Managing the Risk of Chemical Spills from Flooding
A Guide for Wisconsin Manufacturers

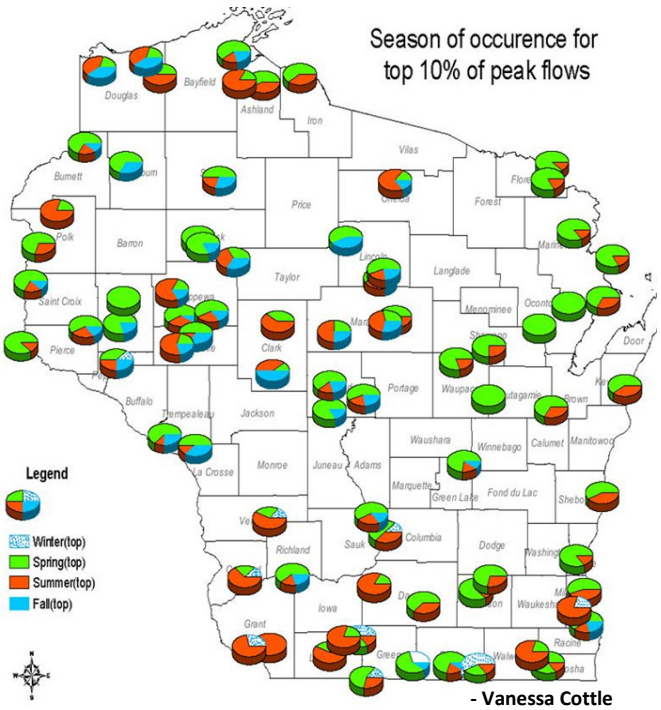
Chemicals, fuels or other materials stored on site at industrial facilities located near rivers and streams can be vulnerable to spills when flooding occurs. Facilities located in a Federal Emergency Management Administration (FEMA) designated floodplain are at significant risk of flood damage, as most companies in such situations are aware. What these and other nearby companies may not know may not know is that their risk of flooding has increased over recent decades, and is expected to increase into the future.

Midwest states have experienced increasingly frequent floods during the last half-century, according to researchers at the University of Iowa[(1)]. Daily records of 774 stream gauges in 14 states for the period 1962-2011 show a 34% increase in the number of flood events. Projections of Midwest climate also indicate more heavy rainfall with a seasonal shift toward winter and spring for precipitation. This is expected to lead toward increased frequency and severity of flooding along Wisconsin's rivers.

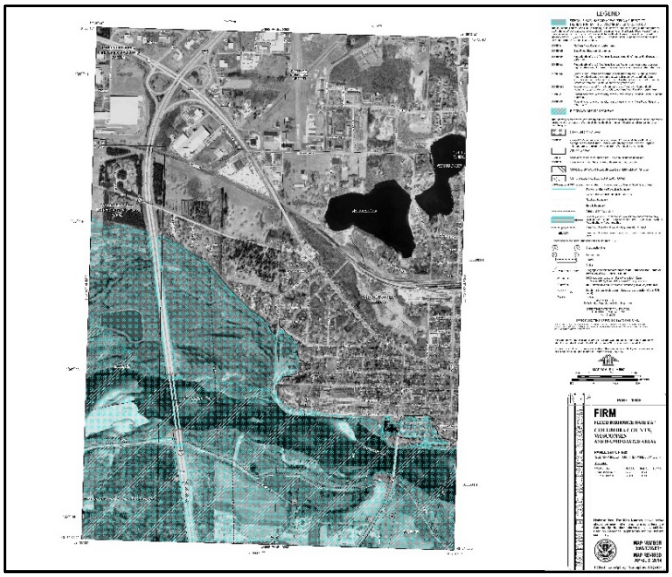
Companies can prepare for rare but potentially catastrophic flood events, and thus limit their potential liability from chemical spills and downstream contamination caused by high flood water. The following provides general guidance for manufacturers to increase their resilience to flooding.

Understanding Flood Risk

Flooding of Wisconsin rivers typically occurs when heavy snowpack, rain and warming temperatures combine to create high volumes of surface runoff in late winter or early spring (see figure). Large scale floods can occur as a result of a series of strong summer storms, especially over hilly landscapes or slowly draining watersheds. Localized flooding may be caused by stream blockages of ice or other debris, or flash flooding from very heavy rainfall.



- Vanessa Cottle

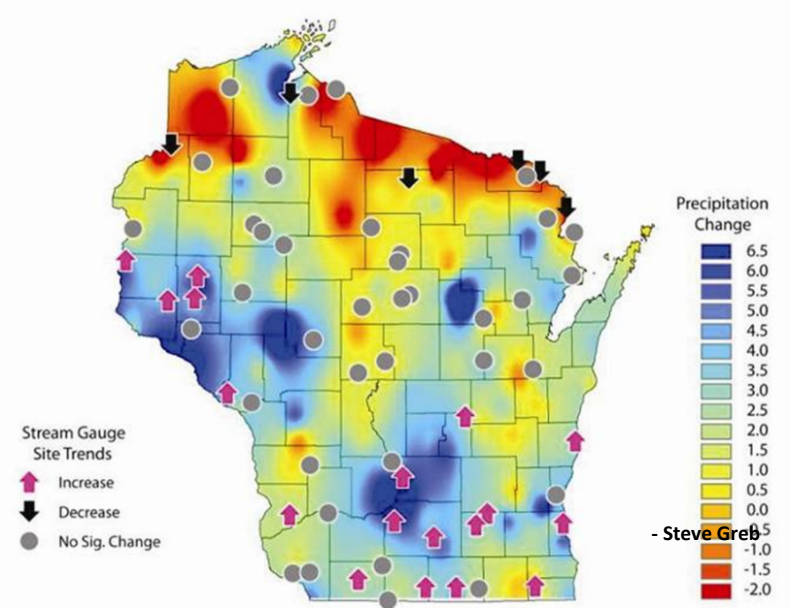


FEMA has identified many areas that are prone to flood inundation. Defined by either the 100-year flood level (a 1% risk of occurring in any year) or in some cases the 500-year flood level (0.2% risk), these floodplain delineations have been mapped for use in determining flood insurance rates and for infrastructure siting and design. FEMA provides Flood Insurance Rate Maps (FRIMs) that show the boundaries of Wisconsin's floodplains[2]. The figure at left shows the Wisconsin River floodplain at Portage, WI.

- Portage, WI FIRM #55021C0262E

How the risk of flooding is changing

The figure at right illustrates the relationship between trends in precipitation and annual streamflow in Wisconsin. Between 1950 and 2006, those areas of Wisconsin that received increased snow and rainfall, also experienced increased stream flow. Climate projections for Wisconsin show a continued increase in rainfall through mid-century, especially during late winter and spring. The heaviest rainfalls have become more frequent, and are projected to continue to increase in frequency and intensity[3,4]. As a result, the risk of flooding along Wisconsin's rivers and stream has and is expected to increase.



- Steve Greb

Flood vulnerability

While many facilities have taken steps to prevent inundation from flood waters, even the best prepared facilities are at risk from extreme events. The picture at right shows the Reedsburg, WI wastewater treatment plant inundated during the June 2008 Baraboo River flood. Despite having an intact 100-year flood berm (not visible due to high water) the plant sustain $800,000 worth of damage.

- Steve Zibell

Knowing when to expect a flood

In the past, the opportunity to prepare for a coming flood was measured in minutes or hours. Today, days of warning are typical for all floods except the most extreme flash flood events. Regularly tracking river elevation projections during the flood season or during periods of heavy rain will provide advance warning for implementing flood prevention and response measures. The National Weather Service - North Central River Forecast Center[5] provides river elevations (stage) and flood warnings and predictions for most of Wisconsin's rivers. The US Geological Survey[6] provides historic flood information, allowing facilities to understand past flood heights.

Protecting your facility from floodwaters

FEMA provides guidance on reducing the risk of flood damage in its publication FEMA P-936 *Floodproofing Non-Residential Buildings* (2013)[7]. FEMA recommendations that are applicable to industrial facilities include:

- Creating a facility site map showing surface elevations and potential points of water entry;
- Building dikes or flood walls and keeping a supply sand bags on hand;
- Installing backflow preventers on sanitary and storm drains;
- Having access to emergency pumps for draining any incursion of water.

Being prepared for flood waters you can't control

No matter how prepared a facility may be, a higher flood can overwhelm existing flood proofing and inundate an industrial facility. These steps that can be taken to minimize the impact of flood waters in your facility:

- Locate critical equipment (e.g electrical utilities) and chemical storage at elevations well above peak flood projections. This may include moving materials to an area of higher surface elevation, or locating high voltage electrical boxes on upper galleries or catwalks.

- Create a manual of utility locations and disconnect procedures to assist personnel in shutting down the facility, especially when shutdown is on an emergency schedule or is being done by someone not trained to perform a shutdown.

- Train employees about flood response to allow workers to respond to impending risk in an effective manner. An EPCRA[8] response plan should be in place to assist first responders.

- Establishing just-in-time inventory control, or other means of limiting on-site inventory of chemicals and other materials, can keep spills and flood damage to a minimum.

- Archive regulatory records off site to allow for an immediate post-flood chemical inventory check and spill reporting.

What to do when the water recedes

Cleaning up a flood can have hazards of its own. USEPA's report *Flood-Related Cleaning*[9] provides information on how to protect worker health and safety while debris and sediment are being removed from the site, and surfaces and equipment are cleaned, sanitized and brought back into operation.

This is also the time to take stock of any chemicals or hazardous materials that have spilled on site or been carried downstream. Contact Wisconsin's 24-hour spill reporting hotline[10] at 800-943-0003 as soon as spills of material are known.

References

1. National Science Foundation #15-011, *Scientists confirm that Midwest floods are more frequent* - http://www.nsf.gov/news/news_summ.jsp?cntn_id=133987

2. FEMA Flood Map Service Center – https://msc.fema.gov/portal

3. National Climate Assessment - http://nca2014.globalchange.gov/report/our-changing-climate/heavy-downpours-increasing

4. Schuster, Zachary T., K.W. Potter, D.S. Liebl, *Assessing the Effects of Climate Change on Precipitation and Flood Damage in Wisconsin*, Journal of Hydrologic Engineering, 2012, 17:888-894

5. National Weather Service, North Central River Forecast Center, River Forecasts - http://www.weather.gov/ncrfc/

6. USGS Surface-Water Data for Wisconsin – http://waterdata.usgs.gov/wi/nwis/sw

7. FEMA P-936 *Floodproofing Non-Residential Buildings* (2013) - http://www.fema.gov/media-library/assets/documents/34270

8. Wisconsin Emergency Planning and Community Right-to-Know Act (EPCRA) program - http://emergencymanagement.wi.gov/EPCRA/program.asp

9. *Flood-Related Cleaning*, USEPA Draft report (2009) https://www.epa.gov/sites/production/files/2014-08/documents/flood-related_cleaning_report.pdf

10. WI-DNR Spill reporting requirements – http://dnr.wi.gov/topic/spills/report.html