



30 Years Later:
Remembering the Explosion at Pasadena

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Bruce K. Vaughen
Kenneth Bloch

In Memory

**This presentation is respectfully prepared and presented
in memory of the 23 people who died in the explosion
at the Phillips Petroleum Company's Pasadena, Texas
facility on October 23, 1989.**

- **“Process Safety” Thirty Years Ago**
- **Process Description**
- **The Incident**
- **Process Safety Today**
- **Questions?**



“Process Safety” Thirty Years Ago

- “Process Safety” term
- US Regulatory history and response
- Industry record since then

“Process Safety” 30 years ago

- There were process safety-related efforts, such as
 - Hazards identification methods
 - Hazards reviews
- The “Process Safety” and “Process Safety Management (PSM)” terms as we know them today did not exist
- There were no “Process Safety Engineers”
- There were no “Process Safety Coordinators”

US Regulatory history and response

- Although some US regulations via OSHA existed, these focused on workplace and personal safety and health
- The Pasadena explosion accelerated development of OSHA’s “Process Safety Management” regulation (issued in 1992)

Note: Other regions in the world had developed or have developed similar process safety-related regulations over the last four decades

Significant incidents have occurred since then:

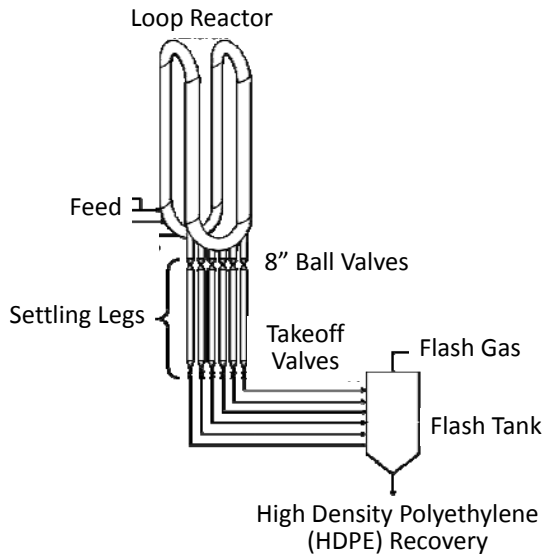
- Refinery explosion and fire in Texas City (2005)
15 fatalities, 180 injuries
- Offshore rig, explosion, fire, and oil spill (2010)
11 fatalities, 17 injuries
- Toxic chemical release in LaPorte, TX (2014)
4 fatalities



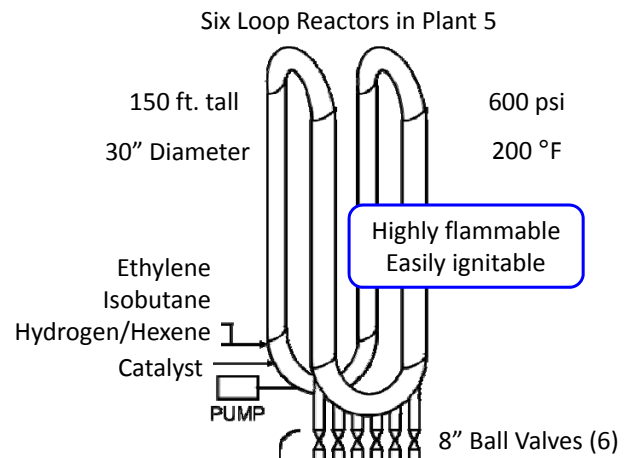
- **“Process Safety” Thirty Years Ago**
- **Process Description**
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- **Process Safety Today**
- **Questions?**
- Operations
- Maintenance

Operations

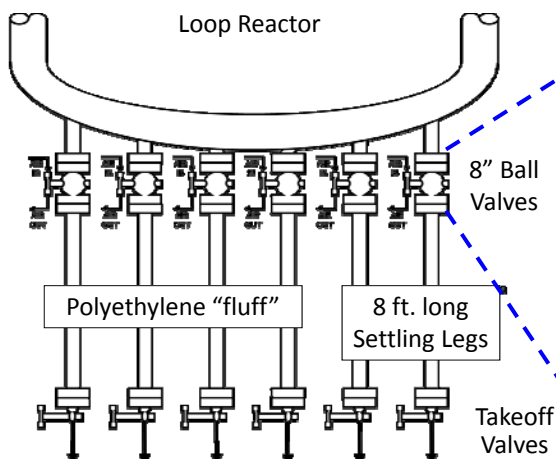
Reactor to HDPE Recovery



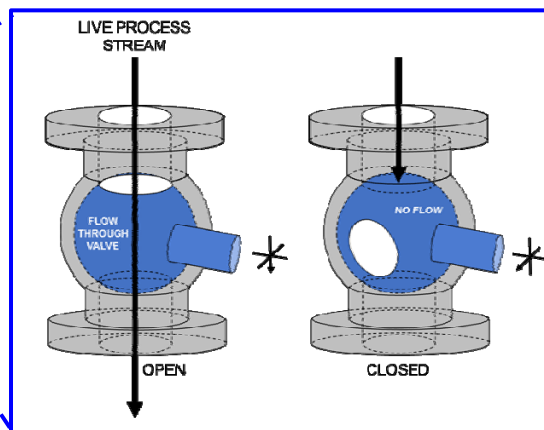
Expanded Reactor View



Operations



Ball Valve Operation



Air actuated

Settling Leg Maintenance

Performed with Loop Reactor running

Steps when unplugging settling leg

- 1) Close the 8" Ball Valve (Indicator reads closed)
- 2) Disconnect the 8" Ball Valve actuator air supply and discharge hoses
- 3) Lock the 8" Valve stem in its closed position
- 4) Remove the takeoff valve
- 5) Manually pull the log out

Outline

- **"Process Safety" Thirty Years Ago**
- **Process Description**
- **The Incident**
- **Process Safety Today**
- **Questions?**

- Summary
- Findings

Summary



Before

After

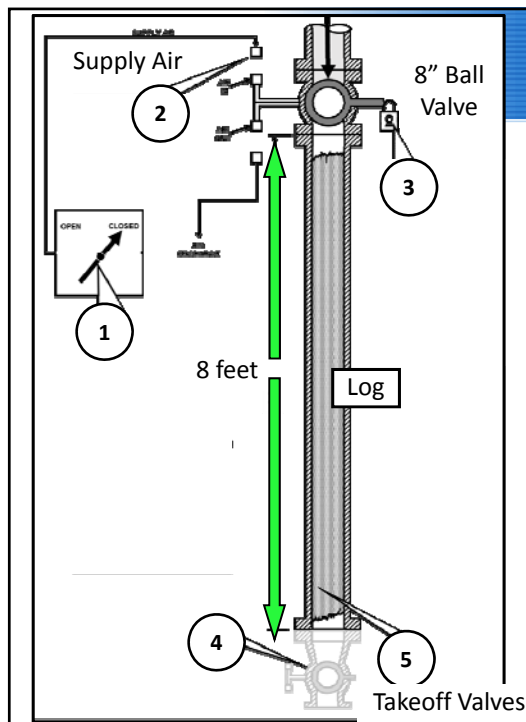


Summary

Incident Impact

- 23 fatalities
(22 within 150 ft. of the loop reactor)
- > 130 injuries
- Estimated 85,000 lbs were released and ignited within 2 min
- Blast force equivalent to 2.4 tons of TNT
- Vapor Cloud Explosion registered 3.5 magnitude on the Richter scale
- Significant property damage

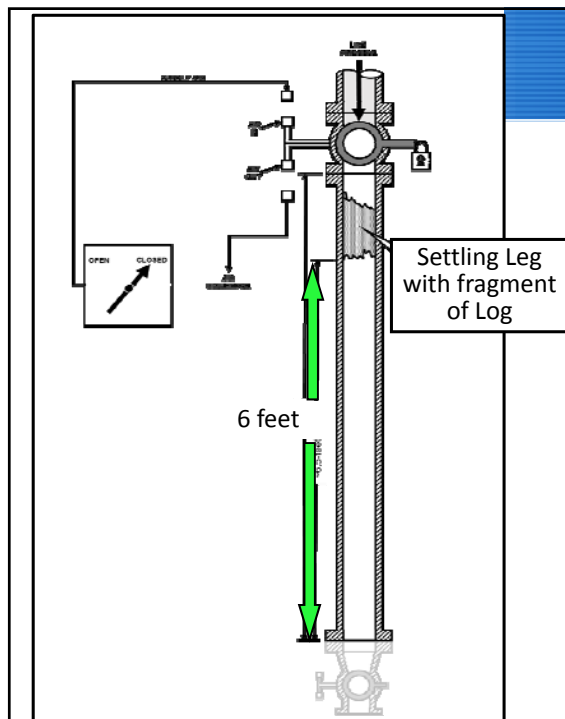




Maintenance As Written

Steps when unplugging settling leg

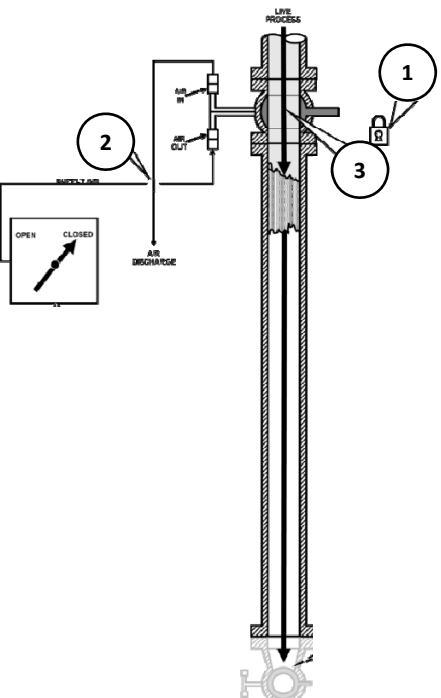
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Maintenance Issue

However, day of incident

Cannot reach Log fragment and then manually pull the log out

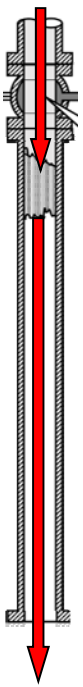


Findings after the explosion

Findings

- 1) The 8" Ball Valve stem was *unlocked*
- 2) The actuator air supply and discharge hose connections were *reconnected in reverse*
- 3) The 8" Ball Valve will malfunction open if the air supply is *connected in reverse*

Note: This data was obtained afterwards during the investigation.



Reactor at 600 psi

Open 8" Valve

Plug

Takeoff valve removed (open to atmosphere)

Feasible conclusion due to findings

- Plug discharged out due to reactor pressure
- Nothing to stop flow from reactor
- Entire contents of reactor released outdoors

Company understood hazard and risk, thus the maintenance procedure with lockout and disconnected air supply

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Lessons Learned from this incident

- Adhere to Safe Work Practices (SWP)
- Comply with standards and regulations
- Manage disabling of safeguards
- Adhere to operational discipline
- Live in the safe operating zone

These lessons still apply today!

Adhere to Safe Work Practices (SWP)

Lesson that still applies today:

Safe Work Practices (SWP) exist for a reason

If a SWP suffers from a “workaround” (*when the exact steps are not taken to get to the same goal*), there is the danger of a “normalization of a deviance” (*where the deviation becomes routine*)

Note: Normalization of Deviance was attributed to poor process safety culture at NASA for the 1986 Shuttle disaster and the 1984 Bhopal disaster

The “SWP” in the Pasadena explosion was the maintenance issue which did not address a known engineering design (the next lesson)

Comply with Standards and Regulations

Lesson that still applies today:

Standards exist and regulations have been created for worker’s benefit

Many exist because of previous incidents which have caused harm

In Pasadena’s case, there was a corporate standard which could not be performed during the maintenance due to the existing design of the reactor system (corporate standard known as a “double block and bleed design”)

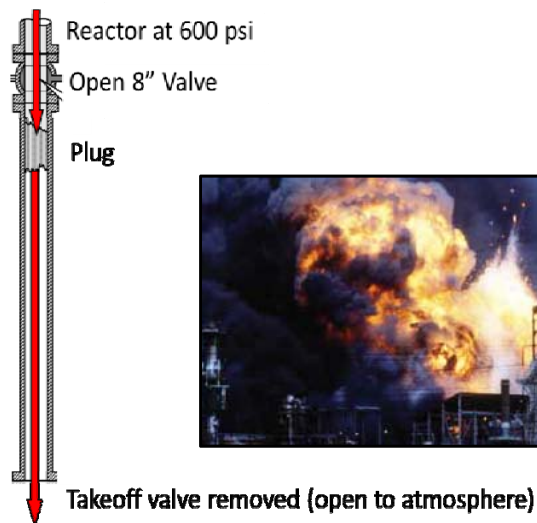
Building a “SWP” to deviate from a known corporate standard should be seriously addressed and not implemented

Manage Disabling of Safeguards

Lesson that still applies today:

Safeguards are designed and implemented to protect workers

Disabling them for any reason, even during a maintenance task, should not be performed without proper understanding of the risks, especially on a live process



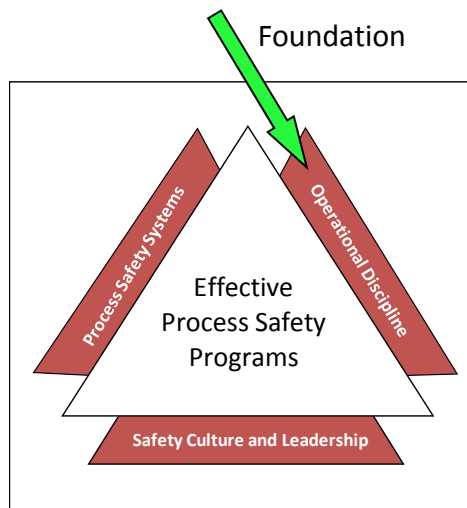
Adhere to Operational Discipline

Lesson that still applies today:

Every one must carry out each task the right way, every time when sustaining an effective Process Safety Program

Everyone:

- Engineers
- Technicians
- Operators
- Mechanics
- Electricians
- Supervisors
- Managers

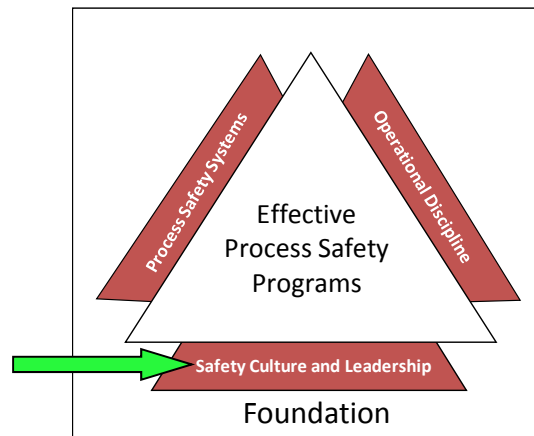


Operational Discipline and...

Safety Culture and Leadership:

- All levels in a organization

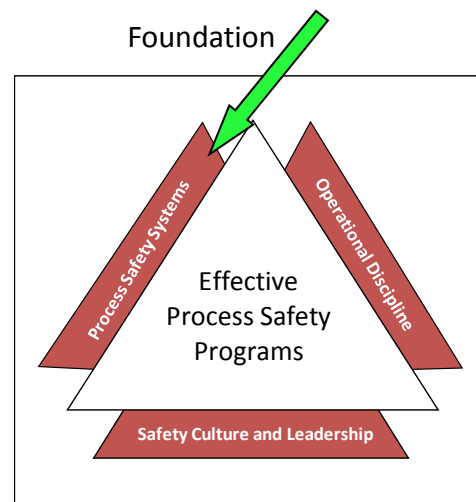
Strong leadership drives the organization's process safety culture, resulting in strong process safety performance



Operational Discipline and...

Process Safety Systems (which include):

- Safe Work Practices (SWP)
- Standards
- Operating Procedures
- Maintenance Procedures
- Management of Change (MOC)
- And many other systems



Lessons Learned from this incident

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Lesson that still applies today:

Poor Process Safety Leadership

Weak Operational Discipline

Ineffective Process Safety Systems

- Poor process safety performance
- Greater process safety risk
- More incidents

Don't operate in the unsafe zone!



Lessons Learned from this incident

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Any questions on these?

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