Overpressurization of Natural Gas Distribution System, Explosions, and Fires, in Merrimack Valley, Massachusetts

Roger D. Evans
Investigator-in-Charge
Accident Location

The impacted area
Merrimack Valley -- Consequences

- 1 fatality
- 22 individuals transported to the hospital
- Over 50,000 residents asked to evacuate
- Electricity shut down for 18,000 customers
- Gas shut down for 11,000 customers
Parties to the Investigation

• Massachusetts State Police
• Columbia Gas of Massachusetts
• NiSource, Incorporated
• Massachusetts Department of Public Utilities
• US Department of Transportation – Pipeline and Hazardous Materials Administration
Previous NTSB Overpressurization Investigations

- Seven overpressurization accidents investigated over the past 50 years
- A 1977 accident in El Paso, Texas, was nearly identical to this accident in Merrimack Valley
- Single point of failure
Safety Issues

• Overpressure protection in low-pressure gas distribution systems
• Engineering management for gas distribution systems
• Emergency response to large-scale accidents
Property Damage

• 131 structures impacted
NiSource, Inc.
4 million Customers
8,000 Employees

Columbia Gas of Virginia
265,000 Customers

Columbia Gas of Massachusetts
325,000 Customers

Columbia Gas of Kentucky
135,000 Customers

Columbia Gas of Maryland
33,000 Customers

Columbia Gas of Pennsylvania
433,000 Customers

Columbia Gas of Ohio
1.4 million Customers

Northern Indiana Public Service Co.
830,000 N. Gas/ 470,000 Elec. Customers
Industry Postaccident Actions:

AGA Released:

“Leading Practices to Reduce the Possibility of a Natural Gas Over-Pressurization Event”


Leading Practices to Reduce the Possibility of a Natural Gas Over-Pressurization Event

November 26, 2018
Pipeline Operations
The Winthrop Regulator Station:
South Union Street Project Timeline

- 2015 -- Project planning began
- March 2016 -- First constructability review
- June 20, 2016 -- Project begins
- August 4, 2016 -- 8-inch PE installed at Winthrop regulator station
South Union Street Project Timeline (cont.)

- October 17, 2016 – Sensing line Email from construction
- January 6, 2017 – Second constructability review
- 2017 – Project delayed
- December 14, 2017 – Third constructability review
Events of September 13:

- South Union street project was underway on a pressurized main.
- The final tie-in to complete the work was at the north end of South Union.
- The Winthrop Regulator Station is at the south end of South Union.
The Excavation Site at Salem and South Union streets:
High-pressure gas main normal operating pressure of 75 psig
99 psig maximum allowable operating pressure
8-inch low-pressure polyethylene main
8-inch cast iron low-pressure main abandoned on day of accident.
Normal 7-inch w.c. to 12-inch w.c.
(14-inch w.c. maximum allowable operating pressure)
Pipeline System Records
Columbia Gas Engineering Workflow

Field Engineer

Constructability Review

Supervisory Engineering Approval
Columbia Gas
Records and Documentation

- Geographic information system: computer-based centralized record system
- Used in development of project
- Sensing line information not included
Columbia Gas
Records and Documentation
Continued

• No engineering plans to relocate sensing lines
• Email: “eventually” be relocated
• Informal and unstructured approach to documenting critical step
Columbia Gas Constructability Review

Constructability Review Signatures

For Engineering: [Redacted] [Redacted] 12/14/17
For Construction: [Redacted] [Redacted] 12/14/17
For M&R: [Redacted] [Redacted] 12/14/17
(L&M & R only needs to sign when applicable)
For Land Services: [Redacted] [Redacted] [Redacted]
(Land Services only needs to sign when applicable)
Professional Engineer License

• Technical competency
• Continuing education requirements
• Code of ethics
• Duty to public safety & health
• Personally accountable for work approved
Professional Engineer Exceptions

• Massachusetts eliminated exception on December 31, 2018

• Currently, 28 states and 3 commonwealths with industrial exemption for natural gas infrastructure projects
Below Grade Regulator Control Lines: Caution When Excavating Near Regulator Stations or Regulator Buildings

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<thead>
<tr>
<th>Companies Affected:</th>
<th>NIPSCO</th>
<th>CGV</th>
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Columbia Gas Risk Assessment

• Did not mitigate all the risks identified
• Did not conduct an effective risk assessment for the South Union Street project
• Did not ensure necessary engineering controls for overpressure protection
Limitations of Low-Pressure Natural Gas Distribution Systems

• Multiple overpressurization incidents over the past fifty years investigated by NTSB

• Systems based on sensing lines and regulators for prevention of over pressure events – NOT Optimal
NTSB Postaccident Actions:

• NTSB issued:
  • One recommendation to Massachusetts
  • Four urgent recommendations to NiSource

• Congressional Hearing
  • Chairman Sumwalt participation in the Congressional Hearing