

Refinery Hot Work Explosion

- > **Incident Date: July 17, 2001**
- > **Delaware City, Delaware**
- > **1 Killed, 8 Injured**
- > [Full Report and Video on CSB Website](#)



CSB Driver of Critical Chemical Safety Change

Safe Hot Work Practices have been identified as one of the CSB's Drivers of Critical Chemical Safety Change. The CSB continues to see hot work incidents involving materials in the areas surrounding the work activity, and have found a significant subset of incidents, involving a tank or container where flammables are present, to be particularly dangerous. In addition, the CSB continues to observe hot work incidents involving a tank or container at high hazard facilities like refineries and chemical plants. These incidents typically result in injuries and fatalities, and have the potential to result in a major catastrophic accident. The CSB has thirteen investigations and deployments to hot work incidents, and has made ten recommendations, one of which remains open. This Safety Digest highlights one such CSB investigation, which focuses on a hot work incident.

More information on the CSB Hot Work Driver of Critical Chemical Safety Change can be found at: <http://www.csb.gov/recommendations/hot-work/>

Incident Summary

On July 17, 2001, an explosion occurred at the Motiva Enterprises Delaware City Refinery in Delaware City, Delaware. The explosion killed one worker, injured eight others,

and caused significant off-site environmental impact. In June and July 2001, Motiva directed contractors to repair a catwalk that provided access to instrumentation on the roofs of six 415,000-gallon carbon steel sulfuric acid storage tanks. The catwalk had deteriorated due to acid vapors in the atmosphere around the tanks. The contractor employees worked this job over several days, cutting out damaged sections of the catwalk grating and welding down new sections.

On July 17, as the contractors were working, a spark from the hot work most likely: 1) either entered the vapor space of one of the tanks, tank #393; 2) or contacted flammable vapors escaping from one of the corrosion holes on the roof of that tank, and flashed back into it. An explosion in the vapor space of the tank caused the tank shell to separate from its floor, lift up and come down across the dike wall, and release its contents of 264,000 gallons of spent sulfuric acid. An adjacent storage tank also lost its contents. Flammable and combustible material in the spent acid ignited, and a fire burned for 30 minutes. A total of 1.1 million gallons of sulfuric acid was released, overwhelming the area diking, containment, and wastewater systems. Approximately 99,000 gallons of acid reached the Delaware River, killing fish and other aquatic life. One of the contractors working on the tank

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was killed, and eight others were injured, as a result of the explosion and tank failure.

Corrosion History

The storage tank that failed, #393, was one of six storage tanks originally built in 1979 that stored fresh and spent sulfuric acid used in the refinery's sulfuric acid alkylation process. Over the years the tanks had experienced significant localized corrosion. Leaks were found on the shell of tank #393 annually from 1998 through May 2001. All of the reported leaks were repaired, except for the one discovered in May 2001. At the time of the incident, however, several additional holes in the roof and shell of tank #393 had gone unreported and unrepaired. As leaks occurred and were repaired, the Motiva tank inspectors repeatedly recommended an internal inspection of tank #393. Despite the imminent hazard presented by this particular storage tank, Motiva repeatedly postponed its inspection, originally scheduled for 1996. In 2000, after the U.S. Environmental Protection Agency identified 18 tanks that required internal inspection, and after Motiva reduced its maintenance budget, the tank inspection program was reprioritized, which further deferred the inspection of tank #393 until January 2002.

The inspections of tank #393 between 1992 and 1998 showed that the general rate of corrosion was in line with expected values for tanks in concentrated sulfuric acid service. However, the prevalence of leaks in the tank in the 3 years prior to the incident, along with the indications of horizontal grooving, demonstrated the acceleration in localized corrosion. The

breaches in the tank shell discovered post-incident indicated that the problem had been even more widespread than known. The accelerated corrosion could have occurred if rain water had gotten into the storage tank. Accelerated corrosion occurs in a sulfuric acid tank when water dilutes the acid.

Safety Change

In its investigation report, the CSB made a recommendation to the Delaware Department of Natural Resources and Environmental Control (DNREC) to ensure that regulations require that facility management take prompt action in response to evidence of tank corrosion that presents hazards to people or the environment.

On June 11, 2004, DNREC finalized and posted a new regulation for aboveground storage tanks (ASTs). This regulation required that: "When an AST has been tested or inspected as required by these Regulations the Owner or Operator shall immediately initiate the actions required or recommended

by the report of the Certified API 653 Inspector, including but not limited to requirements or recommendations for repair or removal from service." These regulations applied to storage tanks with capacities greater than 250 gallons. In recognition of this safety change, the CSB voted to close this recommendation as "Closed-Acceptable Action" in November 2004. (Note: DNREC amended its regulations in 2005 and 2017. Also, shortly after the CSB Motiva Final Report came out, OSHA concluded that Motiva's tank #393 was not a storage tank, but rather a "process vessel," which would have subjected it to OSHA's Process Safety Management regulations.) Changes like these will help facilities to quickly address atmospheric storage tank corrosion issues before they can culminate in a catastrophic incident.

