

9th Chemical Process Safety Sharing (CPSS)

Safety Moment

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Phillips disaster of 1989



9th Chemical Process Safety Sharing (CPSS)
9th Jun. 2022, Thailand





Phillips disaster of 1989



- **Date** 23 October 1989
- **Location** Phillips Petroleum Company's Houston Chemical Complex, Pasadena, Texas, US
- **Incidence** Leak of Hydrocarbon more than 85,000 pounds, A flammable vapor cloud formed which subsequently ignited resulting in a massive vapor cloud explosion
- **The consequence of explosion** 23 fatalities and 314 people were injured. Extensive damage to the plant facilities occurred.



Incident Summary



- The day before the incident scheduled maintenance work had begun to clear three of the six settling legs on a reactor
- During routine maintenance, isolation valves were closed and compressed air hoses that actuated them physically disconnected as a safety measure. The air connections for opening and closing this valve were identical and had been improperly reversed when last re-connected. As a result, the valve would have been open while the switch in the control room was in the "valve closed" position
- After that, the valve was opened when it was expected to stay closed, and finally passed the reactor content into air. A vapor cloud formed and travelled rapidly through the polyethylene plant. Within 2 minutes, the vapor cloud ignited and exploded.
- 15 minutes later, the 2nd explosion of the 76,000 liters of isobutane storage tank, and finally by other explosions, probably about 6 in total.

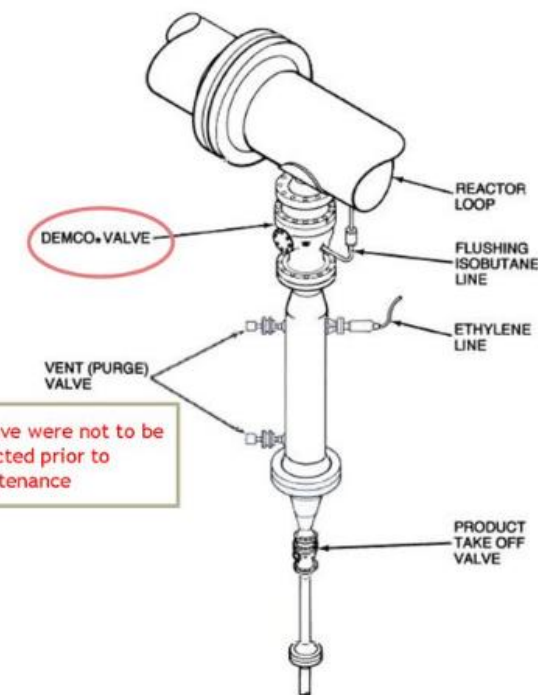
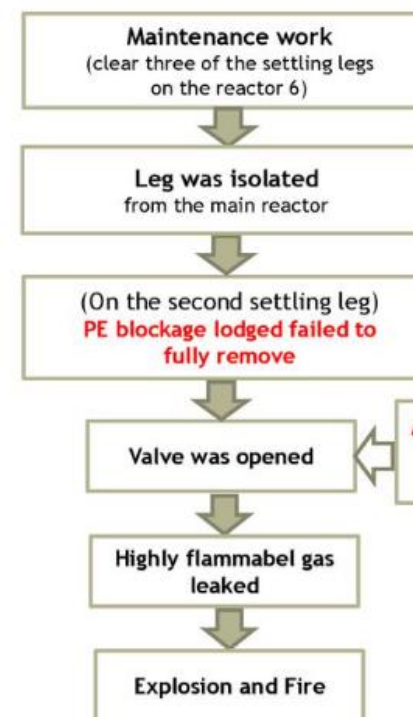
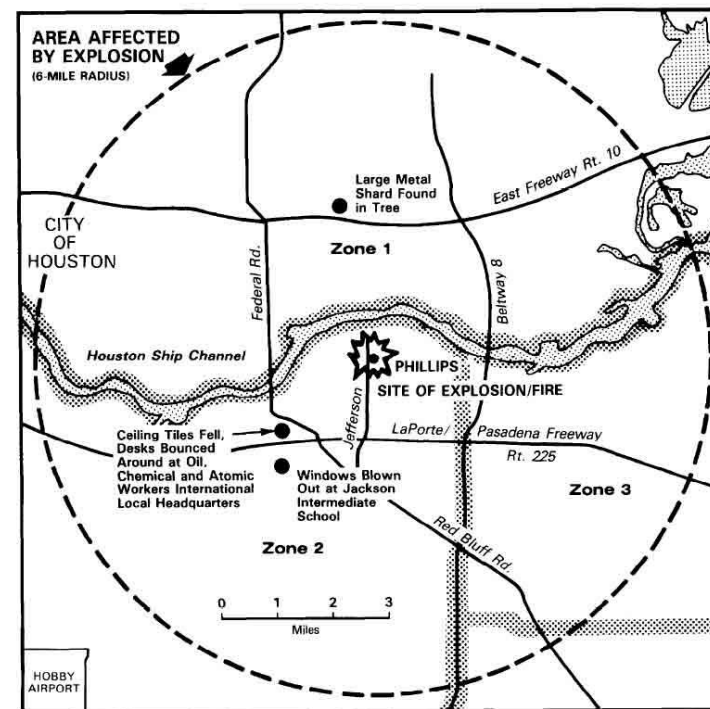


Fig. Typical Piping Settling Leg Arrangement

Key Issues



- Manpower cut-backs raised concerns for safety.
- Excessive overtime - workers stressed-out.
- Use of sub-contract maintenance creates conflict.
- Inadequate lock-out procedures.
- Inherently flawed reactor design.



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Failing in Technical Measures

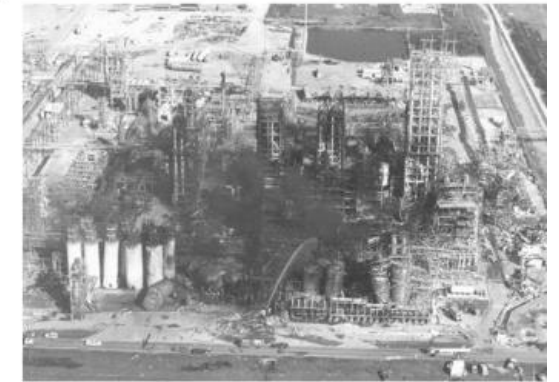


- Lack of Process Hazard Analysis (PSA)
- Inadequate standardized operating procedure
- Inadequate maintenance permitting system
- Inadequate lockout/tagout procedures
- Lack of combustible gas detection and alarm system
- Inadequate ventilation systems in nearby buildings
- Fire protection system not in sufficient state of readiness
- High occupancy structures too close to hazardous operations
- Inadequate space between buildings



Aerial view of
the Phillips 66 plant
taken before the explosion

View of the Phillips 66 plant
from west to east
taken after the explosion





Thank you for your attention