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Phillips Pasadena 1989 and CAPECO 2009

Two explosions, twenty years apart, on the same date



Phillips Pasadena 1989 CAPECO 2009

Description

On 23 October 1989, maintenance work was being carried out on a polyethylene reactor at the Phillips 66 Houston Chemical Complex in Pasadena, Texas. During the work, a valve opened and more than 85,000 pounds of highly flammable process gases, principally ethylene and isobutane, were released.

A large vapour cloud formed within the congested process area and ignited within approximately 90 to 120 seconds. The explosion and subsequent fires killed 23 people and injured more than 130. Employees of both Phillips and its maintenance contractor were among the casualties.

Exactly 20 years later, on 23 October 2009, Tank 409 overflowed while gasoline was transferred from a ship to the CAPECO terminal in Bayamón, Puerto Rico. Nearly 200,000 gallons escaped over an estimated 26 minutes, forming a low-lying vapour cloud covering approximately 107 acres. It travelled through open drainage paths and ignited near the wastewater treatment area. The explosion damaged around 300 homes and businesses and started fires involving 17 storage tanks. There were no fatalities, although three members of the public were injured.

Key findings

- The immediate events were different. One release occurred during maintenance on operating process equipment. The other developed during a marine transfer when a storage tank was overfilled. Both demonstrate what can happen when a large flammable release is not prevented, detected or stopped by effective layers of protection.
- At Phillips, the maintenance isolation arrangements were not sufficiently secure. The investigation identified weaknesses in process hazard analysis, procedures, lockout and tagout, contractor management, gas detection, ignition control and emergency protection. Earlier audits had identified unsafe conditions, but many findings had not been effectively addressed.
- At CAPECO, operators relied on unreliable tank gauging equipment and manual calculations. Tank 409 had no independent high-level alarm and no automatic system capable of stopping or diverting the transfer. Previous spills, overfills and equipment problems had not resulted in sufficient improvement.
- The very different casualty figures do not mean that one explosion was minor. Outcomes were influenced by occupancy, the location and timing of the releases, plant layout, congestion, drainage, ignition and the number of people exposed. CAPECO caused extensive off-site damage and could easily have resulted in far greater loss of life.

Why does it concern me?

Twenty years separated these accidents, yet the underlying lessons remained familiar. A valve position, a tank-level reading or an operator's calculation should not be the only protection against a catastrophic release. Safety-critical activities require reliable isolation, accurate instrumentation and independent safeguards capable of preventing escalation when the primary control fails.

Maintenance and transfer operations also create important interfaces. Responsibilities, information and control may be divided between operators, contractors, supervisors, vessels and terminal personnel. Unless these interfaces are clearly managed, everyone may complete their own task while no one has a complete picture of the developing risk.

These events remind us that major accidents rarely result from one incorrect action or one failed item of equipment. They develop when weaknesses in design, maintenance, procedures, competence, communication and organisational learning align.

Ask the following questions:

- Are maintenance isolations physically secure and independently verified?
- Could one faulty instrument or incorrect reading lead to a major loss of containment?
- What independent safeguard will stop an overfill or major release?
- Are previous leaks, spills and equipment failures treated as opportunities for learning?
- Have vapour dispersion, drainage, congestion and nearby occupancy been considered?
- Are responsibilities across operators, contractors and other organisations clearly understood?

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