Case Studies

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Case Studies

- Eight Incidents
- What We Can Learn
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 of 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.
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.
3. Compressed Gas Supplier – St Louis, Missouri, USA

Contributing Causes:
- Premature release of a safety relief valve
- High temperature ambient conditions - 100°F (38°C)

4. Chlorine Release – Festus, Missouri, USA
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- 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.

Contributing Causes:

- The ruptured hose should have had an inner Teflon liner reinforced with a C-276 exterior metal braid.
  - 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
6. Nitrogen Asphyxiation - Hahnville, Louisiana, USA

- March, 1998
- One dead, one injured
- Two workers were overcome by nitrogen gas while performing a black light inspection 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.

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.
7. Pipe Rupture

A thermally unstable material (a peroxide) was being fed from a weigh tank to a reactor.

Normal practice was to empty the weigh tank, leaving the transfer piping empty.

A leak developed and quick repair was expected so valves were closed leaving the pipe FULL of peroxide.

The reactor temperature was well above the point at which the peroxide decomposes. Heat from the reactor slowly warmed the material in the piping.

The material reached its decomposition temperature.

The result—overpressure that ruptured the piping.

There were no injuries, just a lot of surprised people.
8. Pneumatic Pipe Testing - Brazil

Source: Unknown
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.

<table>
<thead>
<tr>
<th>Hazard Analysis</th>
<th>Analysis method can be FMEA, What If, HAZOP, Checklist, Fault Tree, Event Tree, Probabilistic Risk Assessment, or other method. The method should identify:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Significant accident scenarios</td>
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<tr>
<td></td>
<td>- Significant vulnerabilities</td>
</tr>
<tr>
<td></td>
<td>- Mitigation measures for significant vulnerabilities</td>
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</tbody>
</table>

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<tr>
<th>Standard Operating Procedures</th>
<th>Procedures should be written and followed</th>
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What We Can Learn

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

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