EMERGENCY RESPONSE

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1.0 SCOPE

This document is a general overview of basic areas of concern for Emergency Response (ER). It addresses the major perils of fire/explosion, flood, the winter hazards of freezing and roof collapse, windstorm and earthquake. Its intent is to highlight actions that can minimize the impact of the emergency to property loss and business interruption.

This document is developed to assist property owners, operators, and occupants in developing a procedure for response to a variety of property insurance related events. It is not intended to meet the emergency response requirement as established by governmental or other organizations.

See Section 4.0, *References*, for a listing of FM Global data sheets or other publications providing supporting information to this data sheet.

Data Sheet 10-1, *Pre-Incident Planning - Fire* provides information on how to establish a pre-fire plan with the public fire service.

1.1 Changes

June 2007. Revisions made to reinforce the necessity to develop a Flood Emergency Response Plan (FRP) using common sense to reduce the financial impact to a facility due to flooding.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Introduction

The recommendations provided below are designed to allow for the development of emergency response plans for a variety of potential incidents. It is anticipated that all such plans will have elements associated with fire and explosion and most likely one or more of the natural hazard type perils.

2.2 Human Factor

2.2.1 Actions Applicable to All Incidents Requiring Emergency Response

Before the Emergency Response Plan (ERP) is set up, it is important to understand the site-specific needs and requirements. The recommendations below assist the user in understanding the requirements for an effective emergency response. Address the high and medium level priority emergencies that have occurred and also that could occur.

2.2.1.1 Assess the needs of each individual facility. Evaluate the impact of any fire, explosion, or natural hazard incident on the property, the general public, the environment, and the ability to resume business after an emergency. (See Section 3.1.1 for checklist.)

2.2.1.2 Create a written policy that includes, as a minimum, the following three important sections:

- 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 flammable liquid spills or Class D metal fires. Instead, only defensive action would be provided until the public fire service arrives.)
- A *Policy* section to outline the plan and top management's commitment. The policy should be reviewed at least annually to ensure that changing conditions are included and kept up to date.
- A *Responsibility* section to designate people by name or title that generate and maintain the emergency response plan.

2.2.1.3 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 creates specific job descriptions. (See Section 3.1.2.)

2.2.1.4 Educate and train personnel to perform the assigned duties for each level of response needed for the Emergency Response Team (ERT). (See Section 3.1.3.)

2.2.1.5 Monitor the Emergency Response Plan (ERP) over time by auditing the ERP at least annually, and revise as needed. Changes will occur and as they do, they need to be well managed. Audits of equipment, storage and property help determine past and evolving changes and future plans.

2.2.1.6 Develop a process to ensure that the ERP is updated promptly, as needed, for changes in construction, occupancy, protection and exposures. Update the Emergency Response Team Leader (ERTL) of any changes.

2.2.1.7 Develop the ERP and train the ERT to respond efficiently during and after an emergency. This is the responsibility of the ERTL (e.g., in the case of a predicted storm warning or watch, the ERT may be needed to carry out pre-emergency tasks like shutting down certain critical operations and boarding up windows). (See Section 3.1.4.)

2.2.2 Actions Required For Specific Types of Events

Each type of emergency event has specific characteristics that must be anticipated and prepared for. These actions are identified in the following sections. Comments applicable to all actions are identified below:

- The safety of employees assigned to perform emergency response is of utmost importance. The facility safety program should give special consideration to the actions that are anticipated by the ERT.
- Frequently, back-shifts will have a reduced staff. This may require that personnel be assigned to perform multiple functions.
- Assignments, as applicable for the site-specific needs, can be made by name or job description.
- Alternates should also be assigned for all key positions.

2.2.2.1 For ‘‘fire & explosion’’ perils, include the following positions and functions (Section 3.1.5):

1. The *Notifier* — maintains a current list of ERT personnel and alternates, contacts ERT personnel for all emergencies and notifies outside personnel like fire, medical, and rescue services.

2. The *Sprinkler Control Valve Operator* — knows where all valves are located and is responsible for operating them in the event of a fire. This person goes to the valve that controls sprinklers protecting the fire area, initially makes sure the valve is open and stands by it until the ERTL or the public fire service chief officer in charge orders the valve shut.

3. The *Fire Pump Operator* — checks the automatic starting pump when the fire alarm sounds. He or she starts the pump if it has not started automatically and keeps it operating until instructed to shut it off. It’s important for this person to be familiar with the operation and care of the pump, trained in starting it manually and understanding its importance in relation to fire protection.

4. *Firefighting Teams, or Industrial Fire Brigades* are trained to handle emergencies within the context of the ERP. (See Section 3.1.6.)

5. The *Salvage Team* — gets the facility back in operation as soon as possible after an emergency. The duties include:

- Be able and ready to start salvage during and after the emergency. Actions should be *immediate*. Damage can worsen as time passes.
- Know how to salvage and clean equipment and stock.
- Concentrate on valuable stock and equipment. Mopping up to remove dampness and drying out areas wetted by water are typical tasks.
- Give priority to any major damage to vital equipment or processes.

6. *Watch Service Personnel* — are a very important part of the ERT, since they are often the only ones at the facility when it is closed. These are the times watch services or security personnel will be required to fill ERT positions. They should receive the same training as the ERT. Their response duties include:

- Know the procedures during and after an emergency and follow them carefully.
- Sound the fire alarm.
- Notify the public fire service in event of fire.
- Check sprinkler control valves to ensure they are open and the fire pumps are in operation.
- Direct fire service personnel to the area of fire origin.

- Notify facility officials.

7. *Support Personnel* — are drawn from maintenance, engineering, and labor groups to perform specific functions as delegated by the ERTL. The individuals needed are determined by the types of incidents expected and actions required for the site-specific situations and exposures. (See Section 3.1.7.)

8. *Personnel Evacuation Coordinator* — sole job is to assure that all personnel are safely evacuated from the building. In large facilities there will likely be area evacuation coordinators who report to the Personnel Evacuation Coordinator.

2.2.2.2 For locations prone to flooding (500-year or more frequent), establish a formal written flood emergency response plan (FERP). Keep the plan up to date, and include the following:

1. A description of the flood hazard and likely flooding scenarios. Important items to include are:

- Weather event that will trigger flood, and where the flood waters will come from.
- Likely warning time.
- Depth of water expected in key buildings.
- Length of time water will remain in the facility.
- Description of the critical areas likely to be flooded, and the business impact.

2. A readily available, reliable, and practical method to obtain a flood warning.

3. A designated individual who has authority to activate the plan, including halting business activities as necessary, with alternates to cover all working periods. In addition, identify specific tasks that will be assigned to available personnel.

4. A procedure that describes the steps to shut down/de-energize utilities in an orderly manner to reduce ignition sources and the amount of damage.

5. Procedures to accomplish the following, if applicable:

- Raise and relocate highly valuable and easily moved equipment, contents and vital records. This may require acquiring or renting special equipment to relocate contents.
- Close emergency valves to the sewer drains.
- Check sump pumps to ensure they are in operation or ready for operation.
- Prevent water from entering key areas by using flood gates, stop logs, water barrier tubes, etc. An alternative but less reliable solution is to use sandbags to keep water from entering.
- Shut down flammable liquid and flammable gas systems.
- Cover large stationary machines with water-displacing, rust-preventive compound.
- Fill empty storage tanks to prevent them from floating.
- Ensure backup power supplies (generators) are functional.
- Set up emergency communication equipment.
- Monitor access to property and outside utilities during flooding.
- Keep fire protection equipment operational for as long as possible.

6. A recovery plan for the rapid restoration of operations to continue as many portions of the business as possible. Refer to DS 10-5, *Disaster Recovery Planning,* in addition to doing the following:

- Prioritize cleanup actions.
- Prioritize the rebuilding or replacement of vital pieces of equipment that are most critical.
- Set up temporary or skeleton operation at remote locations.
- Document procedures on how production will be made up at other facilities.
- Establish agreements with vital sub-contractors to respond in the event of flooding.

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

7. A plan to minimize the fire hazard during and after the flood:

- Ensure the integrity of the electrical system and then restore the electrical services on an item-by-item basis.
- Only perform hot work if necessary and in a safe manner using the FM Global *Hot Work Permit System*, and only after fire protection systems are restored and combustibles are removed from the hot work area.
- Check all flammable liquid storage and flammable gas piping systems for leaks before returning to operation.
- Check all tanks for leaks.
- Remove combustible debris as it accumulates.

8. A plan to return fire protection systems into service promptly by taking the following actions:

- Run or test fire pump, fire pump driver, and controller. Repair if flood damaged.
- 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.
- Check the yard main fire protection system and water tanks for washouts.
- Remove water and mud from fire protection valve pits.
- Inspect sprinkler system piping for damage and repair as needed.
- Test all sprinkler control valves to ensure they are in the full open position, operable, and undamaged.
- Check all fire protection alarm systems and make necessary repairs.

9. Review the plan after each flooding event for ways to improve it and identify any changes to make to the site and facility to reduce the need for emergency actions.

10. If the FERP includes deployment of flood protection equipment (such as barriers, gates/doors, and sump pumps) and controlled shut down 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.

2.2.2.3 For the winter perils of ‘‘freeze and roof collapse’’, include the following aspects in the ERP which are applicable for the site-specific conditions:

- Fuel all mobile equipment and review/confirm sources for obtaining additional fuel supplies for mobile equipment.
- Fuel all stationary equipment and review/confirm sources for obtaining additional fuel supplies for stationary equipment.
- Review procedures with security personnel and other staff who will remain on-site (checking areas that may be subject to freezing and checking roof areas for snow drift conditions).
- Examine/repair portable heating to ensure that it is ready for emergency use.
- Contact any contractors or others who are depended upon for snow removal to ensure that they have scheduled your site for snow removal activities.
- Monitor the amount of snow accumulating on the roof, particularly at intersections of different roof elevations. Initiate snow removal when snow load approximates 50% of design snow load. At the same time, keep all roof drains clear.
- Drain all idle pumps and compressors and make sure they are vented.
- Lubricate equipment for cold weather operation.
- Provide heated enclosures around operating equipment as necessary/appropriate.
- Verify the operation of no-flow switches and alarms in cooling water lines.

- Verify that instrumentation lines and other in-service equipment are insulated or provided with heat tape or other heat sources.
- Drain and blowout all seasonal equipment, condenser lines, tubing, and piping.
- Inspect all boilers and other heating equipment to ensure they are in proper operating condition.
- Check all steam traps for proper operation.
- Verify that there is adequate heat (e.g., minimum 40°F [4°C]) in all buildings where needed to prevent freeze damage from low temperatures. This includes buildings with wet pipe sprinkler systems, as well as fire pump areas. Hang thermometers in normally cold areas/buildings, and monitor these areas more closely.
- Be sure that all hydrants and all outside sprinkler control valves (post indicator and curb box valves) are marked so that they can be located under snow drifts.
- Use the FM Global Hot Work Permit System for any repair activities.
- Perform other site-specific activities as outlined in the ERP.

2.2.2.4 For the ‘‘windstorm’’ peril, include the following aspects in the ERP as applicable for the site-specific conditions:

- Inspect all fire protection to ensure that it is in service.
- Fill all fuel tanks for fire pumps and emergency generators and test their operation.
- Fuel 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).
- Check and ensure proper maintenance of any additional back-up equipment.
- Protect or relocate vital records.
- Shut down operations that depend on outside power sources.
- Move loose outside stock, storage and equipment to a secure location.
- Ensure 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).
- Repair and fill all above and below ground storage tanks.
- Secure outdoor cranes to prevent them from moving, and lower elevated booms.
- Clean out drains and catch basins.
- Close storm shutters or board up/protect windows.
- Anchor moveable outside equipment, including trailers. Relocate portable objects, even small ones (e.g., chairs, signs, etc.) to an indoor location.
- Other site-specific activities as outlined in the ERP.

2.2.2.5 For the ‘‘earthquake’’ peril, include the following aspects in the ERP as applicable for the site-specific conditions:

- Examine all fuel-fired equipment for leaks.
- Consider shutdown of gas supplies as appropriate.
- Examine fire protection water supplies to determine if they are impaired.
- Examine all fire protection systems to determine if they are damaged.
- Initiate repairs to all fire protection equipment as needed to have them restored to service.
- Examine production equipment for damage and make necessary repairs before starting up.
- Control ignition sources including hotwork, smoking, etc., particularly if fire protection systems are impaired. Use the FM Global Hot Work Permit System for any hot work to be performed in and around the facility.

- Examine all electrical equipment and conduct necessary repairs.
- Examine building structures and facades for damage and take necessary steps to repair and/or stabilize.
- Examine exterior structures, equipment, and storage and take appropriate action.
- Other site-specific activities as outlined in the ERP.

2.2.3 Scope of ERT

There are different requirements of emergency response, depending on the size and complexity of facilities. The following are examples, but not all inclusive of what may be required for an effective response.

2.2.3.1 The large manufacturing plant or warehouse may have the full range of requirements as defined in Section 3.1.5 *Fire and Explosion*, plus as required for a natural hazard emergency response. The type of fire brigade (firefighting team) would be based on the type of response required and the needs of the facility.

2.2.3.2 A small manufacturing plant may have a small emergency response team and include ERTL, notifier, sprinkler control valve operator, fire pump operator (if pump provided), and support personnel as defined by the type of utilities at the facility. In addition, emergency response to natural hazard exposures should be considered.

2.2.3.3 An office occupancy would typically have an ERTL, notifier, sprinkler control valve operator, fire pump operator (if fire pump provided), a personnel evacuation coordinator, and natural hazard response personnel as required. It is understood that in some cases, tenants may not have access to sprinkler control valve and fire pump rooms or areas.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 Additional Information

3.1.1 Assessment Checklist

Certain strengths and weaknesses 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 to concentrate the ERP effort have been identified.

Find Out:

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

3.1.2 Planned Levels of Response

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

3.1.3 Education and Training

Each position needs its own set of training objectives. It's 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 that is anticipated will dictate the frequency of training and education sessions. Suggested frequencies for different perils are as detailed below:

- Fire and explosion: Quarterly education sessions and annual live fire training for firefighting teams and industrial fire brigades.
- Windstorm and winter hazards: Prior to the time of the year when likely to occur.
- Earthquake: Semi-annually to review actions to be taken.

3.1.4 Emergency Response Team Leadership

The ERTL:

- Arranges pre-incident planning with the fire service or other public agencies to set up a plan of action in event of a fire or other emergency. Details of how to develop a pre-fire plan can be found in Data Sheet 10-1.
- Establishes step-by-step response procedures for the ERT in handling all emergencies, including fire, flood, windstorm, earthquake, winter storms;
- Directs ERT actions during the emergency;
- Makes sure the ERT members are in place and performing their assigned duties;
- Ensures that emergency materials are available (for natural hazards) prior to the specific season. Sandbags, sand, plywood, nails, snow shovels, snow blowers, portable pumps are typical examples but the list will likely go beyond those.
- Supports public fire service incident commander as required. The 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. Additional details on ICS can be found in Data Sheet 10-1, *Pre-Incident Planning-Fire*.

3.1.5 Fire and Explosion

One of the most important parts of developing a response plan is your pre-fire plan with the public fire service. Good pre-fire planning involves conducting a site visit with the public fire service on your property so that if an emergency strikes, your personnel and firefighters will act as a team. It's important for everyone involved to know *exactly* who does what, where and when. (See Data Sheet 10-1 for details.)

3.1.6 Firefighting Teams and Industrial Fire Brigades

Fire brigades are generally identified in three levels:

1. Industrial Fire Brigades

   Incipient industrial fire brigades typically respond to a fire directly from their work stations, 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 industrial fire brigade uses fire extinguishers and small hose line up to 125 gpm (473 l/min).

2. Advance Exterior Fire Brigades

   This level of industrial fire brigade commonly fights 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 employees, such as accumulations of smoke, toxic gases, and heat, similar to those found in a building). This type of industrial fire brigade is frequently established at chemical plants, flammable and combustible

liquid and flammable gas unloading stations, etc. They use hand-lines 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.

3. Interior Structural Fire Brigades

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

3.1.7 Support Personnel

Activities associated with Support Personnel are detailed below:

1. The *Pipe Fitter* knows the piping distribution network and can shut off supplies of flammable gases, liquids and other hazardous materials in an emergency. Responsibilities:

a) Know where primary and secondary shutoffs are located and how they operate.

b) Restore sprinkler protection where necessary.

c) Isolate, drain and repair any sprinkler piping damaged by fire or explosion.

d) Be familiar with equipment controls.

2. The *Electrician* is essential to larger locations but particularly manufacturing sites. Duties and training include:

a) Know the location of all switchgear, portable generators, and emergency power equipment.

b) Be thoroughly trained on the electrical system.

c) 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.

3.1.8 Flood

3.1.8.1 General

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 changes to the existing facility to reduce potential flood damage. Two 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 or, (2) prevent water from entering the buildings. FM Global Property Loss Prevention 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 common sense manner. A well-planned FERP can significantly reduce, or even prevent, property damage and business interruption. FM Global 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.

The emergency actions necessary to effectively protect the property from flooding are very different from the actions needed in a fire emergency. 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. The key to success is spending an adequate amount of time developing the plan prior to the flood.

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 visually monitor exposures as weather systems approach the area. The amount of warning time available will affect the type and number of actions to take to reduce the flood damage.

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.

Often it is possible to keep low-level flood water (1 to 3 ft [0.3 to 1 m]) from entering a building or areas of a building by using flood gates, stop logs, or water-filled tubes at building openings while relying upon exterior walls to keep water out. Reducing how often flood water enters a building is a cost-effective solution that addresses the more frequent, lower-level flood events. The waterproof quality and strength of the walls used in conjunction with the barriers will govern how successful the emergency action will be.

3.1.9 Winter Hazards (Freeze and Roof Collapse)

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.

3.1.10 Windstorm

Inspect and repair roof flashing, roof covering, roof drains and gutters as routine maintenance. There is little time to perform these 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.

3.1.11 Earthquake

It is critical to have a well defined plan of action that can be implemented immediately after the earthquake. 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 tasks as outlined below.

The ERP should include site-specific actions based on the information in the ERP. As earthquakes strike without warning, it is essential that the facility be prepared to withstand the expected intensity. The Emergency Response Team Leader will initiate activation of the ERT.

3.2 Loss History

3.2.1 Collapse Loss

A winter storm with 12 in. (0.3 m) of heavy snow and 2 in. (0.05 m) of freezing rain hit an asphalt roofing plant. High winds (gusts to 60 mph [27 m/sec]) accompanied the snow and it drifted on the steel on steel frame roofs where there were roof elevation changes. 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 was remodeled and half of the roof was raised for the entire 400 ft (122 m) length. This left a high section and low section of roof (each 40 ft (12 m) wide) with many elevation changes and places for snow

to drift. Elevation differences ranged from 4 to 11 ft (1.2 to 3.4 m). The strength of the lower roof was not increased during remodeling. The storm created a snow drift up to 8 ft (2.4 m) deep against the walls where there were roof elevation differences. This produced snow loads of up to 113 psf (5.4 kN/m^2) on the roof. The design snow load of the roof was unknown but suspected to be 20 psf (0.96 kN/m^2). The structure could not withstand the snowload and it collapsed. Roof reinforcing was needed. However, in the interim, an Emergency Response Plan for limiting drifted roof snow loading was needed. An effective Emergency Response Plan would have anticipated snow accumulations in this area of the plant due to the building elevation changes. Implementation of the Emergency Response Plan would have provided an opportunity for personnel to remove snow from the roof during the storm as the depth of snow reach specified levels (50% of design snow load).

3.2.2 Flood Loss

When a combination of rain and melting snow resulted in a flood, water entered areas of a paper mill. There was several days warning of the rising river crest. Excellent efforts by 600 mill personnel reduced the exposure significantly. Even so, the mill was shut down for four days to prepare for and fight the flood. Several hundred motors were relocated along with product susceptible to water damage. Sandbagging restrained the flood-water and pulp storage was undamaged.

3.2.3 Fire Loss

An 8,000 gal (30 m^3) quench-oil tank at a heat treating plant 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 wasn't 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 department. The protection did not work for a fire at the bottom of the tank. An emergency response team (ERT) would have notified the public fire service immediately and responded to fight the fire, but there was no ERT.

The fire department 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 department no doubt it would have had adequate equipment the first time. But there had been no pre-planning.

4.0 REFERENCES

4.1 FM Global

A Pocket Guide to Pre-fire Planning (Item No. P9809).
A Pocket Guide to Emergency Response (Item No. P9914).
A Blueprint for Emergency Response (Item No. P9401).
Riding Out the Storm (Item No. 9106).
Cold Weather Combat (Item No. 9610).
Preventing Roof Collapse From Snow Loading (Item No. P9408).
Freeze-up Checklist (Item No. P9521).
Winter Losses: Stopping Them Cold (Item No. P9710).
Preparing for Flood Potential (Item No. P9803).
Flood Checklist (Item No. P9805).
Data Sheet 10-1, *Pre-incident Planning-Fire*.

4.2 NFPA Standards

NFPA 600 *Industrial Fire Brigades*

APPENDIX A GLOSSARY OF TERMS

This document does not contain any undefined terms.

APPENDIX B DOCUMENT REVISION HISTORY

June 2007. Revisions made to reinforce the necessity to develop a Flood Emergency Response Plan (FRP) using common sense to reduce the financial impact to a facility due to flooding.

May 2002. First published.