CSB Safety Spotlight:

AN ILLUSTRATION OF CHEMICAL SAFETY EXCELLENCE — American Fuel and Petrochemical Manufacturers Voluntarily Implements a Safety Recommendation Not Issued to Them

U.S. Chemical Safety and Hazard Investigation Board

The U.S. Chemical Safety and Hazard Investigation Board (CSB) is spotlighting the positive actions of entities that have implemented a CSB safety recommendation issued to a different recommendation recipient. The primary focus of this Safety Spotlight is on the American Fuel and Petrochemical Manufacturers (AFPM) for the organization's action in response to a recommendation addressing fluid catalytic cracking (FCC) units made by the CSB to a different party as a result of the agency's investigation of the explosion and fire at the Husky Energy refinery in 2018.

Husky Energy Superior Refinery Explosion and Fire (2018)[1]

CONSEQUENCES: 36 workers injured, facility destroyed, $550 million onsite damage, $110,000 offsite property damage, and evacuation and shelter-in-place orders for nearby communities.

On April 26, 2018, an explosion and fire occurred at the Husky Energy refinery in Superior, Wisconsin (Husky Superior). This incident occurred during a unit shut down in preparation for maintenance. While the FCC Unit was being shut down, a flammable mixture of oxygen and hydrocarbon formed inside the primary and sponge absorber, resulting in the explosion. The CSB investigated this incident and concluded, among other things, that Husky Superior relied upon unverifiable and degraded safeguards to prevent the mixture of air and hydrocarbons within their FCC unit's process equipment. The investigation resulted in 16 recommendations intended to prevent a similar incident.

View of the Husky Energy Superior refinery following the April 26, 2018 explosions and fire.

The recommendation pertinent to this Safety Spotlight is CSB Recommendation No. 2018-02-I-WI-R13, which was issued to the American Petroleum Institute (API) but was voluntarily implemented by AFPM on its own initiative. The text of the recommendation is below:

Using API's processes to determine the appropriate safety product, develop a publicly available technical publication for the safe operation of fluid catalytic cracking (FCC) units. The document should be applicable to both new and existing units. Include the following topics at a minimum:

a) Description of typical FCC unit hazards, including air leaks into hydrocarbon systems or hydrocarbon leaks into air systems that could form a flammable mixture during transient operation (startup, shutdown, stand-by, and the actions required to transition between these modes). If needed, include differences between possible reactor/regenerator configurations;

b) Recommended practices for safeguards to control FCC unit hazards;

1 https://www.csb.gov/husky-energy-superior-refinery-explosion-and-fire

View of the Husky Energy Superior refinery following the April 26, 2018 explosions and fire.

a) Recommended monitoring for process safety during FCC unit transient operations;

b) Recommended emergency operating procedures for FCC-specific scenarios;

c) PHA guidance for key FCC-specific scenarios, including transient operation;

d) Recommended FCC-specific field and board operator process safety training topics and methods;

e) Guidelines for process safety assessments of FCC units; and

f) Incorporate lessons learned from this CSB investigation and the CSB's ExxonMobil Torrance Refinery Electrostatic Precipitator Explosion investigation throughout the document and include references in the document's bibliography.

AFPM's Actions

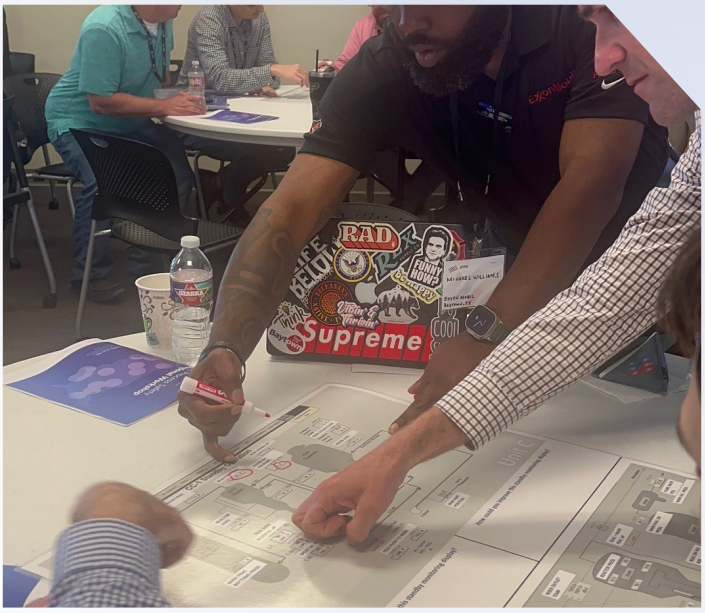
Following the Husky Superior incident, AFPM's Process Technology Committee on FCC took the initiative and voluntarily began developing a series of regional workshops to improve process safety for FCC units. These workshops are intended to leverage the industry's knowledge and good practices for FCC operation. They are designed as interactive knowledge-sharing sessions with the goal of each attendee taking back a list of actionable items to improve FCC safety at their site. The topics addressed by the workshops include:

- Industry Safety Overview,
- Industry Know How and Body of Knowledge,
- Practice Share Sessions,
- Safety and Supporting Information and Communication to Local Personnel,
- Transient Operations and Tools for Monitoring,
- Startups, Shutdown, Emergency Procedures,
- Mixing of Air and Hydrocarbon, and
- Full FCC Process Safety Curriculum Resources.

View of industry experts engaging participants at one of the many workshop sessions presented during AFPM's FCC Roadshow.

To date, AFPM has presented 18 of these workshops to over 700 attendees at facilities across the United States covering 76 of the 93 refineries in the U.S. and Canada that have FCC units.[1] The workshop sessions to date have included presentations from industry experts and practice shares, allowing participants to engage with one another while addressing process safety topics specific to FCC units. Each session also concluded with an interactive activity intended to reinforce the lessons from the session.

In addition to the workshops, AFPM has also established a webpage[2] for FCC Process Safety, which contains resources to help share knowledge and learnings from common FCC hazards and recent events. The webpage, like the workshops, is presented in four sections:



FCC Roadshow participants - Health and Safety Council (HASC)

Section 1: Safety Information
Section 2: Procedures
Section 3: Monitoring Transient Operations, and
Section 4: Air and Hydrocarbon

Other resources are also presented for the benefit of the user. The resources available through this webpage are open to anyone to view and download. Resources of note that were developed and made available by AFPM include:

- Industry FCC Safety Scenarios for PHAs,
- FCC Safety Bulletins,
- Standby Operations Monitoring Checklist,
- Reactor Oxygen Monitoring, and
- Important FCC Procedure Elements.

The material presented in the workshops and the resources on the AFPM webpage satisfy all of the requirements of the CSB's recommendation and has the added component of in-person delivery. Despite the significant quality and quantity of resources already available, the AFPM continues to develop additional resources, which will also be available on the AFPM's FCC Process Safety webpage at no cost.

The CSB encourages interested parties to check the site regularly for updated content. These resources effectively capture not only the lessons learned from the Husky Energy Superior Refinery Explosion and Fire, but also those from the ExxonMobil Torrance Refinery Explosion,[3] and present them in a manner that is engaging and offers practical solutions and insights into the real-world challenges faced by the refining industry.

1 Future workshops are planned to be held at the Health and Safety Council (HASC) Training Center in Pasadena, Texas on April 22, 2026, and at the Phillips 66 facility in Billings, Montana on September 23, 2026.
2 https://www.afpm.org/issues/safety-health/fcc-process-safety
3 https://www.csb.gov/exxonmobil-torrance-refinery-explosion-/

View of the April 20, 2010 blowout and explosion incident at the Macondo oil well, located off the coast of Louisiana.

The CSB commends the leadership and staff of AFPM and their FCC Process Technology Committee for their excellent work in developing and conducting these workshops. Based on the success of these workshops and the practical benefits of bringing this information directly to the people who work in the facilities where the hazards exist, the CSB believes that process safety in FCC units has undoubtedly been improved and will help prevent future incidents in FCC units.

Though the primary focus of this Safety Spotlight is on the actions of AFPM, other entities have voluntarily implemented CSB recommendations not issued to them as well. When this happens, the CSB designates the status of the recommendation as "Closed – Acceptable Alternative Action." To date, this has been done for four other CSB recommendations in addition to the Husky Superior recommendation:

- **Pryor Trust Fatal Gas Well Blowout and Fire**[4]: CSB Recommendation No. 2018-01-I-OK-R4 was issued to API but was implemented by the International Association of Drilling Contractors (IADC).
- **West Fertilizer Explosion and Fire**[5]: CSB Recommendation No. 2013-02-I-TX-R14 was issued to the State Firefighters' and Fire Marshals' Association of Texas but was implemented by the Texas A&M Engineering Extension Service (TEEX) and the Texas Commission on Fire Protection (TCFP).
- **Macondo Blowout and Explosion**[6]: CSB Recommendation Nos. 2010-10-I-OS-R1 and 2010-10-I-OS-R11 were issued to the Department of the Interior's Bureau of Safety and Environmental Enforcement and were partially implemented by API's Center for Offshore Safety (COS).

The CSB recognizes the actions of these other entities (AFPM, IADC, TEEX, TCFP, and COS). This type of positive collaboration to implement CSB recommendations illustrates that addressing chemical safety is a shared responsibility and should be emulated by others. Such commendable action helps drive chemical safety excellence.

A CSB Safety Spotlight is an advocacy product that highlights the activities or innovations of those entities, to include recommendation recipients, that positively drive chemical safety change.

4 https://www.csb.gov/pryor-trust-fatal-gas-well-blowout-and-fire/
5 https://www.csb.gov/west-fertilizer-explosion-and-fire-/
6 https://www.csb.gov/macondo-blowout-and-explosion/