed, such as equipment hung from the roof. Reinforcement may be needed, especially in areas where drifting snow is likely to accumulate; make sure the roof is reinforced to handle the additional load.

- Check annually for loose connections (especially bow-string trusses), members that have been removed during renovations, sagging or twisted roof supports, or signs of rot or corrosion.
- Ensure shovels, wheelbarrows and snowblowers are readily available for crews to remove snow from the roof to prevent overloading. Adjust the height of the snowblower's blade so it does not damage the roof. When using the snow blower, take care not to create drifts. Avoid using ice choppers on the roof, as they may damage the roof cover.
- Check drains, scuppers and downspouts to ensure they are free of debris. It may be helpful to clear paths to the edge of the roof and drains depending on the pitch of the roof, low spots and the location of drains. Where practical, install and maintain heat tracing inside gutters to assure a clear path for snowmelt. Downspouts may be truncated above the potential level of snow banks. Alternatively, open-channel downspouts may be used.
- For new construction, ask your FM Global engineer to review your plans and specifications for potential hazards. Ensure equipment or structures such as conveyor enclosures, dust collectors, cooling towers and water tanks meet anticipated snow loads.

In addition, you should continually monitor roof conditions and put your snow removal plan into effect before snow levels get too high. Note both the level of snow on the roof, as well as excessive deflection of room framing members below the roof, which are both signs of heavy snow loads. Warning signs include sagging of purlins, joists, beams or trusses, as well as sprinkler heads deflecting below suspended ceilings. Remove snow from the roof in increments rather than all at once, and take care not to create a drift by moving snow from one area onto an adjacent area. Be careful not to damage roof coverings during snow removal.

If, despite your best efforts, a collapse does occur, contact your local FM Global office immediately and take steps to minimize additional damage to the building and/or interior contents. Call the necessary contractors and local utilities and shut off damaged water, gas, process and electrical systems in the collapsed area. However, shut off as little of the automatic sprinkler system as possible and continue protection in the rest of the facility by improvising connections to bypass the collapsed area. Take extra precautions to avoid fire hazards in unprotected areas, and follow FM Global's sprinkler control policy, *Red Tag Permit System* (P7427). In addition, relocate or cover equipment housed in the collapsed area that may be susceptible to damage from freezing or melting snow, and shore up building sections, if safe to do so.





Freeze-Up

Frigid temperatures can affect vital areas of your facility, including sprinkler systems, process piping, compressors and compressed air lines, instrumentation and control lines, valves and fittings, heating and air conditioning equipment, steam piping, boilers, water tanks, fire pumps, and underground water mains. Clearly, any impairment to these systems would negatively affect your day-to-day operations. In fact, a freeze could cause equipment damage, and mechanical and electrical breakdowns that could shut down your entire facility.

Certain occupancies are prone to suffer large freeze losses, especially between December 20-27, when many locations reduce operations and shut down plants for the holidays. A study of freeze-related losses conducted by FM Global for a recent 10-year period revealed that, on a frequency basis, mercantile facilities, offices, schools, hospitals, hotels/motels and apartments suffered roughly 43 percent of the freeze losses. Yet, on a severity basis, the woodworking and mill working, pulp and paper, and chemical industries were more likely to suffer large freeze losses. While these occupancies comprised just nine percent of the total number of freeze-related losses, they accounted for more than half of the total loss dollars paid.

The key is to plan as if freeze-ups were a certainty, even if your facility is located in a warm climate where severe temperature drops are uncommon.

While you can't predict what the upcoming winter season has in store, you can protect your facility and critical operations from freeze-up through sound loss prevention and control measures. The key is to plan as if freeze-ups were a certainty, even if your facility is located in a warm climate where severe temperature drops are uncommon. Freeze prevention and mitigation begins with a carefully drawn freeze plan prepared in accordance with FM Global Property Loss Prevention Data Sheet 9-18/17-18, *Prevention of Freeze-Ups*, to prepare buildings, equipment and personnel for the season's potential impact. Make sure to develop and train your ERT well before winter to deal with pre-storm precautions, as well as address events during and after a storm.

In general, make sure your winter action program includes:

- A schedule for preparing facilities (including building utilities and production equipment) prior to the cold weather season.
- A weather watch with procedures for alerting management and maintenance personnel.
- Arrangements for guards and maintenance personnel to be available during expected cold spells. When storms loom for an extended period of time, have ERT personnel patrol the building in search of cold spots, structural damage, large leaks or sprinkler piping breaks.
- Procedures for repairing or replacing damaged equipment, and for restoring fire protection as safely and quickly as possible.
- Avoid curtailment of operation or shutdown, even for part of a day. Have procedures for monitoring and maintaining adequate heat, especially if operation curtailment or shutdown becomes necessary.

Above all, be sure to maintain normal activities (heat-producing and attendance) during severe weather so as to maintain heat and awareness during the expected freeze. Please refer to FM Global's *Freeze-Up Checklist* (P9521) for specific measures to take both before and during cold weather.





Safeguarding Fire Protection Systems

A freeze-up of automatic sprinkler systems, water spray systems and portable extinguishers can mean water damage to interior contents, damage to sprinklers and piping, or worse—an impaired fire protection system that creates the potential for a highly destructive fire to sweep through your facility. To safeguard your fire protection system during cold weather, it is critical that you maintain sufficient heat in all buildings, especially in sprinklered areas. Sprinkler piping is typically run within concealed areas, with only the sprinkler heads showing.

To mitigate a freeze-up, you should monitor the temperature of susceptible areas, such as concealed spaces, eaves, areas with no direct heat, stairwells and shipping departments with large doors that are often open. In addition, make sure all fire pump suction lines, wet pits or suction tanks are properly maintained, kept free of ice and heated as necessary (follow FM Global’s *Red Tag Permit System* (P7427) to help monitor impairments to fire protection systems).

Should a freeze-up occur, provide extra heat and safely thaw out frozen equipment and systems. Once the storm has passed, quickly restore impaired fire protection systems and provide ERT members with phone numbers of outside contractors who can immediately repair breaks in the sprinkler system.

Flooding

Deep snow cover, frozen terrain and heavy, warm rains create the worst-case flood scenario. During times of extreme cold weather, nearly all rainfall and snowmelt becomes runoff because the ground is frozen and cannot absorb water. The outcome of such a scenario could be devastating. But, there are measures you can take to minimize your exposure to this risk. The most basic way to protect your facility from a flood is to avoid locating in a flood-exposed area. Short of that, use the 500-year flood level as a yardstick and position important items as high above that level as possible.

You also should investigate nearby exposures to determine how flooding near your site may impact access and operations at your facility, even if your site is not directly flooded. What roads, shipments, utilities, suppliers or customers, for example, might be affected and under what flooding conditions? Will fire protection or fire service response be affected?

FM Global's publications *Preparing for Flood Potential* (P9803) and *Flood Checklist* (P9805) offer invaluable information regarding flood preparedness. In addition, you also should take the following precautions:

- Seek the assistance of your FM Global engineer, outside agencies and internal resources in developing various scenarios for potential flooding. How much rainfall or snowmelt can cause flooding? What can happen upstream to cause problems? How much warning will you have? What protection structures are currently in place? What will outside agencies do for you and the local community as flood waters rise?
- Develop a comprehensive flood response plan tailored to your specific exposures, scenarios and operations. Your plan should address pre-flood preparations, flood response, post-flood cleanup/salvage/repair, business contingencies during flooding, and business-resumption planning.

Review and update the response plan prior to both the winter and spring flood seasons:

- Periodically inspect culverts, ditches and bridges on and around your property, especially after trees drop their leaves during the fall. Flowing ice and debris can quickly clog streams, causing them to overflow.
- Eliminate or minimize as much exposure to your operation as possible, for instance, by moving important substations or yard storage, building an emergency access route, or relocating critical equipment or processes to a higher area. Should any type of winter weather-related loss occur despite your best efforts, FM Global engineers and claims adjusters can help you minimize additional damage and restore operations as soon as possible.

Remember: a pre-season action plan and an organized workforce will prepare your facility for whatever the winter season may bring; appropriate procedures during the season and following any loss will help minimize damage and expedite a return to normal operations.



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