June Public Meeting

U.S. Chemical Safety and Hazard Investigation Board

Givaudan Sense Colour Vessel Explosion

CSB Public Business Meeting

June 18, 2026

U.S. Chemical Safety and Hazard Investigation Board

Givaudan - Louisville, Kentucky

U.S. Chemical Safety and Hazard Investigation Board

Background

- The facility produced liquid and powder caramel coloring used in the food and beverage industries
- D.D. Williamson began operations at the Louisville facility in 1948 and was acquired by Givaudan Flavors Corporation in 2021
- The Louisville facility was previously the subject of a CSB investigation in 2003 when a vessel explosion resulted in one worker fatality

Facility Location

- The facility was located near residences and other businesses, with the closest residential property located less than 100 feet from the facility

Givaudan - Louisville, Kentucky

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Incident Summary

- On November 12, 2024, Reactor 6, used to produce caramel food coloring, exploded when the sugar ingredient experienced an uncontrolled decomposition reaction producing heat and gases
- A vent valve on the reactor failed in the closed position, which initiated the uncontrolled reaction
- The relief system was undersized and could not relieve the pressure generated by the gases

Givaudan - Louisville, Kentucky

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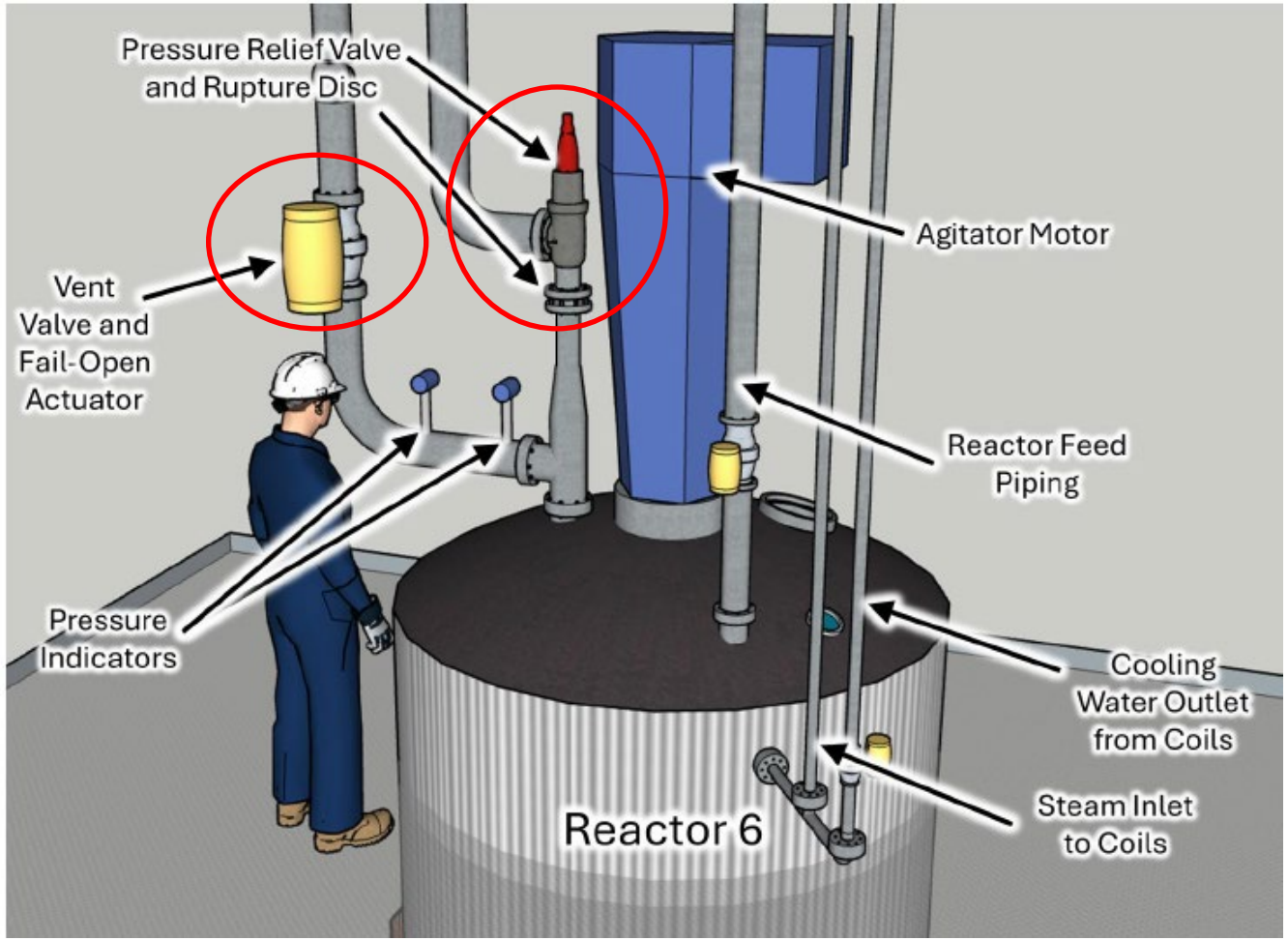

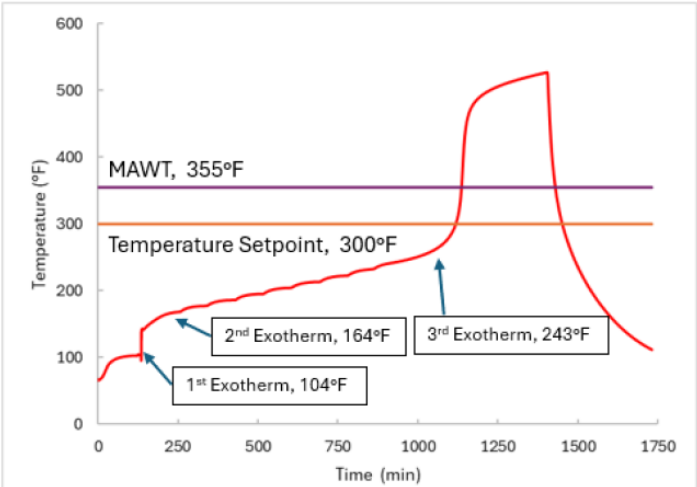

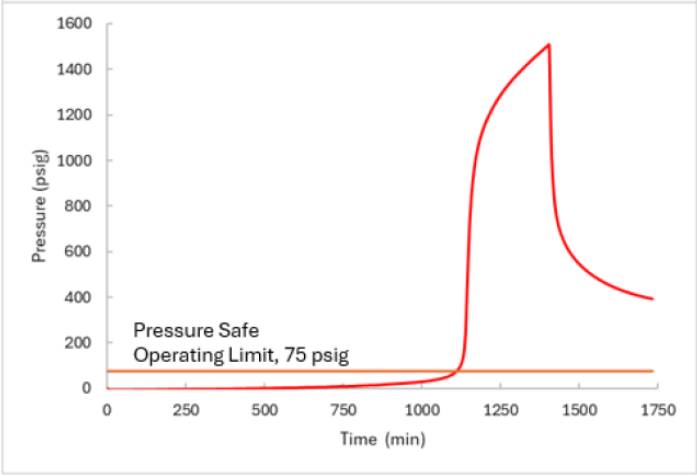

Vent valve failed in closed position, triggering a runaway decomposition reaction of the sugar ingredient in the caramel coloring batch. The pressure relief system was undersized and could not relieve the pressure produced by the runaway reaction.

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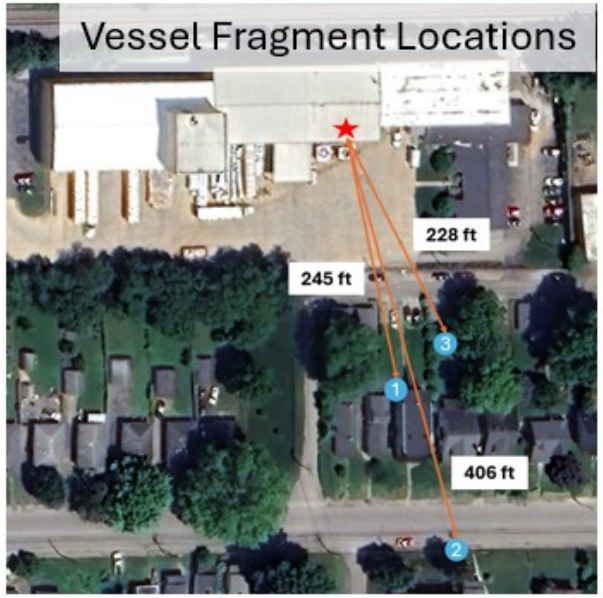
Incident Consequences

- The explosion fatally injured two employees and seriously injured three employees
- The explosion resulted in ~$30 million in damage to the facility and ~$10 million in damage to nearby homes and businesses
- Givaudan has demolished the Louisville facility



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Safety Issue: Understanding Chemical Reaction Hazards

- Givaudan/D.D. Williamson did not understand the sugar decomposition hazards
- Givaudan did not equip the reactor with a properly sized relief device
- Lack of industry guidance in managing the hazards of sugar decomposition
- Lack of information included on safety data sheets to warn of the decomposition potential of the sugar ingredient

Recommendations:

To Givaudan:

- Hire a third-party consultant to complete chemical testing and analysis of all types of caramel coloring products
- Hire a third-party consultant to design adequate emergency pressure relief systems
- Maintain this data and analysis for use in PHAs

To International Technical Caramel Association:

- Publish a technical guidance document detailing safe practices for manufacturing caramel coloring

To sugar manufacturers & industry groups:

- Update safety data sheets to include decomposition temperature and consequences of exceeding that temperature
- Alert members of this hazardous reaction and incident at Givaudan

Givaudan - Louisville, Kentucky

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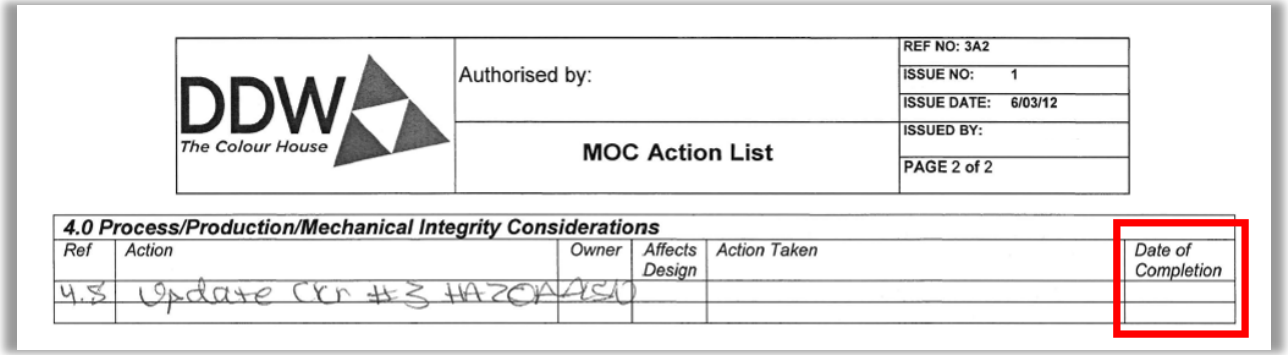
Safety Issue: Commitment to Managing Process Safety

- D.D. Williamson/Givaudan created the framework for a process safety policy at the Louisville facility, but did not follow through with implementation
- No process safety policy "owner" to ensure implementation
- A poor process safety system led to a loss of institutional knowledge about caramel coloring reaction hazards, a lack of hazard analyses, and unsafe reactor designs



DDW The Colour House

Authorised by:

REF NO: 3A2
ISSUE NO: 1
ISSUE DATE: 6/03/12
ISSUED BY:
PAGE 2 of 2

MOC Action List

4.0 Process/Production/Mechanical Integrity Considerations

Ref	Action	Owner	Affects Design	Action Taken	Date of Completion
4.5	Update CRR #3 HAZOP/LOPA				

Recommendations:

To Givaudan:

- Hire third-party consultants to:
  1. Conduct a hazard analysis of the new facility. Givaudan will implement the recommendations issued by the third party
  2. Develop a process safety management system for the new facility
- Designate an employee to own the process safety policy & fill a senior leadership position responsible for overseeing process safety at all Givaudan caramel coloring facilities

Givaudan - Louisville, Kentucky

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Safety Issue: Safe Operating Limits

- Reactor 6 exceeded its safe operating limits, but employees did not evacuate as specified in procedures
- There were no alarms or other indications to alert the operators that safe operating limits were exceeded and that they needed to evacuate
- Employees were not adequately trained on the values of, purpose of, or required response to the established safe operating limits

Recommendations:

To Givaudan:

- Establish a corporate policy addressing training of personnel on safe operating limits and response actions
- Establish automatic alerts, such as alarms or control screen indicators, to notify operators when limits are reached

Givaudan - Louisville, Kentucky

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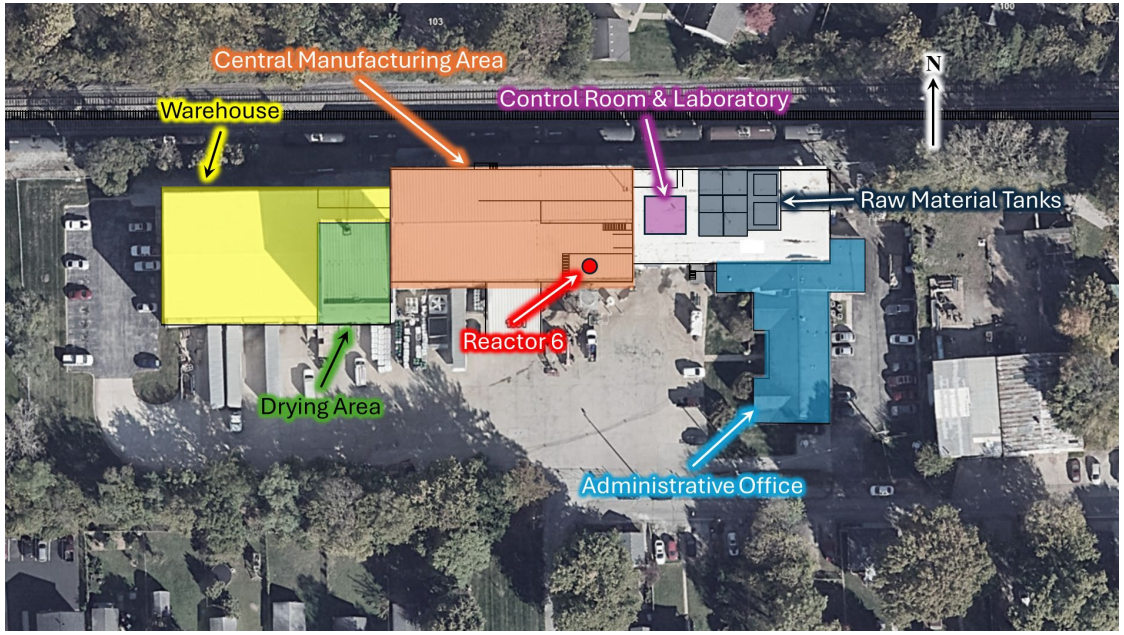
Safety Issue: Facility Siting

- The control room, where both employees were fatally injured, was 40 feet from Reactor 6 and within the blast zone
- The control room was constructed without conducting a facility siting analysis and was not blast-resistant

Recommendation:

To Givaudan:

- Hire a third party to conduct a facility siting study prior to construction of any new caramel coloring facility to help protect facility occupants and critical equipment from the hazards created by explosion, fire, or toxic material release



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Safety Issue: Regulatory Coverage of Reactive Hazards

- The Louisville facility was not regulated by OSHA PSM or EPA RMP process safety regulations
- As a result, they were not required to implement safety management system elements such as:
  - Process Hazard Analysis (PHA)
  - Management of Change (MOC)
  - Compilation of Process Safety Information (PSI)
- Improved safety management systems would have provided opportunities for personnel involved in Reactor 6 design to understand the decomposition hazards and install a properly sized relief system for Reactor 6

Recommendation:
To OSHA and EPA:

- Broaden the coverage of PSM and RMP process safety regulations to achieve more comprehensive control of reactive hazards

Catalyst Refiners, Inc.

Public Business Meeting

June 18, 2026

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Incident Overview

Summary

- On April 22, 2026, at approximately 9:30 a.m., a release of hydrogen sulfide occurred at the Catalyst Refiners facility in Institute, West Virginia.
- Catalyst Refiners' process was used to refine silver from spent ethylene oxide catalyst
- Catalyst Refiners was decommissioning the site

Consequences

- Two fatal injuries to Catalyst Refiners employees
- Four serious injuries to Catalyst Refiners employees
- Multiple others, including responders, evaluated or treated
- Shelter-in-place issued for 1-mile radius

Background

U.S. Chemical Safety and Hazard Investigation Board

Response

- Local fire departments and EMS immediately responded. Charleston Fire Dept and EPA confirmed the presence of hydrogen sulfide. West Virginia Department of Environmental Protection also responded.
- The CSB deployed three investigators on April 26, 2026, to interview personnel, gather evidence, and collect documentation

Ongoing Investigation

- Continued interviews with employees
- Laboratory analysis of onsite chemicals
- Potential cause identification
- Assessment of causal factors

Nippon Dynawave Longview, WA

Incident Date: 2026-03-26

3rd Quarter Public Meeting

July 18, 2026

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Incident Description

Incident Description

- On May 26, 2026 at approximately 7:08 am, a tank filled with roughly 900,000 gallons of white liquor catastrophically failed, releasing a wave of caustic liquid that knocked down walls and filled a large portion of the facility.

Incident Impact

- This incident resulted in 11 workers being fatally injured and 3 serious injuries.
- The caustic material reached the Columbia River as well as a ditch which served the Longview community.

Kraft Process and White Liquor

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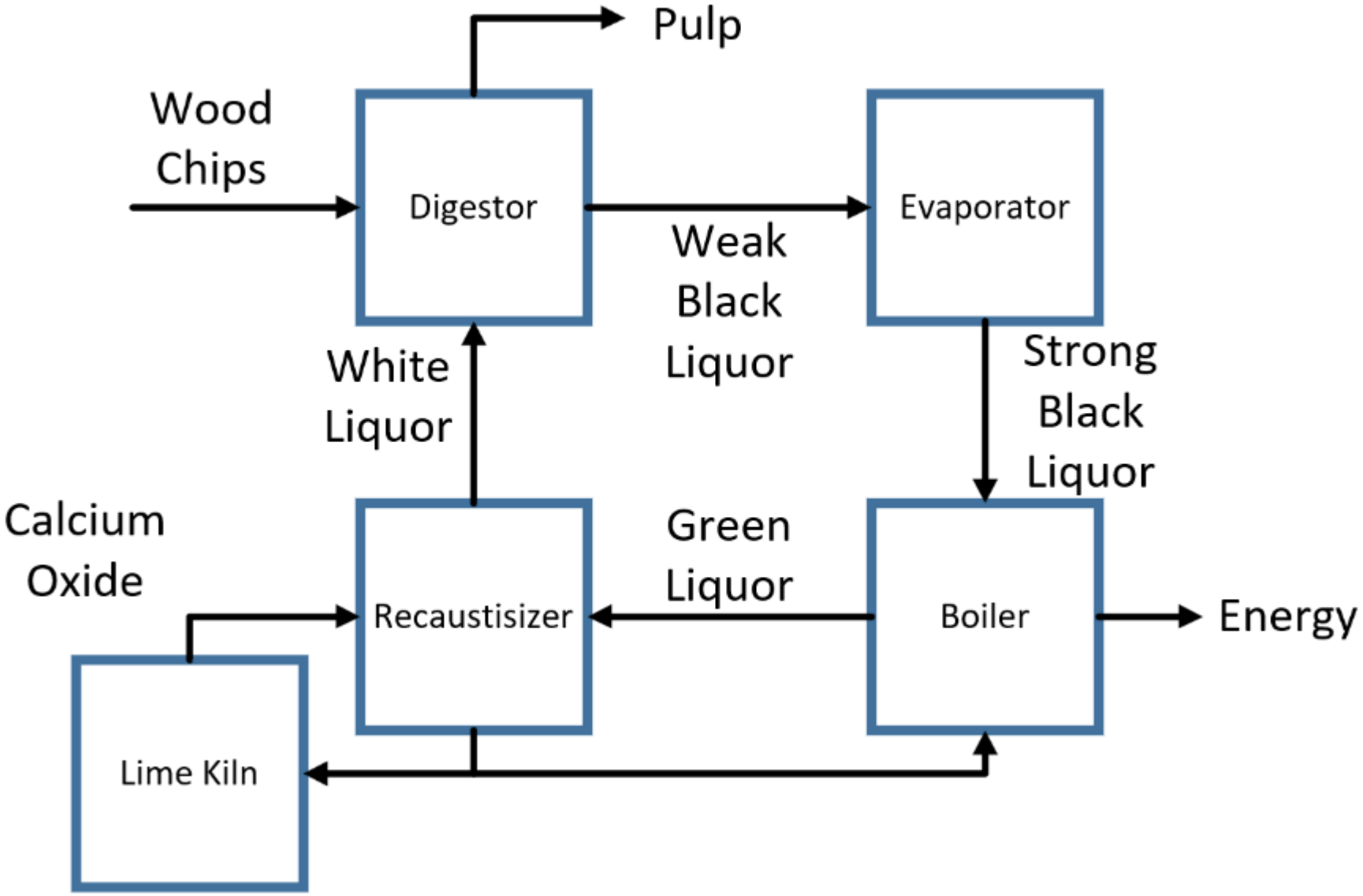

Path Forward

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- The CSB is continuing to gather facts and analyze several key areas:
  - Mechanisms that led to tank failure
  - Facility Siting
  - Maintenance and Mechanical Integrity
  - Relevant facility, corporate, and industry standards
- The CSB's investigation of this incident is ongoing. Complete findings, analyses, and appropriate recommendations will be detailed in the CSB's final investigation report.

Accidental Release Events

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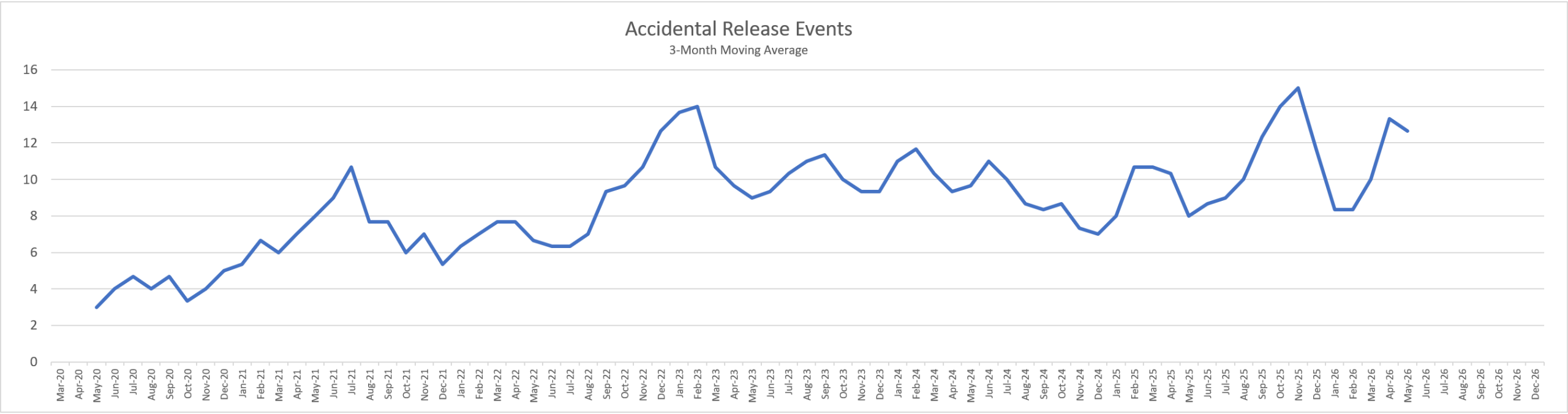
- 651 reportable events (through May 2026)
- 103 with fatalities, 355 with serious injuries, and 314 with substantial property damage



Office of Recommendations

Charles B. Barbee, Director of Recommendations

Adam Henson, Recommendations Specialist

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Office of Recommendations

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Highlighted Recommendations

- Didion R2 & R7 to Didion
- ITC R6 to API
- Optima Belle R15 to CCPS

CSB Recommendations to CCPS

Highlighted Recommendations

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Didion Milling Company Explosion and Fire

- May 31, 2017
- Combustible Dust Explosion
- 5 Workers Fatally Injured
- 14 Worker Injured
- Extensive Property Damage
- Issued 9 recommendations to Didion

CSB Recommendation R2 to Didion:

Implement modifications to pneumatic conveying & dust collector ductwork systems.

CSB Recommendation R7 to Didion:

Update the facility emergency response plan and train all employees.

Highlighted Recommendations

U.S. Chemical Safety and Hazard Investigation Board

Didion Milling Company Explosion and Fire

- Didion implemented both R2 & R7
- On Sept 1, 2025 – all 9 recs O-URNRR
- One week later – all 9 recs O-ARAR
- As of today, 7 of 9 rec acceptably closed
- Only 2 more to go!!!

Closed – Acceptable Action …keep up the good work!

Highlighted Recommendations

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Intercontinental Terminals Company (ITC) Tank Fire

- March 17, 2019
- Pump failure in a tank farm resulted in a massive fire that burned for 3 days.
- 15 above ground storage tanks were destroyed
- Containment wall collapsed
- Approx 21M gallons of contaminated liquid released into adjacent waterways

CSB Recommendation to the American Petroleum Institute (API):

Update API STD 2610, Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities, to include flammable gas detection systems and address both engineering and administrative controls, including response actions for catastrophic leaks.

Highlighted Recommendations

U.S. Chemical Safety and Hazard Investigation Board

Intercontinental Terminals Company (ITC) Tank Fire

- API Published 4th Ed API STD 2610 in March 2026
- Flammable gas detection/response
- Also…substantive improvements to safety management section
- Added OPS safety info, compliance audits, employee participation, and trade secrets

Closed – Exceeds Recommended Action …Outstanding!

Highlighted Recommendations

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Optima Belle Explosion and Fire

- December 8, 2020
- A decomposition reaction resulted in a fire and toxic chlorine release.
- 1 worker fatally injured
- 2 workers evaluated for respiratory irritation
- 1 member of the public had a leg injury
- $33.1M in property damage

CSB Recommendation to the Center for Chemical Process Safety (CCPS):

Update Guidelines for Process Safety in Outsourced Manufacturing Operations. Include current best practices, guidance specific to tolling brokers and/or project managing companies, and alignment with the Guidelines for Risk Based Process Safety.

Highlighted Recommendations

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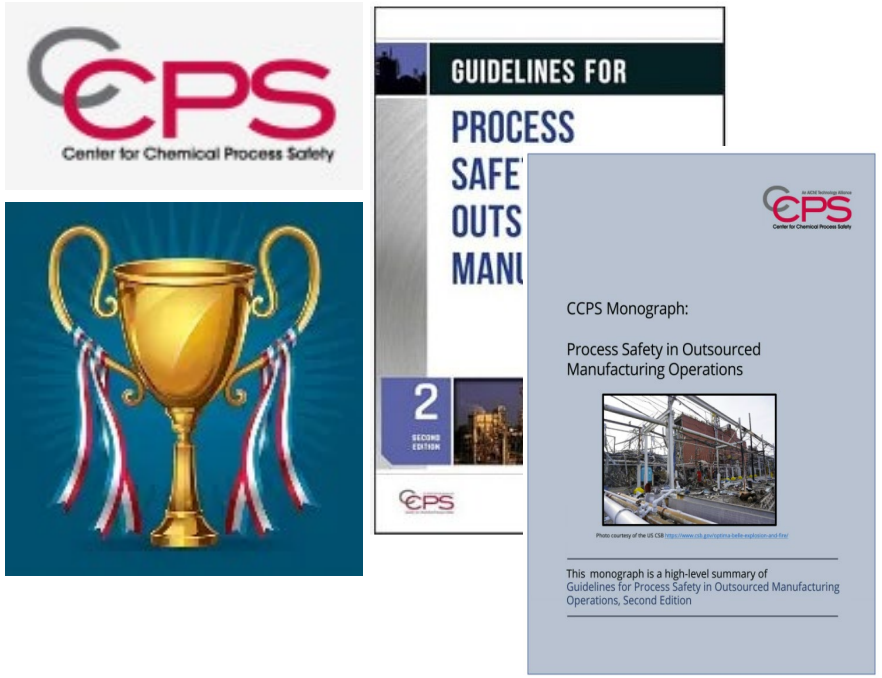
Optima Belle Explosion and Fire



- CCPS executed a complete rewrite of *Guidelines for Process Safety in Outsourced Manufacturing*
- 2nd Ed. Published in March 2026
- Also…monograph: *Process Safety in Outsourced Manufacturing Operations*
- Free, high-level summary of book, to reach a broader audience

Closed – Exceeds Recommended Action …Fantastic!

CSB Recommendations to CCPS

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INVESTIGATION	DATE REC ISSUED	DATE REC CLOSED	STATUSES
Union Carbide	February 23, 1999	March 14, 2002	C-AA
Morton International	August 16, 2000	June 24, 2002	C-AA
Reactive Hazards	October 8, 2002	June 18, 2004	C-ERA
Reactive Hazards	October 8, 2002	June 18, 2004	C-ERA
Formosa Plastics - TX	July 20, 2006	November 19, 2008	C-AA
Formosa Plastics - IL	March 6, 2007	August 20, 2010	C-AA
BP Texas City	March 20, 2007	September 23, 2010	C-AA
Veolia Environ. Services	July 21, 2010	April 10, 2013	C-AA
Arkema	May 24, 2018	June 18, 2020	C-AA
Wacker	June 15, 2023	March 4, 2025	C-AA
Optima Belle	July 6, 2023	June 9, 2026	C-ERA

- 11 Recs / 24 yrs
- All acceptably closed
- 3 C-ERA

Public Comments

Steve Hamrick & Hillary Cohen
Moderating

Public@csb.gov

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Thank you for attending

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