



# U. S. Chemical Safety and Hazard Investigation Board

## RECOMMENDATION STATUS CHANGE

### SUMMARY

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| <b>Report:</b>                | Enterprise Pascagoula Gas Plant Explosion and Fire |
| <b>Recommendation Number:</b> | 2016-02-I-MS-R1                                    |
| <b>Date Issued:</b>           | February 13, 2019                                  |
| <b>Recipient:</b>             | American Petroleum Institute (API)                 |
| <b>New Status:</b>            | Closed – Acceptable Action                         |
| <b>Date of Status Change:</b> | April 1, 2021                                      |

#### Recommendation Text:

*Develop a new informational product or incorporate into the next revision of Brazed Aluminum Plate-Fin Heat Exchangers for General Refinery Services 1st ed.; ANSI/API Standard 668 (formerly Standard 662, Part 2), guidance focused on the safe operation, maintenance, and repair of brazed aluminum heat exchangers (BAHX) to advance understanding of thermal fatigue hazards and how to mitigate them. At a minimum the informational product/incorporated material must include:*

- a. Information on the potential for both minor leaks and catastrophic failure as a result of accumulated thermal fatigue (beyond a single cyclic thermal shock event);*
- b. Clarification on the optimal placement of BAHX temperature and pressure sensors to effectively monitor the operating conditions for the potential impact of accumulated thermal fatigue on BAHX, including temperature rates of change; and*
- c. Clarification on the need to safely vent layers that have been blocked off as part of the repair process for interpass leaks in all BAHX configurations, as well as information describing the consequences when safe venting does not occur.*
- d. Should applicable data from CSB Recommendation No. 2016-02-I-MS-R4 (R4) be available prior to finalizing the requirements of this recommendation, then the data from R4 will be considered for inclusion and/or incorporation by reference in the product required by this recommendation. If the decision is made not to include/incorporate by reference the data from R4, then a detailed explanation for the exclusion will be provided.*

#### Board Status Change Decision:

##### A. Rationale for Recommendation

On June 27, 2016, a major loss of containment (LOC) resulted in the release of methane, ethane, propane, and several other hydrocarbons at the Enterprise Products Pascagoula Gas Plant (PGP) in Pascagoula, Mississippi. The hydrocarbons ignited, initiating a series of fires and explosions, which ultimately shut down the site for almost six months. Two workers were on the night shift when the incident occurred and were uninjured.

The U.S. Chemical Safety and Hazard Investigation Board (CSB) determined that the probable cause of this incident was the failure of a brazed aluminum heat exchanger (BAHX) due to thermal fatigue. The absence of a reliable process to ensure the mechanical integrity of the heat exchanger contributed to the catastrophic failure of the equipment. Consequently, the Board issued one recommendation to API to modify an existing product or develop a new product that provides guidance focused on the safe operation, maintenance, and repair of BAHX that addresses thermal fatigue hazards. This status change summary addresses CSB Recommendation No. 2016-02-I-MS-R1 (R1).

#### B. Response to the Recommendation

API advised the CSB that in November 2018, API published the First Edition of Standard 668, *Brazed Aluminum Plate-fin Heat Exchangers for General Refinery Services* (Formerly Std. 662, Part 2). The publication was extensively revised by the API Subcommittee on Heat Transfer Equipment with CSB input and was intended to provide requirements and recommendations for the mechanical design, materials selection, fabrication, inspection, testing, and preparation for shipment of brazed aluminum plate-fin heat exchangers for use in the petroleum, petrochemical, and natural gas industries. The new standard substantially addressed the applicable requirements of the recommendation and, of note, provided recommended practices regarding BAHXs. Part d. of the CSB Recommendation states that, “*should applicable data from CSB Recommendation No. 2016-02-I-MS-R4 (R4) be available prior to finalizing the requirements of this recommendation then the data from R4 will be considered for inclusion and/or incorporation by reference in the product required by this recommendation.*” R4 was issued to the GPA Midstream Association and has not been implemented and therefore the data was not included in the API standard.

#### C. Board Analysis and Decision

Based upon the information above, the Board voted to change CSB Recommendation No. 2016-02-I-MS-R1 to: “**Closed – Acceptable Action.**”