



1. Pipeline Rupture – Bellingham Washington, USA

- June 10, 1999
- 16-inch-diameter steel pipeline ruptured
- Released about 237,000 gal (900,000 l) of gasoline
- Ignited and burned approximately 1 1/2 miles (2 km) along the creek.
- Three people died as a result of the accident.



US National Transportation Safety Board

1. Pipeline Rupture – Bellingham Washington, USA

- Fracture originated at an external gouge mark in the pipe that was approximately 8 1/2 in. (220 mm) long and oriented longitudinally.
- Gouge reduced the wall thickness of the pipeline by approximately 20 percent.



1. Pipeline Rupture – Bellingham, Washington, USA

Contributing Causes:

- Damage done to the pipe during the 1994 construction at a water treatment plant
- The pipeline company's inadequate inspection the construction work during the project
- The pipeline company's inaccurate evaluation of inline pipeline inspection results
- The pipeline company's failure to test under approximate operating conditions, all safety devices

2. Truck Explosion

- A pickup truck with a small cylinder of acetylene stored in the cab was parked for the weekend.
- The cylinder had a small leak.
- A flammable atmosphere developed inside the truck's cab.
- When the
 - owner returned and opened the door---BOOM.



Center for Chemical Process Safet



3. Compressed Gas Supplier – St Louis, Missouri, USA

- June, 2005 spectacular fire and series of explosions
- Projectiles flew from the plant as far as 900 feet (275 meters)
- A safety relief device on a cylinder located in an area where empty propane or propylene cylinders were stored at the site vented with high energy.
- The escaping gas ignited, the flame impacted other cylinders and heated them to the point that they too vented.





4. Chlorine Release – Festus, Missouri, USA

 August, 2002 - Chlorine was being transferred from a railroad tank car when the transfer hose burst.



- Both automatic and manual emergency shutdown systems failed
- The release was unabated for about three hours before emergency responders were able to stop the release.
- They entered the chlorine cloud wearing "Class A" safety gear and climbed on top of the car to close the manual shut off valves.
- Three people were hospitalized.

4. Chlorine Release – Festus, Missouri, USA

Contributing Causes:

- The ruptured hose should have had an inner Teflon liner reinforced with a C-276 exterior metal braid.
 - with a C-270 extend metal blatt.
 - Instead the braid was stainless steel.
 - The hose failed after less than 2 months of service.
 - Both the purchase and shipping papers indicated that the hose was constructed of the proper materials.
- An emergency shut down system failed to work because of severe build up on the valve ball.



5. Acetylene Gas Explosion - Perth Amboy, New Jersey, USA



6. Nitrogen Asphyxiation -Hahnville, Louisiana, USA

US Chemical Safety and Hazard Investigation Board



6. Nitrogen Asphyxiation -Hahnville, Louisiana, USA

- March, 1998
- One dead, one injured
- Two workers were overcome by nitrogen gas while performing a black light inspection1 at an open end of a NPS 48 horizontal pipe.
- Nitrogen was being injected into connected process equipment to protect catalyst
- The nitrogen was venting from one side of the open pipe where it had formerly been connected to a mixer.

6. Nitrogen Asphyxiation -Hahnville, Louisiana, USA

Contributing Causes:

- Procedures to control potential hazards created by erecting temporary enclosures around nitrogen-containing equipment were inadequate.
- Nitrogen and confined space hazard warnings were inadequate.



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8. Pneumatic Pipe Testing - Brazil

- Incident happened during a pneumatic test of the tank associated piping.
- Block valves were closed to isolate the piping.
- Block valve(s) leaked through and over pressured the tank.
- Primary cause: failure to install blanks or blinds to isolate the test segment.

What We Can Learn

Following well known safety principles could have prevented or mitigated the effect of all of these incidents.

Hazard Analysis	Analysis method can be FMEA, What If, HAZOP, Checklist, Fault Tree, Event Tree, Probabilistic Risk
	Assessment, or other method. The method should identify Significant accident scenarios Significant vulnerabilities Mitigation measures for significant vulnerabilities
Standard Operating Procedures	Procedures should be written and followed

What We Can Learn

Following well known safety principles could have prevented or mitigated the effect of all of these incidents.

Management of Change Procedures	A process should be established to review proposed changes to materials, technology, equipment, procedures, personnel and facility operation for their effect on safety vulnerabilities
Employee Training	Employees should be trained in all aspects of the work, advised of changes, and periodically refreshed
Mechanical Integrity	Establish a preventative maintenance plan that includes Test/inspection frequency and needed documentation

What We Can Learn

Following well known safety principles could have prevented or mitigated the effect of all of these incidents.

Emergency Response	Establish a plan for responses to emergencies, including communication and interaction with local emergency response officials
Self-Audits	Establish how the organization will verify that safety related practices are being followed throughout the life of the facility