

INSIGHTS

U.S. Chemical Safety Board Issues Factual Update on TPC Group Port Neches Facility

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Today, the CSB issued an interim [factual update](#) on its investigation of the November 27, 2019 explosion at TPC Group's Port Neches facility in Texas. The November 2019 explosion resulted in millions of dollars of estimated loss, shut down the area for several days, and a fire that burned for months. The facility manufactured 1,3-butadiene and raffinate-1, and the facility was subject to OSHA's process-safety-management ("PSM") standard and U.S. EPA's risk-management-plan program ("RMP").

Based upon the CSB's investigation so far, the explosion may have occurred from a loss of containment in the final fractionation phase for the butadiene. Approximately 6,000 gallons of butadiene emptied from a fractionator and formed a vapor cloud. The release point may have been a section of piping between the fractionator and the suction side of a transfer pump. The vapor cloud ignited causing the explosion.

Current Theory on Causation—Popcorn Polymers

The CSB's investigation appears focused on the possible presence of "popcorn polymer" in the process vessels and associated piping. Popcorn polymer is a hard, porous, and opaque material that is created when oxygen reacts with butadiene. First, oxygen reacts with butadiene to form peroxides. Second, butadiene peroxides react with butadiene to form popcorn polymer. These reactions can continue and increase the volume of the polymer until the substance produces enough pressure to crack steel equipment. Although the TPC facility was under different ownership at the time, the facility had a popcorn-polymer-caused pipe rupture in 1999.

An exacerbating factor to popcorn-polymer-related issues is "dead legs" in process piping. A "dead leg" occurs when a piping segment is open to the associated process but the segment does not actually have any material flowing through the section. Some industry observers have found that dead legs may promote popcorn polymer formation. The CSB found that the butadiene fractionator had a dead leg component for at least 82 days prior to the incident, which may have contributed to the cause.

Key Takeaway

It is still likely too early to know if the CSB's theory is accurate or not. But from a process-safety perspective, chemical facilities with processes involving butadiene should be reminded about the potential risk from popcorn-polymer formation. The economic loss associated with the TPC facility suggests an internal review to determine whether your facility has a history of popcorn-polymer formation, has inspection practices in place to identify the problem, takes steps to

minimize "dead legs," and has a mitigation strategy in place to address any issues your internal review identifies. As these kinds of problems arise in industry, the "standard of care" companies are expected to employ to address the problems also evolves.

Background on CSB

The CSB is a scientific, investigative organization with no enforcement authority. Established by the Clean Air Act amendments of 1990, the CSB is responsible for determining accident causes, issuing safety recommendations, studying chemical safety issues, and evaluating the effectiveness of other government agencies (such as OSHA and EPA) involved in chemical safety. For significant investigations, like the TPC Group explosion in Port Neches, the Board has historically issued an "interim" factual update. The observations and findings in these factual updates are not final, but give a good indication of the direction of the CSB's investigation and some insight on the possible recommendations that the Board may issue.