



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

Report:	Philadelphia Energy Solutions (PES) Refinery Fire and Explosions
Recommendation Number:	2019-04-I-PA-R4
Date Issued:	September 26, 2022
Recipient:	American Petroleum Institute (API)
New Status:	Open - Awaiting Response or Evaluation/Approval of Response
Date of Status Change:	Not Applicable – Initial Status

Recommendation Text:

Update API RP 751 Safe Operation of Hydrofluoric Acid Alkylation Units to require the following:

- a. Protection of critical safeguards and associated control system components, including but not limited to wiring and cabling for control systems and primary and backup power supplies, from fire and explosion hazards, including radiant heat and flying projectiles; and*
- b. Installation of remotely-operated emergency isolation valves on the inlet(s) and outlet(s) of all hydrofluoric acid containing vessels, and hydrocarbon containing vessels meeting defined threshold quantities.*

Board Status Change Decision:

A. Rationale for Recommendation

On the morning of June 21, 2019, a pipe elbow in the Philadelphia Energy Solutions (PES) hydrofluoric acid (HF) alkylation unit ruptured. A large vapor cloud—composed of about 95% propane, 2.5% HF, and other hydrocarbons—engulfed part of the unit. The vapor cloud ignited, causing a large fire. Three explosions then occurred in the unit. The third explosion was the largest and occurred when a pressure vessel violently ruptured and flew across the Schuylkill River. Two other pressure vessel fragments, one weighing about 23,000 pounds and the other 15,500 pounds, landed in the PES refinery.

PES estimated that 5,239 pounds of HF and 676,000 pounds of hydrocarbons were released during the incident. The HF alkylation unit was severely damaged resulting in an estimated property damage loss of \$750 million. Five workers and a firefighter experienced minor injuries during the incident and response. On June 26, 2019, PES announced that the refining complex would be shutting down.

The U.S. Chemical Safety and Hazard Investigation Board (CSB) investigated the incident and found several safety issues to include process safety management and other safety related standards. There were issues with PES's mechanical integrity program and their verification of

safety of equipment when new safety information is discovered and published in Recognized and Generally Accepted Good Engineering Practices (RAGAGEP). Additionally, the CSB identified gaps regarding standards or regulations that address remotely operated emergency isolation valves, safeguard reliability in HF alkylation units, as well as inherently safer design considerations specific to the use of HF. As a result of these findings, the CSB issued one recommendation to the API. This status change summary addresses **CSB Recommendation No. 2019-04-I-PA-R4**.