U.S. Chemical Safety and Hazard Investigation Board

CSB Business Meeting

January 26, 2023

Ethylene Release and Fire at Kuraray America, Inc. EVAL Plant

Pasadena, Texas | May 19, 2018

Report and animation video released in December 2022

Incident Summary

- May 19, 2018
- Reactor system was being brought back online after a maintenance turnaround
- Ethylene release and fire occurred at 10:28 a.m.
- 266 employees and contract workers were onsite
- 23 workers were injured

Cause

Emergency pressure-relief system did not discharge the flammable ethylene vapor to a safe location

Contributing

- Other SMS elements allowed high-pressure conditions to develop inside the reactor
- Nonessential personnel present during this upset condition

Safety Issues

1. Emergency Pressure-Relief System Discharge Design
2. Presence of Nonessential Workers During Startup and Upset Conditions
3. Hazardous Location
4. Recognized and Generally Accepted Good Engineering Practices
5. Process Hazard Analysis Safeguards
6. Process Hazard Analysis Recommendations
7. Warning Signs
8. Equipment Design
9. Operating Procedures
10. Operator Training
11. Abnormal Operating Conditions
12. Safety Interlock Disabling
13. Alarm Management
14. Process Alarm Response
15. Safe Operating Limits
16. Environmental Permit Limits
17. Management System Self-Assessment Audits

Safety Issue 1

- Emergency Pressure-Relief System Discharge Design

Safety Issue 1

- Emergency Pressure-Relief System Discharge Design

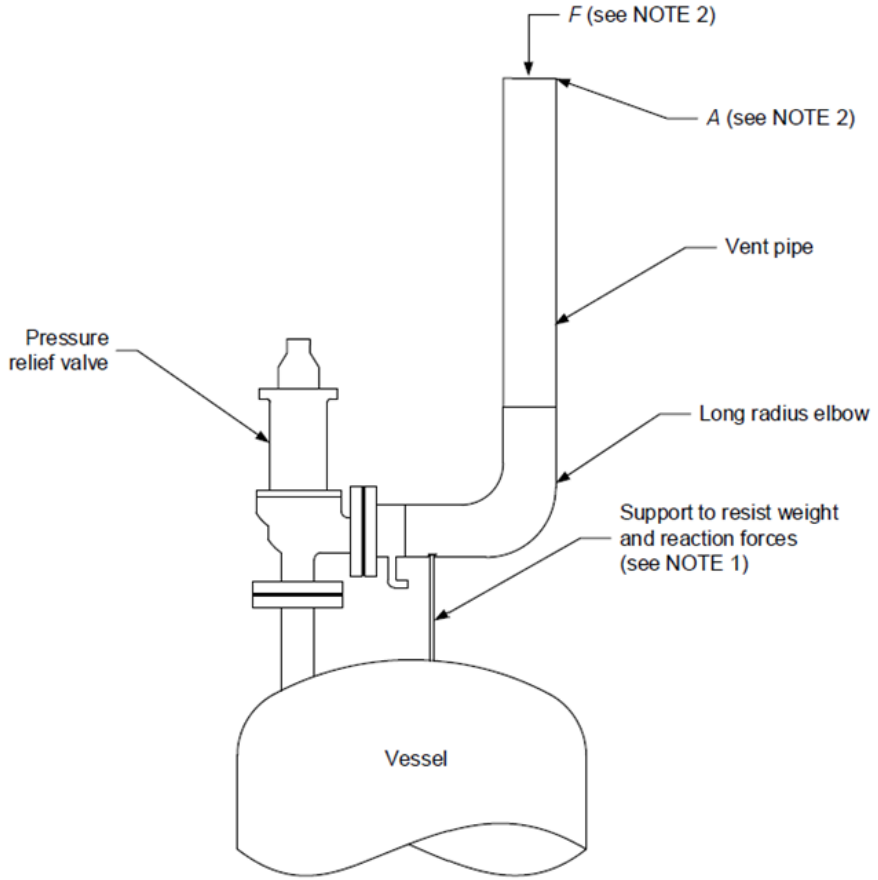
Industry Standards

- **ASME Design Code**

  Outlet piping from emergency pressure-relief systems "shall lead to a safe place of discharge."

Industry Standards Rely on Vertical Discharge

- API 520
- API 521



NOTE 1 The support should be located as close as possible to the centerline of the vent pipe.
NOTE 2 *F* = reaction force; *A* = cross-sectional area.

Figure 6—Typical Pressure-relief Valve Installation with Vent Pipe

Industry Standards

- What is an unsafe location?
  - API RP 754:

An atmospheric pressure-relief device … discharge that results in a potential hazard to personnel, ... due to the formation of flammable mixtures at ground level or on elevated work structures, ...

Major Incidents in PSM Preamble

- **1984 Bhopal, more than 2,000 deaths**
- 1989 Phillips 66, 24 deaths, 132 injuries
- 1990 ARCO Chemical, 17 deaths
- **1990 BASF, 2 deaths, 41 injuries**
- 1991 IMC, 8 deaths, 128 injuries

- Bhopal and BASF involved pressure-relief system discharges that caused great harm to people

Post-Incident Modifications

Recommendations

- **12 safety recommendations issued to Kuraray America, Inc.**

Develop and implement an emergency pressure-relief system design standard to ensure that each of these safety systems will discharge to a safe location. Include a requirement to periodically evaluate the site's emergency pressure-relief systems and make appropriate modifications to ensure that each of these systems discharge to a safe location such that material that could discharge from these safety systems will not harm people.

U.S. Chemical Safety and Hazard Investigation Board

1750 Pennsylvania Ave, NW, Suite 910
Washington, DC 20006
202-261-7600

Visit our Website: www.csb.gov

USCSB

@chemsafetyboard

U.S. Chemical Safety Board