



Understanding the Hazard

Flood

Natural Hazards

For a facility located in a known flood zone, it is not a case of if it will flood, but when. Flood damage and disruption is increased by many factors, including contaminated water and the duration of the flood. FM Global can help you evaluate the risk to your facility from this hazard.

UTH topic categories:

- Construction
- Equipment
- Fire Protection
- Human Element
- ▶ **Natural Hazards**
- Process Hazards

This series of publications is designed to help you understand the everyday hazards present at your company's facilities. For more information on how you can better understand the risks your business and operations face every day, contact FM Global.



The Hazard

The majority of flood is predictable and inevitable, but flood loss also is preventable. Why, then, is flood the most costly natural hazard in the world? It is estimated that financial loss caused by flood in any given year is between US\$2 billion and US\$3 billion worldwide. And, during years that see extreme events, such as when Hurricane Katrina hit New Orleans, La., USA, in 2005, that figure can exceed US\$20 billion.

Predictable

Flood maps are available in many countries covering major urban communities. These maps focus primarily on highlighting geographic areas often referred to as "high-hazard flood zones," meaning those places at greatest risk of flood from rivers and seas. These zones identify areas that have been flooded in the past, or are predicted to flood in the future. History shows approximately 80 percent of all flood loss occurs within these zones.

Inevitable

Facilities located within high-hazard flood zones will experience a major flood. In fact, they are five to seven times more likely to experience a flood causing US\$100,000 or more in damage than to suffer a fire or explosion of a similar magnitude. With approximately one in 10 existing industrial facilities located within a flood zone, the need to understand the flood hazard and take action is critical.

Preventable

When planning a new facility, the simple solution to the flood hazard is to build outside known flood zones, including levee-protected areas, and design the site to ensure all storm-water drainage systems are adequate.

But, what about existing facilities? The answer is to focus on two main strategies: keeping the water out of important buildings where practical, and limiting what gets damaged when flood water does enter a structure.

As with all hazards, it is important to make as many permanent, physical changes as you can to reduce the damage a flood can cause. Then, consider actions that can be taken during an emergency, if the worst should occur.

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What you can do at your facility

Now:

- Ensure you have a clear understanding of the potential flood scenario. This should include your potential warning time, the duration of flooding likely to occur and the depth of flooding anticipated in or around each building or area. Your FM Global engineer can help.
- Develop a Flood Emergency Response Plan (FERP) (see page 3 sidebar).
- Identify and permanently relocate portable high-value items, such as valuable records and plans from basements and low-lying areas.

Soon:

- Where practical (typically, when the potential depth is >1 ft. [0.3 m]), redirect water from buildings using permanent landscaping, curbs and speed ramps. If buildings are flood-resistant (masonry or concrete), place permanent concrete curbs, steps or ramps to keep flood water out of key buildings and critical substations.
- If it is impractical to modify buildings or landscape to keep flood water from entering buildings, focus on reducing the impact to key areas, valuable items and critical equipment:
 - High-value items, such as stock, supplies and important records or plans, should be permanently relocated to buildings that are not exposed to flood. If relocation is not possible, permanently elevate portable items above the anticipated flood level, and reorganize inventory so high-value items are stored at higher levels.
 - Reduce the potential damage to key electrical, computer and telecommunication equipment by either permanently raising equipment or by providing permanent walls and curbs around critical substations or equipment rooms to keep water out.
- Use FM Approved flood abatement products.

Science of the Hazard

The key to preventing flood loss at your facility is to fully understand the exposure to your site. It is critical to be aware of how much warning time you may have, how deep the flood water is likely to get, what the possible impact of fast-moving water might be, and how long it might take the flood water to recede. In addition, bear in mind flood water contains various contaminants, including mud, sand, chemicals (such as gasoline and oil) and even raw sewage, all of which add to the damage potential. Also, waves of little more than 3 ft. (1 m) in height can cause structural damage, and can demolish lightweight buildings.

Your FM Global engineer can help you understand your potential flood scenario using available flood, rainfall and topological data, in addition to local knowledge. Looking solely at flood maps sometimes leads people to think locations outside flood zones are immune to flooding. This is simply not true. The main reason is urbanization, where changes in the landscape have altered the flood path since the map was created. In addition, a site's design and layout itself can create a localized flood hazard if the storm-water management system is overtaxed.

Once you have a clear picture of what to expect—including an estimate of the damage and disruption a flood will cause your business—you can take action to reduce your risk.

Practical Permanent Solutions and Emergency Response Plan Are Key

To reduce the impact of flood on your business, there are simple, practical steps you can take immediately, such as moving critical items out of basements and away from low-lying areas. Then, you can further reduce your risk by making permanent physical changes to your facility, where practical, to keep flood water out of key areas, or permanently elevating important items above predicted flood levels. Finally, if the residual flood risk warrants it, develop a Flood Emergency Response Plan (FERP) (see page 3 sidebar).

What Are the Chances?

The following table lists the probability of a flood occurring *at least* once in a high-hazard flood zone during a given period of time. For example, if your building is in a high-hazard flood zone, there is a 26% chance it will experience the 50-year flood level, and a 14% chance it will experience the 100-year flood level, *at least* once within a 15-year period. Buildings located in flood zones may have floor elevations below the 100-year flood level, and significant flooding will occur at much shallower flood levels.

Probability of a Flood Occurring at Least Once in a High-Hazard Flood Zone		
PERIOD OF TIME	50-YEAR FLOOD	100-YEAR FLOOD
10 years	18%	10%
15 years	26%	14%
20 years	33%	18%
25 years	39%	22%
30 years	45%	26%

Creating a Flood Emergency Response Plan (FERP)

A FERP should include:

- A reliable flood-warning method
- A clearly defined, designated leader with the authority to take action, including shutting down operations in preparation for a flood
- Plans for safely shutting down production lines and electrical systems
- Simple actions to reduce the financial impact of the flood, such as relocating high-value equipment and supplies
- Practical clean-up, temporary operation and recovery plans

Where practical, you can further reduce your risk by:

- Providing flood protection equipment, such as FM Approved doors and barriers
- Developing a more extensive FERP, with assigned personnel providing coverage 24 hours a day, seven days a week
- Instituting regular training exercises

In 2011, the flooding of important commercial and industrial areas all over the world clearly demonstrated that severe floods are not one-time occurrences. Brisbane, Australia, suffered major flooding in 2011, but flooding had been even deeper four times over the past 170 years (in 1841, 1887, 1893, and 1974). Thailand suffered major flooding in 2011 as well, with levels similar to those experienced in 1942. The Susquehanna River in New York, USA, has flooded commercial and industrial areas six times since 1993, with floods in both 2006 and 2011 equaling or exceeding the 100-year event.

Loss Example

A spice manufacturing facility experienced two almost identical flood losses one year apart. The second time around, storage of finished products had been relocated to a height above the previous flood levels. Also, employees took their laptop computers home and were able to conduct vital business transactions from there. These steps resulted in the second flood loss being less than 50 percent of the first, a savings of US\$1 million.



This maintenance office, located in a below-grade area, was completely submerged. Valuable maintenance records, service agreements and other articles were lost.

But What About...

...the fact my facility is located in a flood zone, but has never flooded?

If located in a high-hazard flood zone, there is a 45-percent chance your facility will experience a significant flood at least once within a 30-year period. The likelihood of less severe but more frequent flooding is far greater. Remember, it is always a question of *when* (and how often) rather than *if* a flood will occur.

Need more information?

Ask your FM Global engineer or client service team about the following:

- FM Global Property Loss Prevention Data Sheet 1-40, *Flood*
- FM Global Property Loss Prevention Data Sheet 10-2, *Emergency Response*
- Understanding the Hazard, *Relying on a Levee* (P0307)
- Understanding the Benefit: *FM Approved Flood Abatement* (P11204)

Ordering Information

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...our disaster plan that is designed to work for all hazards?

The unique aspect of preparing for a flood is that you can ensure you have the maximum advanced warning possible. You can predict the event and establish action steps to prepare your facility.

...the fact we have a good FERP. Why do we need to make physical changes to our site as well?

A FERP can be very effective, but relies on human action. By taking a few practical, physical steps to reduce the flood impact, you are not solely dependent on the plan. After all, you would not install an automatic fire sprinkler system with a manual fire pump and then rely on your emergency response team to be your first line of defense.

...the fact our facility is protected by a levee? That means there is no flood risk, right?

Flood-control works, such as levees and dikes, do reduce the likelihood of a flood. However, they are complex systems and the level of protection afforded by them at any given time is a function of the design and maintenance of the system. If your site is protected by a levee or dike, your entire flood risk management program is in the hands of the levee management authority. For more detailed information, refer to Understanding the Hazard, *Relying on a Levee* (P0307).

Don't Let This Happen To You



This location had a Flood Emergency Response Plan (FERP) and barriers to keep floodwater from flowing through doorways and other wall openings. Unfortunately, the FERP didn't include sealing interior storm water sewer drains, which allowed water into this warehouse. Water depth reached approximately 2 ft. (0.6 m) above the floor.