PRE-INCIDENT AND EMERGENCY RESPONSE PLANNING

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1.0 SCOPE

This data sheet provides recommendations to help facility management develop a pre-incident and emergency response plan for applicable perils, including earthquake, fire and explosion, flood, freeze, liquid leaks and spills, snow, wildland fire, and windstorm. Developing a comprehensive plan in partnership with relevant local public services, such as the fire service, can significantly enhance its effectiveness. The intent of the information provided is to highlight actions that can minimize the impact of an incident on property loss and business interruption.

This document is designed to assist property owners, operators, and occupants in developing a plan and procedure to respond to a variety of property insurance-related events. It is not intended to meet emergency planning and response requirements as established by governmental or other organizations.

See Section 4.0, References, for a list of FM Property Loss Prevention Data Sheets and other publications that provide supporting information on this subject.

1.1 Hazard

One of the most significant hazards at a facility is the unexpected, emergency, or upset condition. A pre-incident and emergency response plan can help minimize the impact of such an event.

The hazard of not establishing these plans is increased damage coupled with an interruption to the continuity of normal production operations. An emergency that is not managed well can have a direct dollar impact on the financial bottom line.

Having a plan in place can greatly enhance the facility's response and that of any outside responding service agency, as well as the positive outcome of an emergency incident. A well-documented and implemented plan can also help minimize the size, magnitude, and scope of property damage in the event of an emergency incident. It also increases the likelihood the affected facility will be able to maintain continuity of operations.

To understand the hazards addressed with pre-incident planning and emergency response, see the following Understanding the Hazard (UTH) brochures:

- Lack of Pre-Incident Planning (P0033)
- Lack of Emergency Response (P0034)

1.2 Changes

January 2023. Minor editorial changes were done for this revision.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Introduction

2.1.1 Pre-incident planning involves working with relevant public services to evaluate current protection systems, building construction, contents, and operating procedures that can impact emergency response. A pre-incident plan is a critical tool responding personnel can use in an emergency to help minimize the overall scope of property damage, and increase the likelihood the facility will be able to maintain continuity of operations.

2.1.2 Emergency response planning involves developing action plans for site-specific incidents considering the facility's needs and requirements. An effective emergency response plan, like a pre-incident plan, helps mitigate the overall scope of property damage, and increases the likelihood of the facility to maintain continuity of operations.

2.1.3 Use FM Approved equipment, materials, and services whenever they are applicable and available. For a list of products and services that are FM Approved, see the *Approval Guide*, an online source of FM Approvals.

2.2 Human Factor

2.2.1 General

The general guidance in this section is intended to be applied to all perils when developing pre-incident and emergency response plans.

2.2.1.1 Site Assessment

2.2.1.1.1 Work with relevant public services to develop a comprehensive plan for the facility. The purpose of a partnership is three-fold:

A. To combat site-specific emergency incidents at a facility.

B. To coordinate equipment and personnel at the site with public service agencies in handling incidents.

C. To assist the responding agencies in their development of strategies and tactics when responding to incidents at the facility.

2.2.1.1.2 Evaluate the exposure of the facility to any applicable perils and assess the ability to resume business after the incident. (See Section 3.1 for assessment questions.)

A. Determine which perils require an emergency response plan (ERP) based on the facility's exposure.

1. Earthquake ERP in 50-year through 500-year earthquake zones (see Section 2.2.2 and Data Sheet 1-2, *Earthquakes*).

2. Fire ERP (see Section 2.2.3 and any relevant hazard-specific data sheet)

3. Flood ERP in 500-year or more frequent flood zones (see Section 2.2.4 and Data Sheet 1-40, *Flood*).

4. Freeze ERP in locations where 100-year return period daily minimum temperature (DMT) is 20°F (-6.7°C) or colder on the FM Worldwide Freeze Map available on www.fmglobal.com (see Data Sheet 9-18, *Prevention of Freeze-ups*).

5. Liquid leaks and spills ERP (see Section 2.2.6 and Data Sheet 1-24, *Protection Against Liquid Damage*).

6. Snow ERP in locations subject to ground snow load ≥5 psf (0.24 kN/m^2) (see Section 2.2.7 and Data Sheet 1-54, *Roof Loads and Drainage*).

7. Wildland Fire ERP (see Section 2.2.8 and Data Sheet 9-19, *Wildland Fire*).

8. Windstorm ERP (See Section 2.2.9).

B. Determine which perils would benefit from pre-incident planning with external agencies.

2.2.1.2 Pre-Incident Plan

2.2.1.2.1 Develop a pre-incident plan that can be executed at the time of an incident. A sample form to aid in the development process can be found on the Fire Service Learning Network. Access the form by logging into the website https://www.fmglobalfireserviceresources.com and selecting "Training" from the top menu, then "Program Resources" from the dropdown menu. The form is titled *Pre-Incident Plan Data Collection Form* and is available in both PDF and MS Word formats.

2.2.1.2.2 Incorporate the FM Insurance Plan (or other property plan) and include a footprint view of the entire property. Consider adding construction, fire protection, utility, and special hazard details to the drawing (see Appendix C for a list of drawing details to consider).

2.2.1.2.3 Include the expected level of response by facility personnel. Consider all possible scenarios (e.g., the facility may operate just one shift or have personnel onsite 24 hours a day, personnel may not be permitted to perform certain functions, such as checking fire protection controls valves, fire pumps, etc.).

2.2.1.2.4 Include the expected level of response by external emergency services.

2.2.1.2.5 Implement an incident command system (ICS), including key facility personnel as part of a unified command (see Appendix D).

2.2.1.2.6 Establish emergency response training requirements; training is an essential part of emergency preparedness and pre-incident planning.

2.2.1.3 Emergency Response Plan

2.2.1.3.1 Create a written ERP that includes, at a minimum, the following three sections:

A. A **Purpose** section to declare the company's intent and objectives. It should also specify planned limitations to the response to certain site-specific incidents. For example, one may decide not to fight certain types of fires like ignitable liquid spills or Class D metal fires. Instead, only defensive action would be provided until the public fire service arrives.

B. A **Policy** section to outline the plan and top management's commitment.

C. A **Responsibility** section to designate people by name or title that generate and maintain the emergency response plan.

2.2.1.3.2 Establish clear communication protocols to be followed in an emergency.

A. Designate an individual and an alternate with the authority to activate each emergency response plan.

B. Identify onsite communication systems, such as specific radio frequencies, limited radio coverage areas, phone paging, intercoms, etc. Establish primary and alternate communications channels to be used in an emergency.

C. Provide contact information for the facility manager, key emergency response team members and those knowledgeable of facility operations and systems. Include a protocol for contacting employees, managers, and corporate contacts during and outside of business hours.

2.2.1.3.3 Develop a structure for the emergency response team (ERT) that matches the site-specific needs based on the type of response required for various incidents and create specific job descriptions.

2.2.1.3.4 Ensure sufficient resources are available for mitigation and cleanup of hazardous production or process materials (HPM) such as but not limited to corrosive liquids, low flashpoint ignitable liquids, pyrophoric materials, or toxic chemicals if needed.

2.2.1.4 Education and Training

2.2.1.4.1 Educate and train the ERT to respond efficiently before, during, and after an emergency (e.g., in the case of a predicted storm warning or watch, the ERT may be needed to carry out pre-emergency tasks such as shutting down certain critical operations and boarding up windows). (See Sections 3.3 and 3.4.)

A. Ensure any actions taken by the ERT are done in a safe manner. Consult the facility safety program if needed to ensure all ERT members have the necessary safety training.

B. Train personnel on back-shifts to perform multiple functions if needed due to reduced staff.

C. Train alternates for all key ERT positions.

D. Conduct training and education for emergency response to each peril annually, with a focus on individual perils prior to the time of year when they are most likely to occur. Additional training sessions may be required when ERT members are added or change positions.

2.2.1.4.2 Provide ERT members with additional training based on site-specific needs (e.g., hazardous materials).

2.2.1.5 Management of Change

2.2.1.5.1 Include a management of change component within the pre-incident and emergency response plans to identify any changes to the facility as they happen.

A. Audit the pre-incident plan and ERP at least annually and revise as needed.

1. Review equipment, storage, property, construction, occupancy, protection, exposures, and any other changes that could affect incident planning.

2. Review the plan with all appropriate parties. The frequency of reviews may be increased if changes are in progress at the facility.

B. Review and update the pre-incident plan and ERP after significant events to improve the plan based on lessons learned, and to identify any changes to the site and facility that could reduce the need for emergency actions.

2.2.1.5.2 Update site leadership and emergency response team on any changes.

2.2.2 Earthquake

2.2.2.1 In the earthquake emergency response plan (EQERP), include actions to take before, during, and after an earthquake, with an emphasis on assessing the integrity of fire protection, preventing post-earthquake fires, and restoring business as soon as possible. Plan for severe shaking at the site, utility outages, and major delays in response from local authorities, as heavy demands will be placed on resources. Aftershocks may require the repetition of multiple portions of the plan.

2.2.2.2 Assign duties, assemble resources, identify critical facility features, and establish relationships and contingency plans prior to an earthquake.

2.2.2.2.1 Provide a location for an emergency control center that is expected to be readily available and safe to access immediately following the earthquake (i.e., one that is not expected to sustain severe earthquake damage).

2.2.2.2.2 Store emergency equipment and supplies (e.g., tools, spares, spill kits, firefighting equipment, portable generators, communications equipment, first aid supplies, food and water, inspection materials, copy of EQERP) in a space that will be accessible immediately following the earthquake. Develop a schedule and assign an individual to maintain these resources.

2.2.2.2.3 Locate and identify the following items and their manual or automatic shutoffs, and document procedures for safely shutting down and restoring them:

A. Equipment and systems critical to production

B. Utilities (e.g., electrical, water, natural gas, and other fuels)

C. Other ignitable liquids and flammable gases

D. Fire protection systems

2.2.2.2.4 Identify and document contact information for local authorities (e.g., fire, police), contractors, and companies needed for repair of damaged equipment, utilities, and structures. Establish formal agreements for priority services if the issue is critical for resumption of business.

2.2.2.2.5 For buildings critical to business resumption, establish a building occupancy resumption program (BORP) for private post-earthquake structural evaluation to facilitate prompt structural repairs and recertification of buildings as safe to occupy.

2.2.2.2.6 Connect to a regional earthquake early warning system (EEWS), if available. Develop plans for appropriate personnel safety actions to take, and critical process or equipment shutdowns (manual or automatic) to initiate upon receiving an EEWS alarm.

2.2.2.2.7 Identify any alternate sites, outside the expected damage area of an earthquake, where operations can be continued should the facility be severely damaged or inaccessible, or the interruption of utilities (e.g., water, power) prolonged. To the extent possible, back up data and duplicate any critical items (e.g., molds, machine dies) so they will be available to the alternate site. Determine courses of action to protect systems vulnerable to a power outage (e.g., products stored in freezers).

2.2.2.2.8 Identify and develop plans to address any known exposures that can significantly affect earthquake response, such as site geological risks (e.g., landslide), tsunami risk, or regional seismic hazards (e.g., earthquake-vulnerable bridges or utilities).

2.2.2.3 Include in the plan procedures to follow and actions to take after an earthquake related to the items identified in Section 2.2.2.2.

2.2.2.3.1 Survey fire protection systems and water supplies (e.g., tanks) for damage immediately following the earthquake. Maintain as much fire protection in service as possible by shutting the minimum number of sprinkler valves located directly upstream of each area of damage as are necessary to control leaking from impaired piping. Follow the FM Red Tag Permit System and make repair of damaged fire protection systems a high priority.

2.2.2.3.2 Take immediate and continuing action to prevent post-earthquake fires.

A. Verify proper closure of any automatic seismic shutoff valves provided for ignitable liquids and flammable gases.

B. Survey the site and address flammable gas and ignitable liquid leaks and spills. If automatic seismic shutoffs are not installed or did not close, consider whether flammable gas and ignitable liquid systems should be shut down.

C. Survey the site for combustibles in contact with ignition sources and electrical system damage.

D. Monitor equipment that remains in operation for abnormalities (e.g., overheating).

E. Develop a procedure for resetting flammable gas/ignitable liquid seismic shutoff valves that includes checking the systems for leaks both prior to and immediately after valve reset.

F. Control hot work (such as cutting, grinding, and welding) during salvage and repairs. Prohibit hot work where fire protection is impaired. See Data Sheet 10-3, *Hot Work Management*.

G. Establish a procedure to remove all combustible debris as it accumulates.

2.2.2.3.3 Assess critical equipment, systems, and utilities for signs of improper operation (overheating, misalignment, vibration, arcing, leaks, etc.). These should be shut off as needed to prevent further damage, especially if they increase the risk of post-earthquake fires.

2.2.2.3.4 Plan to survey the site for other significant building and contents damage. Address issues where identified, prioritizing repairs for prompt return to business.

2.2.2.3.5 Conduct salvage operations, including safe start-up of utilities and equipment, safe resetting of shutoff valves, and use of the FM Hot Work Permit System (see Data Sheet 10-3, *Hot Work Management*). Continue monitoring equipment and systems after start-ups because problems may not be apparent immediately.

2.2.2.4 Coordinate the EQERP with local authorities, and engineers, vendors, and/or contractors with whom preexisting formal agreements for priority post-earthquake services have been made.

2.2.2.5 Develop a preliminary plan identifying and ordering the areas and systems to be inspected during an initial rapid visual survey based on their importance and known seismic vulnerabilities. Also develop a protocol for prioritizing subsequent comprehensive reviews. Plan and train for the following conditions and contingencies:

A. Outside assistance: (1) assuming outside assistance, and (2) assuming little or no outside assistance.

B. Earthquake timing: (1) assuming the earthquake occurs during normal business hours, and (2) assuming the earthquake occurs outside normal business hours.

C. Site access: (1) assuming site access is unrestricted, and (2) assuming site access is restricted.

D. Utilities: (1) assuming utilities remain in service, and (2) assuming utilities experience outages.

E. Shaking levels: (1) assuming shaking is light to moderate (MMI VI to VII), and (2) assuming shaking is strong to very strong (MMI VIII or higher). See Data Sheet 1-2, *Earthquakes*, for information on Modified Mercalli Intensity (MMI).

F. Assuming the earthquake is an aftershock affecting an already damaged facility.

2.2.3 Fire and Explosion

2.2.3.1 Conduct a site visit in conjunction with fire service personnel responsible for pre-incident planning to understand the site conditions, exposures, and hazards associated with the site.

2.2.3.2 Define the level of response expected by the fire service. Determine initial assignments based on type of incident, number of alarms, delayed response, etc. Typically, the chief officer-in-charge of the fire service is the incident commander (see Appendix D).

2.2.3.3 Include the following actions when developing the pre-incident and emergency response plan if a high-challenge fire scenario is possible at the facility and manual firefighting is needed in addition to automatic sprinkler protection to control the fire. Refer to any industry or storage specific datasheets for additional guidance.

A. Involve the local fire service in plan development.

B. Identify how the local fire service will gain access to the fire location.

C. Determine how storage will be moved if necessary. Ensure the fire protection at the new location for the storage is adequate.

D. Determine what resources and equipment are needed to gain access and disassemble the storage if needed.

E. Identify and provide locations of any special firefighting equipment needed (i.e., hose station connections, fixed-in-place monitors, visible or infrared camera, remote monitor nozzle steering mechanisms, etc.)

F. Ensure ERT is trained on any special firefighting equipment if they are expected to operate it or make sure the fire service is aware of its availability and how to operate it.

G. Ensure water supply can support the additional hose lines or firefighting equipment needed.

H. Determine if fire watches will be needed and how they will operate.

I. Identify the required resources and equipment for salvage and recovery.

2.2.3.4 Practice and evaluate the pre-incident and emergency response plans on a regularly scheduled basis to ensure they will work properly. This can be done via table-top exercises or full-scale, hands-on situation simulation.

A. Develop credible scenarios for onsite incidents (e.g., ignitable liquid fires, log yard fires, conveyor fires, exposure fires, fire protection impairments). Consider including such adverse factors as a frozen pond intended for supplying fire service pumpers, limited access in freezing weather, a brush fire exposing multiple buildings, etc. if they are credible scenarios.

B. Conduct joint training drills to ensure all aspects of the plan work effectively. Include the responding fire service agencies along with any hazardous materials response team, local emergency management, and facility personnel in the drills. Joint drills help to understand the inter-relationship of each group’s actions.

C. Test communication links between the facility, fire service, and other related agencies to ensure they are effective.

D. Designate an individual to meet the responding fire service and provide all relevant information such as what fire protection systems are operating and their location within the building, the fire pump status (running or not) and its location, etc.

E. Use the FM Fighting Fire in Sprinklered Buildings training program (see Section 4.1). The training program is free to the fire service and FM clients. Though specifically designed for the fire service, it is also beneficial training for the facility’s emergency response team.

F. Consider the resources available through FM Emergency Response Consultants (ERC). Training for the fire service and local facility management can be provided by ERC onsite or at their training facility in Rome, Georgia, USA.

2.2.3.5 Determine what ERT positions and functions are needed based on the facility. Typical ERT positions and responsibilities are described in Table 2.2.3.5. At a minimum, cover the responsibilities of the emergency response team leader (ERTL), notifier, sprinkler control valve operator, and fire pump operator (if fire pump is provided). Facilities have different needs and it is understood that in some cases tenants may not have access to sprinkler control valve and fire pump rooms or areas.

Table 2.2.3.5. Fire and Explosion ERT Positions and Responsibilities

ERT Position	*Responsibilities*
Team Leader (ERTL)	1. Manages the ERT and keeps contact information updated. 2. Coordinates training of ERT and joint drills with fire service. 3. Provides fire service with relevant information upon arrival.
Notifier	1. Notifies fire, medical and rescue services. 2. Contacts ERT personnel.
Sprinkler Control Valve Operator	1. Knows all valve locations. 2. Verifies valves are open. 3. Operates valves as needed. 4. Places system back in service following an event.
Fire Pump Operator	1. Knows the operation and care of the pump. 2. Trained to start pump manually and understands its importance in relation to fire protection. 3. Checks the pump is running when the fire alarm sounds. 4. Starts the pump if needed and keeps it operating until instructed to shut it off. 5. Places pump back into automatic service following an event.
Salvage Team	1. Gets the facility back in operation as soon as possible after an emergency. 2. Ready and able to start salvage during and after the emergency. Actions should be immediate. Damage can worsen as time passes. 3. Knows how to salvage and clean equipment and stock. 4. Concentrates on valuable stock and equipment. Mopping up to remove dampness and drying out areas wetted by water are typical tasks. 5. Gives priority to any major damage to vital equipment or processes.
Support Personnel	1. Consists of maintenance, engineering, and labor groups to perform specific functions as delegated by the ERTL. 2. Needs are determined by the types of incidents expected and actions required for the site-specific situations and exposures. (See Section 3.6.3.)

2.2.3.5.1 Train personnel present during nonoperating hours (security, maintenance, etc.) in emergency plan priorities. Ensure they receive the same training as the ERT and that response duties include the following:

A. Know the procedures during and after an emergency.

B. Sound the fire alarm.

C. Notify the public fire service.

D. Verify sprinkler control valves are open and the fire pumps are in operation.

E. Direct fire service personnel to the area of fire origin.

F. Notify facility officials.

2.2.3.6 Plan for fire service access (Knox Box or similar technology) during periods when the facility may be unoccupied. Include call lists or similar resources as they are valuable aids for responding personnel.

2.2.3.7 Provide the fire service with relevant information upon arrival, including any automatic sprinkler systems operating, the location of the operating systems and fire pump, and confirmation that the fire pump is operating.

2.2.4 Flood

2.2.4.1 Include flood exposure, impact to business, reliable flood warning system, and cost-effective, feasible mitigation solutions in the flood emergency response plan (FERP).

2.2.4.2 Describe the flood hazard and all likely flooding scenarios. The following are important items to include:

A. The weather event that will trigger a flood, and where the flood water will come from.

B. The likely length of warning time.

C. The length of time water will remain in the facility.

D. Expected floodwater velocities against buildings and key assets.

E. A map showing the extent of flooding with maximum flood levels and depth as compared to finished floor and other elevations of key buildings and utilities.

2.2.4.3 Describe critical areas likely to be flooded, and the operational impact due to the flood event and recovery. Include sufficient detail to enable prioritization of emergency actions appropriate for the business and provide the starting point for the identification of protection options (full and/or partial) and their features (permanent or temporary).

2.2.4.4 Include a readily available, reliable, and practical method to obtain a flood warning. The accuracy and lead time of flood warnings are key inputs for emergency procedures as they establish when action should be triggered. In areas with no warnings, it is important to devise alternative means to detect impending floods. Short warning times constrain the use of temporary measures in favor of permanent ones (which require no manual intervention) to allow deployment within the available warning time. Site access may be restricted by local authorities, limiting staff available to implement the FERP. Long warning times allow for more temporary options to be put in place. The warning time is measured against the time required to activate the emergency plan.

2.2.4.5 Identify specific tasks that will be assigned to available personnel.

2.2.4.6 Provide procedures to accomplish the following, as applicable:

A. Shut down/de-energize processes and utilities in an orderly manner to reduce the amount of damage from flood waters.

B. Raise and relocate highly valuable and easily moved equipment, contents, and vital records. This may require acquiring or renting special equipment to relocate contents.

C. Close emergency valves to the sewer drains and utilities to prevent backflow through the protected perimeter.

D. Monitor and manage underseepage and leakage through the protected perimeter by containment curbs/barriers and sump pumps. Check sump pumps to ensure they are in operation or ready for operation.

E. Prevent water from entering key areas by using FM Approved flood abatement equipment such as opening barriers, temporary perimeter barriers, flood abatement pumps, and flood mitigation valves. Consider the entire protected perimeter (or protected envelope), including floor slabs, walls, basements (floors and walls), and utility penetrations through the protection perimeter. Store this equipment onsite if the amount of time to get the material to the site and assemble it exceeds the notice time, or if transport to the site could be impeded or delayed during a flood event. If onsite storage is not practical, a less preferred method is off-site storage if there is enough time to initiate the flood response, collect materials, ship the materials, gather the response crew, and deploy the protection.

F. Account for underseepage and leakage of barriers, sealed penetrations, and other weak elements of the protected perimeter by providing storage and/or pumping capacity. In areas with ground of high permeability (e.g., coarse alluvial material), flood waters can bypass barriers and enter a site via the ground.

G. Ensure each component of the protected perimeter, particularly basements, has sufficient strength to withstand hydrostatic forces generated by a flood, bearing in mind most of them have not been designed for such conditions.

H. Shut down ignitable liquid and flammable gas systems.

I. Protect key equipment from water damage where flood-proofing is not possible. Consider water-repellant, wrapping, rust-preventive compounds in addition to de-energizing.

J. Fill empty storage tanks to prevent them from floating.

K. Ensure backup power supplies (generators) are functional, located above flood levels, and accessible during an emergency. Ensure sufficient fuel is available or can be safely delivered for the duration of the event.

L. Set up emergency communication equipment.

M. Monitor access to property and outside utilities during flooding.

N. Keep fire protection equipment operational for as long as possible.

2.2.4.7 Include a plan to minimize the fire hazard during and after the flood.

2.2.4.7.1 Ensure the integrity of the electrical system and then restore the electrical services on an item-by-item basis.

2.2.4.7.2 Perform hot work only if necessary and in a safe manner using the FM Hot Work Permit System, and only after fire protection systems are restored and combustibles are removed from the hot work area. See Data Sheet 10-3, *Hot Work Management*.

2.2.4.7.3 Check all ignitable liquid storage and flammable gas piping systems for leaks before returning to operation.

2.2.4.7.4 Check all tanks for leaks.

2.2.4.7.5 Remove combustible debris as it accumulates.

2.2.4.8 Include a plan to return fire protection systems to service promptly by taking the following actions:

A. Run or test fire pump, fire pump driver, and controller. Repair if flood damaged.

B. Examine the fire pump water source (particularly for open bodies of water) to ensure debris will not enter the pump suction line and the sprinkler system.

C. Check the yard main fire protection system and water tanks for washouts.

D. Remove water and mud from fire protection valve pits.

E. Inspect sprinkler system piping for damage and repair as needed.

F. Test all sprinkler control valves to ensure they are in the fully open position, operable, and undamaged.

G. Check all fire protection alarm systems and make necessary repairs.

2.2.4.9 Include a recovery plan for the rapid restoration of operations to as many portions of the business as possible. Refer to Data Sheet 10-5, *Disaster Recovery Planning*, in addition to doing the following:

A. Prioritize cleanup actions.

B. Preplan how to remove mud, silt, and debris from building and equipment using restoration contractors. Include the possibility that cleanup will be delayed.

C. Prioritize the rebuilding or replacement of the most critical pieces of equipment.

D. Set up temporary or skeleton operation at remote locations.

E. Document procedures on how production will be made up at other facilities.

F. Establish agreements with vital sub-contractors to respond in the event of flooding.

G. Establish arrangements with contractors who can help clean up and assist in post-flood repairs.

2.2.4.10 Conduct an annual full drill of the plan that includes installation of the flood mitigation devices and FERP equipment inventory.

2.2.4.10.1 If the FERP includes deployment of flood abatement equipment (such as barriers, gates/doors, and flood abatement pumps) and controlled shutdown of critical equipment, ensure each task necessary to implement the plan is documented and individuals are assigned for all shifts. Conduct regular FERP training exercises that include all staff required to respond, and ensure there is a complete dry run to simulate the flood event at least once a year.

2.2.5 Freeze

2.2.5.1 Establish a written Freeze ERP. Include actions to take prior to the onset of seasonal cold weather and during unusually cold weather. Use FM publication P9521, *Emergency Checklist: Freeze or equivalent.*

2.2.5.1.1 Describe the hazard and likely freeze scenarios. This includes a description of likely weather event(s) or weather history. Plan for at least the 100-year return period daily minimum temperature on the FM Worldwide Freeze Map. Snowstorms and ice storms often accompany freezing weather.

2.2.5.1.2 Include a readily available, reliable, and practical method for monitoring unusually cold weather events, snow and ice storms. This may include sources such as national weather services, weather bulletins, and local emergency agencies.

2.2.5.1.3 Establish an Emergency Response Team (ERT) and procedures for when it will remain onsite such as when the facility is closed or idle during unusually cold weather.

2.2.5.1.4 Establish written procedures for the following:

A. Shutdown of site operations and/or curtailment/idling.

A planned shutdown or curtailing of operations may be needed to prevent equipment damage that can occur with a sudden shutdown from loss of electricity, natural gas, other utilities or the inability to operate in winter conditions.

Where applicable, this may include a priority load-shedding schedule for electrical, natural gas, steam and/or other critical utilities. Identify the processes that can be taken off-line quickly with little damage to equipment or work-in-process.

This requires a detailed review of operations and detailed preplanning to allow sufficient time and gathering of resources which may not be available as the weather worsens.

B. Loss of incoming utilities for a minimum of three days including electricity, natural gas and other on-site utilities operated by a third party.

In most situations this can result in loss of building heat and other freeze protection and loss of refrigeration or climate control for valuable perishable items. Plan for restarting and operating on-site power generation, when present, without the assistance from the outside power system.

Heat from boilers and/or reduced operations may be considered during this isolation period if there are adequate resources on site. This includes power and fuel supplies to maintain reduced operations that prevent freeze damage, on-site emergency response team, and operating personnel on-site prior to and throughout the freeze and/or winter storm.

C. Lack of site access from unsafe road conditions due to snow and/or freezing rain. The duration of inaccessible roads varies based on capabilities of the local authorities to remove snow and treat roads, especially when freezing rain occurs. Areas not subject to regular winter weather typically do not have this equipment and roads in a large area may be impassable for more than three days.

2.2.5.2 Implement procedures in the Freeze ERP as applicable, prior to the onset of seasonal cold weather:

2.2.5.2.1 Prepare all buildings for cold weather by completing the following actions. This includes buildings with any freezable liquids, including domestic water, chilled water, cooling towers, process water, wet pipe sprinkler systems, dry pipe valve rooms, and fire pump areas.

A. Verify there is adequate heat (e.g., minimum 40°F [4°C]), insulation, and the building envelope is adequately sealed in all buildings where needed to prevent freeze damage from low temperatures. Consider the coldest points in the building including:

1. Tops and bottoms of stairwells where exterior doors are present
2. Corners at the windward side, the eaves, and concealed spaces with no direct heat
3. Buildings with wet pipe sprinkler systems, as well as fire pump areas. Ensure fire pump areas with diesel engine drivers have a minimum temperature of 70°F (21°C).
4. Atriums and porticos (especially above suspended ceilings)
5. Near loading dock doors
6. Near large air intakes or exhausts
7. Trailers and temporary housing/offices structures
8. Penthouses

B. Verify that the temperature monitoring system is operating properly and includes all normally cold areas/buildings, including penthouses and concealed spaces and/or above suspended ceilings with vulnerable piping or equipment, and monitor these areas closely. If necessary, provide additional thermometers.

C. Review equipment contingency plans for items susceptible to freezing, with emphasis on key process bottlenecks to production. Include equipment, service or process lines that are outdoors or in unheated/ unattended buildings, non-self-draining steam traps, liquid drains, and high pour-point fuel oil lines.

D. Review plans to inspect sprinkler systems, service water and other piping for leaks after unusually cold weather.

E. Verify emergency supplies are present and in good condition. Consider the following items:

1. Extra tarpaulins for windbreaks
2. Steam hoses for thawing frozen lines
3. Portable heaters for keeping repair crews warm or instrument houses from freezing
4. Antifreeze supplies for cooling systems
5. Shovels, wheelbarrows, and snow blowers
6. Warm clothing and hand protection for maintenance and operating crews
7. Anti-freeze solution for conveyor de-icing systems and for manual de-icing sprayers

F. Perform activities for Liquid Leaks and Spills in Section 2.2.6.

2.2.5.2.2 Prepare all systems and equipment for cold weather by completing the following actions.

A. Winterize equipment with history of freeze damage.

B. Fuel all mobile equipment and review/confirm sources for obtaining additional fuel supplies for mobile equipment. Maintain two fuel sources if one is on an “interruptible” contract. Use winterized fuel blends where temperatures are expected below 10°F (-12°C).

C. Fuel all stationary equipment, including boilers, and review/confirm sources for obtaining additional fuel supplies for stationary equipment, particularly if supplied on an “interruptible” contract. If the backup fuel is oil, verify the tank is full and the delivery system to the heating unit is fully operational.

D. Check that heat-tracing systems are operating properly.

E. Examine/repair portable heating to ensure it is ready for emergency use.

F. Drain all idle pumps and compressors and make sure they are vented.

G. Lubricate equipment for cold weather operation.

H. Provide heated enclosures around operating equipment as necessary and appropriate.

I. Verify the operation of no-flow switches and alarms in cooling water lines.

J. Verify instrumentation lines and other in-service equipment are insulated or provided with heat tape or other heat sources.

K. Drain and blow out all seasonal equipment, condenser lines, tubing, and piping.

L. Inspect all boilers and other heating equipment to ensure they are in proper operating condition.

M. Check all steam traps for proper operation.

N. Check pressure-vessel vents and relief and safety values for frost or ice.

O. Drain low-point drains on dry-pipe fire protection systems.

P. Check fire hydrants and sprinkler control valves for tightness. Repair any leaks.

Q. Flush the circulating heaters and associated piping on gravity and suction tanks to remove scale and sediment. Overhaul steam traps and strainers if necessary.

R. Test freeze-stats and proper closure of dampers on air handing units with water filled coils.

S. Test controls and proper closure of dampers on exterior walls.

2.2.5.2.3 Review procedures with security personnel and other staff who will remain on site to check areas that may be subject to freezing.

2.2.5.2.4 Perform other site-specific activities as outlined in the ERP.

2.2.5.3 Include procedures in the Freeze ERP to accomplish the following, as applicable, during unusually cold weather:

A. Inspect the building envelope each shift closing any openings to the outside that should not be open. Verify that doors and windows are closed, and exhaust louvres/dampers are operating properly.

B. Determine whether operations should be shut down. This includes monitoring and/or contacting off-site electricity, natural gas and other utility suppliers for possible shut-offs or curtailments.

C. Increase building temperature(s) and do not lower temperatures when buildings are unattended such as at nights, weekends and especially long holiday weekends. This is especially critical when the supply of heating fuel or electricity may be interrupted.

D. Check automatic sprinkler risers for frozen piping daily by opening 2 in. (50 mm) drains (if safe to do so) and observing the drop in pressure.

E. Set priorities for steam usage to keep critical equipment in operation.

F. Check areas that may be subject to freezing. Instruct personnel to investigate and provide additional heat to any area upon activation of a low-temperature alarm.

G. Keep all roof drains clear.

H. Use the FM Hot Work Permit System for any portable heating equipment or repair activities needed. Avoid open flames when thawing frozen piping and equipment. See Data Sheet 10-3, *Hot Work Management*. Also, consider any additional hazards created by fuels or gas cylinders associated with portable heating equipment.

I. In regions that do not have adequate road treatment capabilities, obtain critical raw materials that may be in short supply and ship finished products.

2.2.5.4 Include procedures in the Freeze ERP as applicable, when building heat is lost and all efforts to restore adequate heating have failed:

1. Inspect the building envelope and close any openings to the outside. Verify that all doors, windows, louvres/dampers including inside air handling units, or any other openings are closed. Consider installing insulating blankets over louvres and dampers. Open panels to air handling units to delay freezing of water coils.
2. Drain sprinkler piping if a freeze up of water in the piping is deemed imminent. Minimize time the system is impaired and strictly follow FM Red Tag Permit System impairment procedures (i.e., shutting down hazardous operations, notifying the fire service, posting a fire watch). See Data Sheet 10-7, *Fire Protection Impairment Management.*
3. Safe shutdown of production/process equipment according to documented standard and emergency operating procedures.
4. Drain service water and process piping, condensate piping, pumps, compressors, boilers, water cooled jackets, heat exchangers, air conditioning systems, hydraulically operated devices and other equipment and systems that may be damaged by freezing of water or other liquids. Add antifreeze to equipment that cannot be drained.

Consider periodically opening faucets or water outlets or leaving them open with a trickle flow when service water or other water systems cannot be adequately drained but there is adequate water pressure.

2.2.5.5 Safely restore operations that were shut down. Inspect sprinkler systems, service water and other piping and pumps etc. for cracks, leaks, or other damage when unusually cold weather ends or building heat is restored. Turn each system on slowly. Take special care thawing frozen piping and equipment; avoid open flames.

2.2.6 Liquid Leaks and Spills

2.2.6.1 Establish a liquid leaks and spills ERT to be responsible for designated activities for each shift of operation.

2.2.6.1.1 Establish the following ERT roles as applicable: team leader, alternate leader, response coordinator or building engineer, alternate coordinator, maintenance personnel, security, and insurance claims coordinator.

2.2.6.1.2 For each ERT role assignment, provide the employee's name, office phone number, mobile phone number and home phone number.

2.2.6.2 Create and maintain a list of vendors and contractors able to provide critical backup equipment, emergency power, or cleanup services during or after an event. Establish written contracts with key vendors.

2.2.6.3 Prequalify a restoration contractor. Consider their response time, geographic reach, and staffing.

2.2.6.4 Identify critical rooms, buildings, and operations that may be susceptible to liquid leaks and spills.

2.2.6.4.1 Provide a cart near critical rooms and stock it with emergency pipe-repair supplies, an acoustic leak listening device to help identify exactly where the leak is located, and equipment to contain and dry up escaped liquid.

2.2.6.5 Identify where any salvageable content, stock, or supplies may be stored if a liquid spill occurs.

2.2.6.6 Include a plumbing riser diagram or develop simplified drawings of all domestic, chilled, steam, and fire protection water systems as well as other liquid operations that show layouts of pipes, pumps, and shutoff valves.

2.2.6.7 Ensure all shutoff valves are marked on the drawing included in the pre-incident plan. Include main building valves, main valves for each floor, and control valves for critical areas.

2.2.6.7.1 Include a list of valves specifying the valve number, description of the valve (size and type), the location of the valve, the area the valve services, and shutoff instructions. It is important that the valve list description agrees with the labelling on main building pipes and shutoff valves (see Data Sheet 1-24, *Protection Against Liquid Damage*).

2.2.6.8 Instruct designated personnel to immediately contact the fire service upon activation of a waterflow alarm on a fire protection system, and then investigate the area. If there is no fire and the water leakage involves the fire protection system, use the FM Red Tag Permit System to manage the impairment.

2.2.6.9 Instruct personnel to close the shut-off valve to a leaking or burst pipe upon activation of a waterflow alarm on a domestic water system or from a leak detection device.

2.2.6.10 For leaks involving the building structure (e.g., roof drains, windows), take immediate steps to divert the water, contain the spillage, and block additional water from entering the building. Make temporary repairs to minimize water damage to the affected area. Once the leak has been isolated and stopped, initiate cleanup and restoration activities.

2.2.6.11 Prioritize the following restoration activities to facilitate prompt salvage and restoration of operations.

A. Contact the list of contractors and vendors necessary for cleanup and restoration of the site.

B. Identify any damaged building equipment that will require replacement for necessary building or area operation (electrical, HVAC, plumbing, etc.).

C. Initiate liquid removal using pumps, wet vacuums, squeegees, etc.

D. Initiate de-humidification equipment and fans to reduce the possibility of mold growth.

E. Implement a contingency plan for extensively damaged areas that may require relocation of operations, and document procedures on how production will be made up at other facilities.

F. Remove wallboard or provide access panels to facilitate air movement within gypsum board, plaster, or wooden walls.

G. Initiate drying, cleaning, and application of rust-preventive coatings to mechanical and electrical equipment.

H. Relocate salvageable and undamaged stock and supplies to a predesignated safe area with adequate required protection.

2.2.7 Snow

2.2.7.1 Perform the activities listed for Freeze in Section 2.2.5.

2.2.7.2 Establish a formal snow monitoring and response plan. Include actions to take prior to and during the snow season to monitor and address accumulation of snow on roofs with the goal of reducing collapse risk and preventing property damage and business interruption. Snowstorms in quick succession may require repetition of multiple portions of the plan.

2.2.7.2.1 Identify the snow collapse hazard and critical facility features. Include the following:

A. Description of likely weather event(s) or local “snow of record” history.

B. Sketch of the facility showing the live load capacity of all roof areas in psf (kN/m^2). Live load capacities may be found on structural drawings or a structural engineer can be retained to analyze the buildings and provide these numbers. Live load capacities are a key component of a monitoring plan and are essential to making informed decisions about snow response. Where live load capacities are unknown and a structural evaluation to determine them has not yet been made, temporarily use 65% of the flat roof snow load (P_f) or 15 psf (0.7 kN/m^2), whichever is greater, to estimate the live load capacity.

C. Sketch of the facility showing location of rooftop equipment, ducts, pipes, natural gas lines, refrigeration, etc. to ensure that these are identified and are avoided during snow removal; consider marking with snow markers. Also identify roof drain locations with snow markers.

D. Sketch of facility with utility shutoffs and isolation valves to facilitate shutdown if a collapse is imminent.

E. Identify roof elevation changes and note approximate elevation differences, with extra attention to those areas where snow drifts have occurred regularly. These are areas most likely to experience snow drifts and collapse.

F. Identify structural deficiencies such as sagging, corrosion, or altered framing. Prioritize these areas for structural reinforcement in long-term facility planning.

2.2.7.2.2 Establish a snow monitoring team, identify snow load monitoring methods, and define when snow response should occur. Include the following in the plan:

A. Team members and alternates by name or position, for each shift, assigned to monitor incoming snow events and actual snow accumulations.

B. Sources for monitoring developing snow events, such as the national weather service, weather bulletins, and local emergency information sources.

C. Methods for monitoring snow accumulations on the roofs and comparing loads to live load capacities. These may include:

1. Weight and density measurements using a bucket and scale.
2. Measurement or visual assessment of depth against snow markers and estimation of the snow density using Table 2.2.7.2.2.
3. Deflection gauges on horizontal roof framing at strategic locations, with allowable deflections determined by a structural engineer.
4. Structural engineer review of accumulations and structure.

D. Trigger point at which the snow response should be activated and who has the authority to activate this phase of the plan. A trigger of 50% of the live load capacity is suggested.

Table 2.2.7.2.2. Approximate Snow and Ice Depths for Roof Snow Loads

Roof Snow Load, psf (kN/m²)	*Typical Snowpack Depth, in. (mm)*	*Wet Snowpack Depth, in. (mm)*	*Equiv. Ice Depth, in. (mm)*
10 (0.5)	8 (200)	6 (150)	2.5 (65)
15 (0.7)	11 (290)	9 (220)	3.5 (90)
20 (1.0)	14 (370)	11 (280)	4.75 (120)
25 (1.2)	17 (430)	13 (330)	6 (150)
30 (1.4)	20 (500)	15 (380)	7.25 (185)
40 (1.9)	24 (620)	19 (470)	9.5 (240)
50 (2.4)	27 (690)	21 (530)	12 (305)
60 (2.9)	30 (770)	23 (590)	
70 (3.4)	33 (840)	25 (650)	
80 (3.8)	36 (900)	27 (690)	
90 (4.3)	38 (960)	29 (740)	
100 (4.8)	40 (1020)	31 (780)	
110 (5.3)	44 (1120)	34 (860)	
120 (5.7)	48 (1220)	37 (940)	

2.2.7.2.3 Specify snow response steps and resources needed, with consideration for site conditions and personnel safety. Identify actions to take beyond snow response if structural distress is observed. Include the following in the plan:

A. Actions to take to reduce the risk associated with the increasing snow load. These may include:

1. Evacuation of the building and relocation of critical contents.
2. Accelerating snow melt.
3. Snow removal.

B. Specify who will complete snow response activities (i.e., site employees or a contractor). If a contractor, identify multiple contractors capable of doing the work.

C. Methods and equipment needed for response, such as alternate location for contents, increasing heat inside the building, FM Approved snow/ice melting systems, glycol snow melt blankets, shovels, snowblowers, crane and basket, etc. Keep drains clear to ensure any snowmelt is quickly removed.

D. Estimate of the time needed for snow response and key considerations to maximize efforts and reduce the potential for damage to roof equipment and surfaces.

E. Steps to retain a structural engineer to develop a shoring plan if snow response is not effective at reducing roof loads and signs of structural distress are observed. Signs indicating structural distress and that the roof is approaching its design limit include strange noises, bending or twisting of ceilings, framing, piping, and ductwork.

F. Steps to prepare for possible collapse with a focus on limiting damage to contents and preventing fire following collapse. If feasible, relocate equipment and inventory out of the possible collapse areas and, if appropriate, shut down utilities in the area.

2.2.7.3 Keep all hydrants and outside sprinkler control valves (post indicator and curb box valves) cleared throughout the snowstorm.

2.2.8 Wildland Fire

2.2.8.1 Develop a written pre-incident plan with the fire service. At a minimum, address the following issues:

A. Access and egress paths (including alternatives in case of paths being blocked by fire)

B. Resources and contact information for prior warning

C. Communication channels during the emergency (use cell phone or mobile radio as phone cables are vulnerable in a fire)

D. Fire service needs when they are able to respond to the alarm calls

E. Firefighting resources, including personnel, apparatus, and equipment (list and identify the location of these resources and/or the response capabilities that might be available)

2.2.8.2 Establish a documented plan to address the following preparation activities, as applicable, before evacuation. Due to mandatory evacuations and municipal control, there may not be the ability to remain on site for several days or weeks.

A. Removal of accumulated vegetation and debris from around the building perimeter and throughout the roof, including the roof gutters.

B. Removal of combustible yard storage.

C. Relocation of trucks and any other valuable stock or supplies from the site as practical.

D. Closing the building envelope, including any windows and doors and provide temporary covers on air intakes.

E. Shutting down HVAC systems and smoke evacuation systems.

F. Backing up computer servers.

G. Placing equipment in safe mode for expected loss of utilities services.

H. Safely storing or relocating plastic drums of ignitable liquids.

I. Ensuring fire protection is fully functional and in automatic mode before evacuation.

Pre-incident plans may also be justified in urban areas where evacuations can be larger.

2.2.8.3 Fully train and equip the ERT to deal with a wildland fire emergency. Additional firefighting team members are needed compared to a facility fire ERT as the fire service may not be able to assist due to the large number of properties that may be exposed to the fire. Recognize that emergency response efforts may be hindered due to mandatory evacuations and people responding to their own properties.

2.2.8.4 Obtain training on how to respond to a wildland fire emergency from the local fire authority.

2.2.9 Windstorm

2.2.9.1 Establish a hurricane ERT to monitor hurricanes and implement loss prevention measures.

2.2.9.2 Ensure sufficient personnel are available to install hurricane shutters or plywood over window openings as needed.

2.2.9.3 Reduce or eliminate potential windborne debris from the yard outside exposed buildings. This includes securing equipment or storage or bringing it indoors where practical.

2.2.9.4 Inspect hurricane shutters or plywood used to protect openings prior to hurricane season and prior to approaching hurricanes to ensure all components are available. Mounting hardware for shutters, plywood, and dock door braces should be pre-installed to facilitate placement prior to the wind event. Ensure enough staff will be available prior to the wind event to complete these tasks within one 8-hour shift.

2.2.9.5 Inspect roofs prior to hurricane season and prior to approaching storms and after storm events to ensure the entire roof surface is free from leaves and any other debris that may clog roof drains or become windborne debris. Inspect all roof-mounted equipment and replace any bolts missing from the equipment or rain bonnets.

2.2.9.6 Ensure an adequate supply of plastic covers is available to protect computers, keyboards, monitors, printers, and any other valuable equipment that is highly susceptible to water damage. Install covers prior to closing the facility upon notification of an approaching hurricane.

2.2.9.7 Close and latch all interior and exterior doors and install temporary bracing for exterior dock doors as needed. Provide temporary sealing or absorbent materials (towels, etc.) for exterior sliding doors, which are particularly vulnerable to leakage from wind driven rain.

2.2.9.8 Include the following items in the ERP as applicable for the site-specific conditions:

A. Inspection of all fire protection to ensure that it is in service.

B. Filling all fuel tanks for fire pumps and emergency generators and test their operation.

C. Fueling all mobile equipment that might be needed following the storm (fuel supplies may be limited following the storm due to availability of electrical power to operate pumps).

D. Checking and ensuring proper maintenance of any additional backup equipment.

E. Protecting or relocating vital records.

F. Shutting down operations that depend on outside power sources.

G. Moving loose outside stock, storage, and equipment to a secure location.

H. Ensuring that the ERT and other vital personnel have all necessary and proper supplies and equipment (food, fresh water, medical supplies, flashlights, communication equipment with recharging devices that can work from automobiles so that cell phones and other equipment can be recharged).

I. Repairing and filling all above and below ground storage tanks.

J. Securing outdoor cranes to prevent them from moving, and lower elevated booms.

K. Cleaning out drains and catch basins.

L. Closing storm shutters or board up/protect windows.

M. Anchoring moveable outside equipment, including trailers. Relocate portable objects, even small ones (e.g., chairs, signs, etc.) to an indoor location.

N. Other site-specific activities as outlined in the ERP.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 Assessment Questions

Exposures and resources at a site will either help or hinder the emergency response. It is important to know what they are. Once these items are known, the areas upon which to concentrate the ERP effort have been identified.

Determine answers to the following:

1. What fire protection is provided? Is it in service?
2. What processing or storage hazards exist?
3. What type of natural hazard(s) expose the site? For example: floods, hailstorms, windstorms (hurricanes, tornadoes, or typhoons), earthquakes, snow or winter freeze-ups, roof collapse from snow loading, or volcanic activity.
4. What types of materials are stockpiled and ready for use in case a natural hazard incident strikes? For example: FM Approved flood abatement equipment, availability of sump pumps, portable barriers, emergency generators, portable pumps).
5. Are there staffing or equipment limitations?
6. Have key personnel been educated and trained for the site-specific exposures?
7. Are drills and periodic staff training provided?
8. What communications equipment (2-way radios, intercom, cell phones) are available?
9. Identify locations of facility utility and process supply shutoff valves.
10. What contractors will be needed? Determine the availability of their services.
11. What are the applicable regulations and guidelines required by local, state, provincial, and federal jurisdictions?

Also consider exposures that could come from neighboring facilities and the actions that could be taken to help reduce the impact on your facility operations.

3.2 Planned Levels of Response

Some larger organizations (like airports or some manufacturing facilities) might require much larger ERTs. A smaller business comprising a warehouse and office might need only one person for the entire task. You can combine functions or add to them, as needed.

There are different requirements of emergency response, depending on the size and complexity of facilities. The following are examples of what may be required for an effective response.

A. A large manufacturing facility or warehouse may have the full range of ERT assignments as defined for each type of hazard emergency response.

B. A small manufacturing facility may have a small emergency response team as defined by the type of hazards at the facility and may have personnel playing more than one role.

C. An office occupancy would typically have smaller ERTs due to the lack of additional operating hazards found in manufacturing and warehouse facilities.

3.3 Education and Training

Each position needs its own set of training objectives. It is important to establish drills with the on-site team and coordinate them with the public fire service and other outside agencies.

The type of response anticipated will dictate the frequency of training and education sessions. Training and education on response to each peril should be conducted at least annually, with a focus on individual perils prior to the time of year when they are most likely to occur. Education sessions may occur on a more frequent basis with live drills once a year. For example, the fire and explosion hazard may need quarterly education sessions and an annual live fire training drill for firefighting teams and industrial fire brigades.

3.4 Emergency Response Team Leadership (ERTL)

The ERTL usually conducts the following tasks. There could be multiple ERTLs assigned to handle different perils depending on the size of the facility.

A. Arranges pre-incident planning with the fire service or other public agencies to set up a plan of action in the event of an emergency.

B. Establishes step-by-step response procedures for the ERT in handling all emergencies, including fire, flood, windstorm, earthquake, winter storms.

C. Directs ERT actions during the emergency.

D. Ensures ERT members are in place and performing their assigned duties.

E. Ensures emergency materials are available (for natural hazards) prior to the specific season. FM Approved flood abatement equipment, plywood, nails, snow shovels, snow blowers, portable pumps are typical examples, but the list will likely go beyond those.

F. Supports public fire service incident commander as required. An Incident Command System (ICS) is an important and critical activity for major incidents. It is a management concept for all the facets of major incidents. The establishment and the operation of the Incident Command System is built around the pre-fire plan.

3.5 Earthquake

It is critical to have a well-defined plan of action that can be implemented immediately following an earthquake. Plan details and formal agreements should be made well in advance, as there is little to no warning before an earthquake occurs.

The earthquake emergency response plan (EQERP) should include site-specific actions to minimize further damage and support a prompt return to business. The Emergency Response Team Leader will initiate activation of the earthquake emergency response team (EQERT).

3.5.1 Building Occupancy Resumption Program (BORP)

The time it takes to perform structural evaluation and recertification of a building as safe to occupy can significantly increase downtime following an earthquake. This is due to a limited supply of engineers and building inspectors and the numerous buildings needing inspection and recertification. To avoid this problem, a formal agreement should be established in advance for priority services to facilitate the structural evaluation, repairs and return to occupancy.

A simple retainer for a structural engineer may be sufficient; however, delays of weeks to months can still be expected while waiting for building department inspection and official recertification as safe to occupy.

For those locations in which a prompt return to business is critical, a formal written agreement between the building department, building owner, and structural engineer, authorizing the structural engineer to officially inspect and recertify specific buildings, should be made. Known as a building occupancy resumption program (BORP), or back-to-business program, this arrangement must be established well in advance of an earthquake. Not all building departments are familiar with or offer BORP programs. In such cases, a building owner should petition the building department for such a program and work with a structural engineer to establish one.

A specific example of a building department sanctioned BORP is the one developed by the San Francisco, California Department of Building Inspection (DBI) in conjunction with the Structural Engineers Association of Northern California (SEAONC), the Building Owners and Managers Association (BOMA) and the American Institute of Architects (AIA). Information and literature on this program can be found (by searching for “BORP”) on several websites, including the following:

- The City and County of San Francisco DBI website at sfdbi.org
- The SEAONC website at seaonc.org
- The Northern California Chapter of the Earthquake Engineering Research Institute (EERI) website at eerinc.org

3.5.2 Earthquake Early Warning Systems (EEWS)

An earthquake early warning system is a system of seismometers, communication, computers, and alarms that is devised for regional notification of a substantial earthquake while it is in progress. Initial waves of an earthquake are detected and measured near the epicenter by sensors. Those data are quickly processed so alerts can be broadcast to the region before strong shaking arrives. Warning can be in the range of a few seconds to a minute or more depending on the distance from the epicenter. Earthquake early warning systems have been established in Japan and parts of Taiwan, Mexico, and the United States. Where available, an earthquake early warning system can be used to provide warning to personnel so they may move to a safe location and commence shutdown of equipment if needed. It may also be used to automatically shut down sensitive processes or equipment.

3.5.3 Illustrative Losses

When an earthquake occurred at a metal molds manufacturing facility, staff were prepared with an earthquake emergency response plan. Employees were evacuated and an inspection of the building condition, utility services, and equipment conditions were conducted the same day. The inspection of the electrical equipment prevented a fire and limited the loss.

3.6 Fire and Explosion

3.6.1 Pre-Incident Planning vs. Fire Code Inspections

Those who perform code-related inspections of a property are usually from a fire prevention office. Those who perform pre-incident plan visits are typically from the closest, or first due, fire station and will work with facility management to understand the conditions and hazards of the property. The fire service has as big a stake in the pre-incident plan as the facility does. Developing good relations between the fire service and facility management helps everyone understand the hazards at the facility and will help everyone understand concerns associated with the facility. Fire service contacts have advised FM that, historically, their intent is not to evaluate code violation conditions as part of their pre-incident planning activities.

One of the most important parts of developing a response plan is your pre-incident plan with the public fire service. Good pre-incident planning involves conducting a site visit with the public fire service on the property so that if an emergency strikes, personnel and firefighters will act as a team. It is important for everyone involved to know exactly who does what, where, and when.

3.6.2 Firefighting Teams and Fire Response

Fire response is generally identified in three levels: (1) incipient, (2) exterior, and (3) interior structural.

Incipient fire response is when personnel respond to a fire directly from their workstations, and normally do not wear firefighting gear or self-contained breathing apparatus. They fight fires until they are required to take evasive action from the heat, smoke, and flame. This type of industrial fire brigade uses fire extinguishers and small hose lines up to 125 gpm (473 L/min).

Exterior fire response is when personnel fight fire in open spaces, not in an enclosed structure. (A structure is defined as having a roof or ceiling and at least two walls that can present fire hazards to personnel, such as accumulations of smoke, toxic gases, and heat, similar to those found in a building). This type of fire response is frequently established at chemical facilities and ignitable liquid and flammable gas unloading stations. They use handlines flowing up to 300 gpm (1135.6 L/min), master streams, and other devices for applying specialized agents. This level of firefighting requires use of firefighting gear.

Interior structural fire response is when personnel who are trained in the use of all types of manual fire suppression equipment that is available on the site fight a fire. They wear a full complement of firefighting gear and self-contained breathing apparatus.

Base the presence and type of an on-site fire brigade (industrial, advanced exterior, or interior fire response) on the type of response required and the needs of the facility. Not all facilities require an on-site fire brigade.

3.6.3 Support Personnel

Activities associated with support personnel are detailed below:

A. The pipe fitter knows the piping distribution network and can shut off supplies of flammable gases, ignitable liquids, and other hazardous materials in an emergency. Their responsibilities include the following:

1. Know where primary and secondary shutoffs are located and how they operate.
2. Restore sprinkler protection where necessary.
3. Isolate, drain, and repair any sprinkler piping damaged by fire or explosion.
4. Be familiar with equipment controls.

B. The electrician is essential to larger locations but particularly to manufacturing sites. Their duties and training include the following:

1. Know the location of all switchgear, portable generators, and emergency power equipment.
2. Be thoroughly trained on the electrical system.
3. Be accountable for shutting down electrical fans or handling ventilating equipment according to the pre-fire plan. Shutting off the HVAC is important for fire control and fire suppression and preventing smoke, soot, and heat from spreading throughout the facility. Be able to set up temporary power or lighting.

3.6.4 Illustrative Losses

Property losses clearly indicate that failure to have a pre-incident plan results in inappropriate action by the fire service. In one case, action included failure to properly support automatic fire suppression systems. Specifically, this case involved shutting sprinkler control valves prematurely. In another case, the lack of knowledge about certain chemicals in a building caused firefighters to allow the fire to burn freely for several hours. These actions resulted in significantly larger losses than they otherwise would have been.

3.6.4.1 Lack of Pre-Incident Planning at a Pharmaceutical Manufacturing Facility

A local fire station (located on an adjacent street) made regular tours of a pharmaceutical facility, but never formalized a pre-incident plan. A fire started on the top floor of the 5-story building. Fire originated in a box used to temporarily store lab packs (lab waste involving pyrophoric materials) awaiting vendor pickup. Sprinklers operated and the fire service was alerted. Unfortunately, the local engine company and battalion chief from the local fire station were out on another call. The next closest fire station was alerted but was unfamiliar with the facility. Upon arrival, the fire service encountered a heavy smoke condition on the top floor and automatic sprinklers operating.

Upon entry, they immediately noted the magenta propeller on yellow background sign indicating the presence of radioactive materials and exited the structure (no interior attack) with the intention of letting the automatic sprinklers operate and control the fire until the hazardous materials team arrived. Unfortunately, the hazardous materials team was coming from a nearby city and was delayed. While waiting for them, the incident commander ordered the automatic sprinklers to be turned off and the fire pump to be shut down.

Sometime after they impaired the automatic sprinkler protection, flames were noted coming from the roof. The fire service tried to restore sprinkler protection and place the fire pump back in service, but it was too late. Multiple sprinklers in the room of fire origin and a nearby concealed space had operated and fire had vented through the roof. Exterior fire operations were started to attempt to limit the fire spread, but significant damage had already occurred.

With a formal pre-incident plan, the fire service would have known what was in the building and firefighting could have been started nearly immediately upon arrival, minimizing a substantial loss.

3.6.4.2 Lack of Pre-Incident Planning at a Rolled Polystyrene Storage Facility

At approximately 4:00 a.m., an alarm was heard by the operators in the extrusion department of a rolled polystyrene storage facility. An operator quickly entered Room No. 1 and saw flames at approximately eye level on a section of rolls recently placed in the low-bay section of the warehouse. The operator attempted to use a fire extinguisher on the fire, but with little success. He confirmed hearing and seeing sprinkler water spray over the area of fire origin.

An employee verified that the fire pump was operating and called a manager to inform him of the fire. The fire service was only 0.2 miles (300 m) away and before a call could even be made to them, firefighters were on the scene.

Firefighters entered the building and opened the fire door to Room No. 1 that had been previously closed by an employee. Attempts were made using hoses to suppress the fire; however, according to some accounts, the smoke was so heavy that the area of fire origin was now difficult to assess. Firefighters made holes in the roof of Room No. 1 (four 4 x 4 ft [1.2 m x 1.2 m] openings), reportedly to attack the fire from above.

The fire chief then ordered the fire pump and sprinklers to be shut down. Approximately 5 minutes later, the site manager arrived and was told the sprinklers and pump had been shut down. The valves were reopened, and the pump was restarted approximately 30 minutes after they had been shut down.

After making little progress on the fire over several hours, the fire service began to make holes in the roof over Room No. 2. Despite warnings by facility personnel about conducting these spark-producing operations, firefighters proceeded to cut holes with large grinders. The cuts were made through the steel deck, with some cuts even made through parts of the joists. Facility personnel witnessed many sparks over Room No. 2 and then noticed heavy amounts of smoke coming from this second part of the facility. At this point, it is reported there were two fire areas, and the north half of the facility was becoming heavily engulfed in flames.

The fire continued through the afternoon hours and was under control at about 4:00 p.m., twelve hours after the initial call. Both Rooms 1 and 2 were completely consumed in the fire.

With a formal pre-incident plan, the fire service would have known what commodity was being stored within the building. They would have had a site plan to know what doors to close to contain a fire, and would have been aware of the capabilities of the fire pump and automatic sprinkler systems.

3.6.4.3 Lack of Pre-Incident Planning at a Drilling Mud Manufacturing Facility

Shortly before dawn, a passer-by observed a fire at a facility located outside a small town and notified the fire service. The fire occurred in a 60 x 200 ft (18 x 61 m) steel-on-steel frame building that was used for raw material storage for the facility, which manufactured specialty drilling mud for the oil-drilling industry.

Drilling mud is used to reduce friction in the drilling process and includes many different products, from inert material (such as lime and calcium chloride) to almond and walnut shells and lignite-based products. The facility operated one shift. The doors were locked, and exterior lighting was on when the facility was closed. There was no sprinkler protection and no hydrants available.

Upon arrival, the fire chief refused to fight the fire because he did not know the contents of the building. This set off a chain of events, beginning with the facility providing safety data sheets. A chemical industry information agency was contacted, the state department of environmental quality arrived, and construction was begun on a temporary curbing around the facility to contain firefighting water. The fire service still refused to attack the fire.

In the meantime, mutual aid fire services arrived. After ten hours, the fire service began suppression activities, but by then all of the occupancy was burned or damaged and most of the building was severely damaged.

With a pre-incident plan, the fire service would have known what was in the building and firefighting could have been started nearly immediately upon arrival, preventing as substantial a loss.

3.6.4.4 Loss at a Facility Handling Hazardous Materials

A fire occurred at a facility that handled hazardous chemicals, including corrosive and toxic materials. A defective heater ignited nearby combustible materials. There were no automatic sprinklers in this area of the facility. Security personnel spotted the fire and notified the fire service, who responded promptly. Security personnel advised the responding fire units that there were very toxic materials in the facility. Because the fire service lacked knowledge of the site, including where the chemicals were located, they did not attack the fire but merely protected the surrounding area with hose streams. After several hours they realized that, though contained, the fire continued to burn at a very slow rate. Finally, the fire service determined it was safe to enter the building and did so. The fire was quickly extinguished. Upon investigation, it was found that the fire did not even involve the feared chemicals. Again, had there been a pre-incident plan, the fire service would have known what was in the building and firefighting could have been started nearly immediately upon arrival.

3.6.4.5 Pre-Incident Plan Prevents Major Loss at Paper Product Distribution Center

At approximately 1:00 a.m., employees working on a stacker crane reported hearing a loud noise and saw sparks at the ceiling. Power was lost to both the north and south warehouses. The fire service was called, and the site emergency response team was alerted. It was noted at that time that the sparks had ignited several pallets stored in racks.

Within approximately 10 minutes, the fire service arrived. Due to a detailed pre-incident plan, they connected to the closest hydrant and made entry into the facility. They quickly reached the fire area and extinguished the fire with a single hose line. Due to the quick response and preplanning, no sprinklers operated during the fire.

The fact that the fire was manually extinguished prior to operation of the sprinklers exemplified the excellent preplanning of the facility.

3.6.4.6 Pre-Incident Planning Prevents Major Loss from Exposure Fire

A manufacturing and storage facility was notified that the automatic sprinkler system had been taken out of service in the neighboring vacant multi-story mill building of combustible construction (approximately 10 ft [3 m] away). It was quickly realized that this was a major exposure to the facility.

The fire service was notified, and a meeting was held between facility management and the fire service. It was confirmed that the management from the vacant mill had made the proper legal notifications to impair their automatic sprinkler systems.

With confirmation that there was no action that could be taken to properly protect the vacant mill, management from the facility and the fire service worked to develop a pre-incident plan. The pre-incident plan would assume that the vacant mill would remain unprotected, and the fire service response would concentrate on protecting the exposed buildings. In addition to the documented pre-incident plan, the facility took action to block up several windows that faced the vacant mill. They also installed additional security cameras to monitor conditions in the narrow alley between the vacant mill and the facility.

Approximately 1 year after the pre-incident plan had been created and the improvements made to the facility, a fire broke out in the vacant mill. The fire was first reported by a security guard who saw smoke from one of the newly installed security cameras. The fire consumed the entire vacant mill but did not spread to the manufacturing and storage facility due to actions taken by the fire service based on the pre-incident plan, and the fact that the windows had been blocked up. Damage was limited to some roof areas from flying brands and water damage from hose streams penetrating the damaged roof.

3.6.4.7 Lack of Pre-Incident Planning at a Heat Treatment Facility

An 8,000-gal (30 m^3) quench-oil tank at a heat-treating facility was drained in preparation for some changes in its cooling system. An employee using a torch to cut a 4 in. (0.1 m) hole near the bottom of the tank ignited an oil sludge that remained. The fire burned for about two hours and damaged the tank controls in the area and the unprotected building structure.

How did it happen? When the tank was drained no one cleaned out the accumulation of sludge at the bottom. Had a hot work permit been used, and the site been reviewed by a knowledgeable hot work supervisor, this should have been recognized and dealt with. But a permit was not used.

The tank had a manual carbon dioxide system to protect oil surface fires. Employees turned it on and off for half an hour before calling the fire service. The protection did not work for a fire at the bottom of the tank. An ERT would have notified the public fire service immediately and responded to fight the fire, but there was no ERT.

The fire service arrived but without the foam they felt was needed to fight an oil fire. By the time adequate foam had been obtained, more than another hour had passed. Had pre-fire planning been done with the fire service no doubt it would have had adequate equipment the first time. But there had been no pre-planning.

3.6.4.8 Lack of Pre-Incident Planning Delays Fire Service Attack on Fire

Chemical cleaning of metal parts was completed with alcohol and the parts moved to a dryer. An operator noticed a glow under the dryer and went to get another operator to attempt to extinguish the fire. By the time the operators attempted to extinguish the fire, it had spread to the cleaning pit following a trail of alcohol left by the hand cart and dripping parts. The fire service was notified meanwhile the fire continued to spread to adjacent combustible equipment.

The fire service responded quickly and arrived within 15 minutes of the initial fire being noticed. However, they did not start to attack the fire due to concerns over ignitable liquids present within the building. By the time they decided to apply hose streams, an hour and fifteen minutes had passed. At this point the building roof had started to collapse.

With a formal pre-incident plan, the fire service would have known what ignitable liquids may have been involved and how best to start attacking the fire. The lack of fire preplanning with the fire service led to a delay in attacking the fire, which resulted in a significantly larger loss than otherwise would have been experienced.

3.7 Flood

The best strategy to avoid the damage associated with flooding is to avoid building in a flood-prone area, or, if that is not possible, make physical changes to the existing facility to reduce potential flood damage.

Three important changes to make to an existing facility within a flood zone are: (1) permanently elevate equipment and contents 2 ft (0.6 m) above the expected flood level, (2) prevent water from entering the buildings and, (3) increase resilience via FERP actions and/or make the business less sensitive to flood losses.

Data Sheet 1-40, *Flood*, provides additional solutions that can permanently reduce the flood hazard.

The objective of a FERP is to reduce the financial impact of the flood in a commonsense manner. A well-planned FERP can significantly reduce, or even prevent, property damage and business interruption. FM loss history has shown that facilities with good FERPs have reduced damage significantly and resumed operations sooner than those locations with an inadequate or no FERP. Therefore, every location exposed to flooding should have an up-to-date flood emergency response plan.

Facilities in flood zones can take advantage of flood warnings and the predictability of the event. By understanding the likely flood scenario, the advanced warning time can be used to make the biggest impact on reducing the loss.

The effectiveness of emergency actions is governed by advanced planning and how well the available resources (equipment and manpower) are managed. Unfortunately, flooding often affects a wide area and taxes the capabilities of local emergency services, so it is wise not to count on these. Specific emergency steps are tied to a facility's contents, equipment, and construction features. An emergency plan cannot be borrowed from a neighboring facility; the plan must reflect conditions particular to the site. As discussed in Section 2.2.4, a successful FERP is based on a thorough understanding of the flood scenario(s) and the impact to the business to identify vulnerabilities, protection priorities and protection measures.

In some regions of the world, government-issued warnings and watches can be used to obtain the flood warning. If these are not available, the facility may independently monitor weather conditions (rainfall, river levels, etc.) in the area to provide the safest warning time for implementing the FERP action. The amount of warning time available will affect the type, number of actions, and their success.

Do not underestimate the challenge of implementing the FERP based on a warning. A person in charge must have the authority to activate the plan and shut down operations. This person must be someone in a management position able to make and implement decisions.

The objective of de-energizing utilities is to safely shut down all equipment before water enters the facility and allow equipment to cool down in order to prevent thermal damage. Shutdown would also include electrical, gas, and other utilities. Fire protection water must not be shut down. Shutting down power to fire alarms and power supplies must be avoided if possible.

In some cases, it is not feasible or cost effective to flood-proof buildings against the 500- or 100-year event even where shallow flooding (less than 3 ft or 1 m) exists. This may be due to the nature of the building frame (too weak) or its use (too many openings). In these circumstances it may only be possible to protect to lower depths of flooding (e.g., against the 50-year event) or simply reduce the depth but not keep it dry. Such partial solutions still provide benefits to the business and help reduce the exposure to less severe but more frequent events albeit below the desired 100-year standard.

Reducing how often flood water enters a building can be a cost-effective solution that addresses the more frequent, lower-level flood events.

The waterproof quality and strength of the walls and floor slabs used in conjunction with the barriers and closure of penetrations determine the overall flood-protection capabilities.

3.7.1 Illustrative Losses

Hurricane Harvey, a category 4 hurricane, made landfall on 24 August 2017. As the storm headed inland it stalled over Houston, Texas. The total precipitation, in many areas, exceeded 40 in. (1.0 m) in 4 days. Many of our clients successfully installed FM Approved stop logs, flood doors and temporary perimeter barriers to fight the flooding.

A large medical center in downtown Houston closed their 45 flood doors to keep water from entering their buildings. The combination of a well-planned and practiced FERP, flood doors, and physical protection was successful. The account engineer worked closely with field engineering to monitor and test the doors each year prior to Hurricane Harvey.

The hospital was featured in a CNN news story and singled out for being able to stay open and receive patients while 16 other hospitals in the Houston area were closed. The flood doors enabled them to stay open and provided confidence that they could stay open throughout the flooding event.

3.8 Freeze and Snow

Prepare for normal winter weather conditions well in advance (e.g., heating system maintenance, etc.). For winter storms, it is essential to have a pre-plan with action points for the site-specific conditions of the facility. The ERT Support Personnel will play a major role in completing the ERP for this exposure. Based on the pre-plan, the ERT Leader will assign the tasks. When the emergency response plan is implemented, it is important to take immediate steps to prepare for the incoming storm. The ERP should include site-specific actions based on the information in the ERP. Unlike fire emergencies, there is often advance notice of the pending winter storm event. The Emergency Response Team Leader will initiate activation of the ERT.

3.8.1 Illustrative Losses

A winter storm with 12 in. (0.3 m) of heavy snow and 2 in. (0.05 m) of freezing rain exposed an asphalt roofing facility. High winds (gusts to 60 mph [27 m/sec]) accompanied the snow and created snow drift at elevation changes on the steel deck on steel frame roofs. Eleven 40 × 25 ft (12 × 8 m) roof bays collapsed or sagged under the load.

The collapse occurred on a long [about 400 ft (122 m)] narrow [80 ft (24 m)] building. About 14 years earlier the building had been remodeled and half of the roof was raised for the entire length. This left a high section and a low section of roof, each 40 ft (12 m) wide, with elevation differences ranging from 4 to 11 ft (1.2 to 3.4 m). During the remodel, the lower roof was not reinforced to support increased loads due to snow drifts at the elevation changes. The storm created a snow drift up to 8 ft (2.4 m) deep along the elevation change which resulted in snow loads of up to 113 psf (5.4 kN/m^2) in that area. The design snow load of the roof was unknown but suspected to be 20 psf (0.96 kN/m^2) and it could not withstand the snow load and eventually collapsed.

Had a snow monitoring and response plan been in place, the potential for snow accumulations at roof elevation changes would have been identified and monitored, and actions could have been taken to remove the snow before the loads exceeded the roof's capacity.

3.9 Liquid Leaks and Spills

3.9.1 Illustrative Losses

A high-rise building experienced a water leak from a hose station on the 19th floor. A contractor was called, and the FM Red Tag Permit System was followed for the planned sprinkler impairment while the necessary repairs were made. When the repair efforts were completed, the sprinkler system was refilled. During the refill process, a leak was found on the 20th floor caused by an improper installation of a fitting that was dislodged during the sprinkler system refilling process. Immediate action was taken following water leak emergency response protocols to isolate the leak and initiate cleanup efforts. The fitting was properly repaired, and the sprinkler system fully restored on the same day. Without the proper protocols in place to respond to a water leak, more damage could have occurred, and the sprinkler system may not have been placed back into service as quickly.

3.10 Wildland Fire

3.10.1 Illustrative Losses

A wildland fire surrounded a university threatening the campus buildings. The emergency response team acted promptly upon the first report of the fire. They shut down heating, ventilation and air conditioning systems, safeguarded buildings, and set up an incident command center. The emergency response team worked to extinguish spot fires throughout the property assisting the local fire service who responded quickly to fight flames on the ground and air to hold the fire back from the University buildings. University management maintains a 200 ft (60 m) brush clearance zone around the campus which provided ample space for fire service equipment and personnel to protect and reduce the exposure from the fire. The University also conducted joint annual training of the ERT and local fire services to review response procedures and action plans. The pre-incident planning and emergency response plans put in place at the University allowed the emergency responders to act quickly and helped to limit the damage to spot fires, some water damage and smoke damage.

3.11 Windstorm

There is little time to perform inspection and repair activities in the face of an impending storm. It is essential to have a pre-plan with action points for the site-specific conditions of the facility. The ERT Support Personnel will play a major role in completing the ERP for this exposure. Based on the pre-plan, the ERT Leader will assign the tasks.

The ERP should include site-specific actions based on the information in the ERP. Unlike fire emergencies, there is often advance notice of the pending windstorm event. The Emergency Response Team Leader will initiate activation of the ERT.

3.11.1 Illustrative Losses

A windstorm/cyclone warning was issued 2 days before hitting a manufacturing facility with winds up to 40 m/s (87 mph). The site had a wind emergency response plan that they followed in advance of the approaching storm. When the storm hit, the roof and skylights were damaged allowing rain into the main production area. Once the storm had passed the ERT took immediate action to remove the water from the production area, cover the damaged roof and skylights to prevent further water penetration into the building as well as restored electricity with generators. The ERP allowed the ERT to act quickly after the storm to get the operations back up and running.

4.0 REFERENCES

4.1 FM

General:

- Understanding the Hazard: *Lack of Emergency Response* (P0034)
- A Pocket Guide to Emergency Response (P9914)
- Pocket Guide: Automatic Sprinklers P8807
- The Emergency Response Team (P8116)

Fire and Explosion:

- Understanding the Hazard: *Lack of Pre-Incident Planning* (P0033)
- Pocket Guide to Pre-Incident Planning (P9809)
- Fighting Fire in Sprinklered Buildings (P8708)
- FM Fighting Fire in Sprinklered Buildings online training
- Pre-incident and ERP template (https://www.fmglobalfireserviceresources.com)

Flood:

- Flood Checklist (P9805)
- Flood Emergency Response Plan (P0589)
- Data Sheet 1-40, *Flood*

Earthquake:

- Earthquake Checklist (P9807)
- Data Sheet 1-2, *Earthquakes*

Liquid Leaks and Spills:

- Liquid Damage: Guidelines for Healthcare and Education Facilities (P14004)
- Liquid Damage: Guidelines for Commercial Properties (W151500)
- Data Sheet 1-24, *Protection Against Liquid Damage*
- FM online water damage resources:
  - www.fmglobal.com/research-and-resources/tools-and-resources/water-damage-resource
  - https://web.fmglobal.myriskmanagement.com/LiquidDamage

Windstorm:

- Protecting Your Facility Against Major Windstorms (P9811)
- Protecting Roofing Systems Against Windstorm Damage (P0283)
- Emergency Checklist – Wind (P9308)

Freeze and Snow:

- Protecting Your Facilities from Winter Storms (P0101)
- Freeze-up Checklist (P9521)
- Data Sheet 1-54, *Roof Loads and Drainage*
- Data Sheet 9-18,/17-18, *Prevention of Freeze-ups*

Wildland Fire:

- Understanding the Hazard: *Wildland Fire Exposure* (P0414)
- Data Sheet 9-19, *Wildland Fire*

4.2 Others

Deutsches Institut fur Normung e.V. (German National Standard). DIN 14095, *Ground Plans for Components for Buildings for Fire Brigade Use*.

National Fire Protection Association (NFPA) 1081, *Standard for Facility Fire Brigade Member Professional Qualifications*

National Fire Protection Association (NFPA) 1620, *Standard for Pre-Incident Planning*

National Fire Protection Association (NFPA) 1561, *Standard on Emergency Services Incident Management System and Command Safety*.

National Fire Protection Association (NFPA) 600, *Standard on Facility Fire Brigades*.

APPENDIX A GLOSSARY OF TERMS

Critical room: A room with high operational impact or contents that cannot be easily replaced. Examples include main and emergency power equipment rooms, data and communications centers, diagnostic equipment rooms, pharmacy and medical supply storage, laboratories, and clean rooms.

Emergency response planning: The development of action plans for site-specific hazards considering the facility's needs and requirements to provide an effective response.

Fire service: A term for firefighters in any area of the world. Some locally used terms include fire department, fire brigade, fire and emergency services, and fire/rescue.

Incident command system (ICS): A standardized approach to the command, control, and coordination of emergency responders, providing a common hierarchy within which responders from multiple agencies can be effective.

Pre-incident planning: Emergency response planning in collaboration with local agencies such as the fire service.

Unified command (UC): Applies ICS in incidents involving multiple jurisdictions or organizations. Agencies work together through the designated members of the UC to establish a common set of objectives and strategies to resolve the incident.

APPENDIX B DOCUMENT REVISION HISTORY

The purpose of this appendix is to capture the changes that were made to this document each time it was published. Please note that section numbers refer specifically to those in the version published on the date shown (i.e., the section numbers are not always the same from version to version).

January 2023. Minor editorial changes were done for this revision.

July 2022. Interim revision. Changes were made to the freeze peril guidance to maintain alignment with Data Sheet 9-18, *Prevention of Freeze-ups.*

October 2021. Interim revision. Minor changes were made to the snow peril guidance and the pre-incident plan template.

July 2021. This document has been completely revised. Significant changes include the following:

A. Changed title to "Pre-Incident and Emergency Response Planning" (from "Pre-Incident Planning").

B. Incorporated contents of Data Sheet 10-2, *Emergency Response*. Made Data Sheet 10-2 obsolete.

C. Restructured content to highlight guidance based on peril.

D. Added guidance for liquid leaks and spills and wildland fire.

E. Updated snow monitoring and removal recommendations.

F. Added pre-incident planning guidance for high-challenge fires where manual fire extinguishment is needed.

G. Updated illustrative losses.

H. Revised pre-incident plan template.

April 2018. This document has been completely revised. Significant changes include the following:

A. Changed the title of the document from *Pre-Incident Planning With the Public Fire Service* to *Pre-Incident Planning*.

B. Added loss experience information.

C. Added data collection forms to assist in pre-incident planning.

D. Reorganized the document to provide a format that is consistent with other data sheets.

May 2003. Small revision to section titled ‘‘3.2 Loss History’’. Also, minor editorial changes were made for this revision.

January 2002. Provisions for implementation of the Incident Command System (ICS) were added (section 3.1.2).

January 2001. First publication of this document.

APPENDIX C PRE-INCIDENT PLAN DRAWING DETAILS

Items to consider when developing a drawing for a pre-incident plan include the following:

A. Construction

1. Building locations, designations, access points, and size (including height)
2. Building construction features including, but not limited to, the following:

   a. Combustible or noncombustible wall construction
   b. Interior finish materials
   c. Location of firewalls and fire doors
   d. Location of concealed spaces (above and below)
   e. Location of confined spaces
   f. Location of aged and lightweight construction features
   g. Location of elevator shafts, pits, machine rooms
   h. Location of roof access

3. Roof construction (truss, joist, skylights, roof vents, etc.)
4. Location and information on the operation of fixed smoke and heat ventilation systems
5. Stairwells
6. Property lines, topography, and north point designation
7. Roof-mounted solar panels and location of disconnects
8. Roof-mounted equipment, including tall exhaust stacks
9. Industrial exhaust system access points and shutdown locations

B. Fire Protection

1. Location and size of underground fire main, including location of water tank, tank volume and refill rate, if applicable
2. The types and location of fire protection systems:

   a. Sprinkler systems
   b. Special protection systems: foam, gaseous, dry chemical, water mist, etc.
   c. Interior hose connections

3. Location of spare sprinklers for replacement after incidents
4. Locations of any pressure-reducing valves/devices
5. Locations of fire protection control valves, types of valves, and areas controlled by each valve
6. Location of fire alarm system panels
7. Location of both on-site and public water system hydrants. Ensure on-site fire hydrant threads are compatible with the fire service equipment. Understand sources of water supply for onsite hydrants. Include hydrant flow data.
8. Location of other water supplies such as lakes, ponds, or water tanks. Include essential information such as volume.
9. Location of fire service connections to the sprinkler system

   a. Ensure compatibility of hose threads
   b. Pumping pressure requirement
   c. Proper signage to designate which sprinkler system is fed from the fire service connection

10. Location and type of onsite fire pumps:

a. Manual or automatic pump
b. Electric powered (including power arrangement)
c. Diesel powered
d. Exterior or interior access

11. Location and type of manually operated fire protection systems. These may include manual deluge system, shut in winter valves (wood yards), etc.

C. Miscellaneous

1. Location of utility connections and their shutoffs, including, but not limited to, the following:

a. Domestic water
b. Electrical, including overhead power lines
c. Natural gas
d. Onsite gas supplies such as propane
e. Production gases
f. Process piping
g. Utilities that may have an adverse impact on the incident if they are disconnected (e.g., electrical power feeding fire pump, hazardous process controls)

2. Location of special hazards and hazardous processes, including ignitable liquids. Include the following items for each:

a. Location of Safety Data Sheets
b. Quantity, tank material, and volumes typically used for ignitable liquids
c. Location of safe emergency shutdown procedures for hazardous processes
d. List of facility personnel who understand the processes and are capable, available, and authorized to safely shut them down
e. Hazardous material management, along with any special firefighting instructions

3. Location of unusual or concentrated storage areas, including rack layout
4. Types of exposures surrounding the property
5. Access roads (primary and alternate) to the site and potential inaccessibility (e.g., railroad crossing, movable bridges, low-clearance canopies, bridges, flooding, weight restrictions on roads and bridges)
6. Facility access (secure access key box, keys, etc.)
7. Areas extremely sensitive to water and smoke damage
8. Uninterruptible power supply (UPS) rooms (see Data Sheet 5-32, *Data Centers and Related Facilities*)
9. Energy storage systems (see Data Sheet 5-33, *Lithium-Ion Battery Energy Storage Systems*)

APPENDIX D INCIDENT COMMAND SYSTEM

An incident command system (ICS) is a management system designed to enable effective and efficient incident management by integrating a combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure. ICS is normally structured to facilitate activities in six major functional areas: command, operations, planning, logistics, intelligence & investigations, finance, and administration. It is a fundamental form of management, with the purpose of enabling incident managers to identify the key concerns associated with the incident, often under urgent conditions, without sacrificing attention to any component of the command system. Typically, the chief officer-in-charge of the fire service is the incident commander.

An ICS is a process by which the roles and responsibilities of both the fire service and the ERT are defined. Operating procedures are established and used in the management and direction of emergency incidents.

The ERT leader is an integral part of an ICS structure. The ERT leader establishes communication links with the fire service and with the incident commander. They provide information on construction, occupancy, and protection features that are affected by the incident in progress. This action is part of the public-private partnership, and an important consideration when developing a pre-incident plan.

An ICS also provides a plan to coordinate with other outside agencies that may be required as a result of the incident.