



U.S. Chemical Safety and Hazardous Investigation Board

Organic Peroxide Decomposition, Release, and Fire at Arkema Crosby Following Hurricane Harvey Flooding

Fact Sheet

Prior to any fires, Arkema provided extensive information to the Unified Command about the products involved, their characteristics, the amounts and locations on site, and critical safety information

On Monday August 28, 2017, after following established plant procedures to relocate products, the Crosby plant's ride-out crew became overwhelmed by the unforeseeable quantities of water at the site resulting from Harvey. That same day, Arkema personnel notified emergency responders about the evolving situation at the plant. On Tuesday, August 29, the ride-out crew was evacuated.

Soon after the evacuation, emergency responders implemented a 1.5-mile evacuation zone around the facility based on modeling performed that assumed the refrigerated trailers would combust. That same Tuesday, Arkema provided all information requested by the Unified Command about the situation at the site, including the products involved, their characteristics, locations and quantities, and critical safety information for the emergency responders. Arkema specifically warned the Unified Command about the hazards of organic peroxide decomposition and alerted them that emergency responders who may be exposed to this material should wear personal protective equipment and self-contained breathing apparatus. Also on Tuesday, emergency responders evacuated about 205 residents from their homes.

The first fire occurred Thursday, August 31.

Between the time that the ride-out crew was evacuated and before the first fire, the Unified Command made a number of independent decisions in their role as incident command leaders. Unfortunately, despite Arkema warning the Unified Command well before any fire that emergency responders enforcing the 1.5 mile evacuation zone who may be exposed to the smoke should wear personal protective equipment and self-contained breathing apparatus, and after participating in the evacuation of over 200 residents from their homes within the evacuation zone, the emergency responders did not use PPE equipment to protect themselves. Nor did they heed warnings by their supervisors to remain upwind of the Arkema facility. Rather, some of them drove back and forth through the safety evacuation zone they were assigned to enforce, despite clear warnings of smoke from others.

Below are some key quotes and statements derived from the CSB's report:

Monday, August 28, 2017

On Monday, August 28, 2017, "the crisis team alerted the Harris County emergency responders to the possibility of a release or a fire at the Crosby facility." *Report, Paragraph 102*

Tuesday, August 29, 2017

"[On the morning of Tuesday, August 29, 2017], Arkema warned the Unified Command about the hazards of organic peroxide decomposition and alerted them that emergency responders who may be exposed to this material should wear personal protective equipment and self-contained breathing apparatus." *Report, Paragraph 16.*

"... Harris County officials kept eastbound Highway 90 open to traffic even while enforcing the remainder of the evacuation zone. Emergency responders were also staged to block the road if the contents of one of the refrigerated trailers began to combust." *Report, Paragraph 18*

"Emergency responders handling the Arkema Crosby incident established a 1.5-mile evacuation zone around the Arkema Crosby facility. Emergency response agencies—including FEMA, the Environmental Protection Agency (EPA), and the Harris County Fire Department—performed analysis and modeling that assumed the combustion of the refrigerated trailers." *Report, Paragraph 110*

"Based on soot and particulate matter resulting from the refrigerated trailer combustion, a one-mile evacuation zone would be sufficient. To be conservative, provide greater safety for the surrounding residents, and efficiently allocate resources, emergency response officials extended the evacuation zone 1.5 miles. As part of this decision process, the Arkema corporate crisis team was consulted, and the crisis team agreed that 1.5 miles was sufficient given the likely scenario of organic peroxide products combusting." *Report, Paragraph 110*

Wednesday, August 30, 2017

"The emergency responders had been warned that an explosion was "imminent" at the Arkema Crosby facility. Some community members who were evacuated also believed that an incident at the plant could be imminent and therefore rushed to evacuate." *Report, Paragraph 112.*

"Roadblocks were set up at strategic locations so that people could not enter the evacuation zone. Air monitoring stations were established to test for combustion products on the perimeter of the evacuation zone." *Report, Paragraph 114*

"Starting on Wednesday, August 30, 2017, Arkema provided telemetry data to the Unified Command showing that the air temperatures in six of the refrigerated trailers loaded with organic peroxide products were increasing and air temperatures inside three of these trailers were above the estimated SADTs of the organic peroxide products." *Report, Paragraph 297*

“Arkema and the emergency responders held regular meetings during the day to discuss the site conditions and their next steps. Arkema provided a site map of the refrigerated trailers as well as an approximate list of the organic peroxide products loaded into each trailer and the SADT estimated for the products in each trailer.” *Report, Paragraph 116*

“Just before midnight, two of the police officers assigned to monitor the exclusion zone perimeter were asked by a supervisor to respond to a high-water call. To respond, the officers left their position located at the northeast of the Arkema Crosby facility and were traveling west on Highway 90 when they entered a “large cloud of gas,” which engulfed and entered their vehicle as they neared the Arkema plant. The officers turned their vehicle around and retreated back to their original location northeast of the Arkema Crosby facility.” *Report, Paragraph 117.*

“Because the cloud had a chemical odor and the officers experienced adverse health symptoms (eye, skin, throat, and respiratory irritation) from the exposure, the officers concluded this cloud was a chemical release and they initiated a shutdown of Highway 90. The officers subsequently reported the release to the Unified Command.” *Report, Paragraph 117.*

Thursday, August 31, 2017

“Around midnight, amid reports of smoke at the Arkema facility, the Unified Command conducted a safety briefing with the emergency responders at the fire station, which was serving as the base of operations. Units were briefed on the situation at the plant and were advised to remain upwind of any potential release.” *Report, Paragraph 118*

“At 12:30 am, with no confirmation of fire or smoke at the Arkema facility, officials concluded the initial white smoke was a ‘low lying weather cloud’ and reopened Highway 90 to traffic.” *Report, Paragraph 119*

“The police officers, who first reported driving through the cloud, believed they had driven through a chemical release and they informed other police officers that the cloud was recorded on their vehicle’s dash cam, proving the release that they reported. Three other police officers then drove their vehicles on Highway 90 to check on those officers and review their dash cam footage. As they passed near the Arkema facility, the three officers also drove through a cloud originating at the Arkema facility. Even though they turned off their air conditioning, the white smoke still made its way into the vehicles.” *Report, Paragraph 120*

“When the three police officers arrived at the northeast boundary of the exclusion zone, they reviewed the dash cam footage from the first police vehicle that showed the white smoke cloud. The three police officers who had most recently driven through the cloud reported watery eyes and scratchy throats. The three police officers soon believed that they also had been exposed to chemicals from the release at the Arkema facility. From their location, the three police officers could see a black cloud coming from the Arkema facility rising above Highway 90. That cloud and their symptoms combined with the flooding of all nearby roads and the officers’ desire to get prompt medical attention led the police officers to drive west down Highway 90 toward the command post and a hospital that was not flooded. In total, five police officers in four police vehicles drove down Highway 90. The officers called to request medical assistance when they reached the southern end of the exclusion zone.” *Report, Paragraph 121*

“As the police vehicles drove west on Highway 90, the officers were again exposed to a cloud emanating from the Arkema facility.” *Report, Paragraph 122*

“Emergency medical technicians (EMTs) were called to assist with the police officers. While the EMTs were on the way to the scene, they drove through a cloud as well.” *Report, Paragraph 124*

“Even after the evacuation zone was enforced, Highway 90, which ran through the middle of the evacuation zone and near the Crosby facility, was left open to traffic.” *Report, Paragraph 296*

CSB Conclusions

“But once a report came in that the situation at the Crosby facility became less stable and that decomposition might be occurring, emergency response officials should have closed Highway 90 and established alternative routes. As a result of this decision, at least 21 people were exposed to decomposition products and smoke from the burning refrigerated trailer and organic peroxides.” *Report, Paragraph 35*

“Emergency officials understandably kept Highway 90 open initially. But once a report came in that the situation at the Crosby facility became less stable and that decomposition might be occurring, emergency response officials should have closed Highway 90 and established alternative routes.” *Report, Paragraph 299*