



U. S. Chemical Safety and Hazard Investigation Board RECOMMENDATIONS STATUS CHANGE SUMMARY

Report:	Arkema, Inc. Chemical Plant Fire
Recommendation Number:	2017-08-I-TX-R4
Date Issued:	May 24, 2018
Recipient:	Center for Chemical Process Safety (CCPS)
New Status:	Closed – Acceptable Action
Date of Status Change:	June 18, 2020

Recommendation Text:

Develop broad and comprehensive guidance to help companies assess their U.S. facility risk from all types of potential extreme weather events. Guidance should address the issues identified in this report and cover actions required to prepare for extreme weather, resiliency and protection of physical infrastructure and personnel during extreme weather, as well as recovery operations following an extreme weather event, where appropriate. Include guidance for each of the following:

- *Addressing common mode failures of critical safeguards or equipment that could be caused by extreme weather events, including but not limited to flooding. For flooding scenarios, sufficient independent layers of protection should be available if floodwater heights reach the facility.*
- *Evaluating facility susceptibility to potential extreme weather events. Relevant safety information such as flood maps should be incorporated as process safety information.*
- *Involving relevant professional disciplines, including engineering disciplines, to help ensure risk assessments and process hazard analyses are as robust as practicable for any given facility.*

Board Status Change Decision:

A. Rationale for Recommendation

On August 24, 2017, Hurricane Harvey, a Category 4 hurricane, made landfall in southeast Texas. Extensive flooding caused by heavy rainfall from the hurricane exceeded the equipment design elevations and caused the plant to lose power, backup power, and critical organic peroxide refrigeration systems. Consequently, Arkema used its standby refrigerated trailers to keep the organic peroxide products cool. On August 31, 2017, organic peroxide products stored inside a refrigerated trailer decomposed, causing the peroxides and the trailer to burn. Twenty-one people sought medical attention from exposure to fumes generated by the decomposing products when the vapor travelled across a public highway adjacent to the plant. Emergency response officials initially decided to keep this highway open because this road served as an important route for hurricane recovery efforts. Over the next several days, a second fire and a controlled burn conducted by the Unified Command consumed eight more trailers holding Arkema's remaining organic peroxide products that required low-temperature storage. Over the course of the three fires, in excess of 350,000 pounds of organic peroxide combusted. As a result, more than 200 residents living within 1.5 miles of the facility who had evacuated the area could not return home for a week.

As a part of its investigation, the U.S. Chemical Safety and Hazard Investigation Board (CSB) reviewed existing industry safety guidance for companies on how to address flood hazards. CSB discovered that the American Institute of Chemical Engineers' (AIChE) Center for Chemical Process Safety (CCPS) has

published guidance on this topic but found that the guidance was either too generic or did not require sufficiently conservative precautions to have helped Arkema prevent this incident. For example, the guidance did not require elevating critical equipment to heights that would have prevented Hurricane Harvey-level floodwater from disabling safety systems at the Arkema facility. Given this shortcoming, the CSB made a recommendation to the CCPS to develop more broad and comprehensive guidance on how to address flood hazards.

B. Response to the Recommendation

In February 2020, CCPS communicated to the CSB that the CCPS Monograph entitled *Assessment of and planning for natural hazards* had been revised and would be made available on the CCPS web site. The revised Monograph addresses all aspects of the CSB Recommendation, namely:

- Section two states that the Monograph applies to the following meteorological and geological events: flooding, temperature extremes, snow/ice storms, wildfire, tornado, tropical cyclones, hurricanes, storm surge, wind, lightning, hailstorms, drought, seismic events, earthquakes, landslides, tsunami, volcanic eruptions, and dam rupture.
- Section four recommends that companies use “third party, expert natural hazard consultants or from the facility’s insurance carrier” for assistance in gathering and analyzing data on natural hazards and provides a list of numerous web sites as additional technical sources of information. The CCPS Monograph also states that: *Considering natural hazard data as “process safety information” is a good practice.*
- Section five identifies equipment that could be impacted by meteorological and geological events, such as: nitrogen generators, firewater pumps, cooling systems, process control and safety instrumented systems, wastewater pumps plus “any other equipment required for safe operations or that, if compromised, could lead to a process safety event, harm to personnel, the community, or the environment.” Regarding flooding specifically, the Federal Emergency Management Agency 100-year and 500-year flood zones are explained along with that agency’s recommendations for protecting critical facilities and their emergency power systems. Specific scenarios pertaining to flooding and methods that can be implemented to protect against it are also highlighted in several sections throughout the text.
- Section six provides methods for evaluating facility equipment susceptible to meteorological and geological events for both existing equipment and new projects. Risk assessment techniques are outlined and some practical examples are provided.

Finally, the CCPS Monograph also contains sections on how to develop emergency response, recovery and recommissioning plans and contains several Appendices, including a checklist for screening natural disaster hazards.

C. Board Analysis and Decision

As noted above, the revised CCPS Monograph addresses all the elements listed in the CSB Recommendation, so the Board voted to change the status of CSB Recommendation No. 2017-08-I-TX-R4 to: “Closed—Acceptable Action.”