



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

Report:	Philadelphia Energy Solutions (PES) Refinery Fire and Explosion
Recommendation Number:	2019-04-I-PA-R5
Date Issued:	September 26, 2022
Recipient:	American Society for Testing and Materials (ASTM) International
New Status:	Closed – Reconsidered/Superseded
Date of Status Change:	January 17, 2023

Recommendation Text:

Revise ASTM A234 to incorporate supplementary requirements for piping used in HF service, as defined in HF supplementary requirements S9.1 through S9.7 in ASTM A106 version 19a.

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 ASTM International. This status change summary addresses **CSB Recommendation No. 2019-04-I-PA-R5**.

B. Response to the Recommendation

ASTM immediately forwarded the CSB recommendation to the appropriate standard committee, conducted a review of their standards, and found that the requirements that the CSB recommended to be added to ASTM A234/A234M already existed in a reference to a different and more applicable standard. ASTM explained to the CSB and provided evidence that their standard ASTM A234 already has supplementary requirements for fittings used in HF service through the application of S78 Requirements for Carbon Steel Products for Concentrated Hydrofluoric Acid Service contained in their standard ASTM A960/A960M as required by Section 4.1 of ASTM A234/A234M.

C. Board Analysis and Decision

The Board concurs with ASTM's conclusion that supplementary requirements for HF service is already available in ASTM A234/A234M as it requires conformance with ASTM A960/A960M which includes *S78 Requirements for Carbon Steel Products for Concentrated Hydrofluoric Acid Service*. Additionally, the Board appreciates the diligence and swift actions taken by ASTM in addressing the CSB recommendation.

Based upon the information above, the Board voted to change **CSB Recommendation No. 2019-04-I-PA-R5** to: **"Closed – Reconsidered/Superseded."**