Commissioners Information Meeting

Natural Gas Pipeline Infrastructure Update

Colorado

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I. Introduction

Recent high profile incidents have occurred in the U.S. highlighting the present discussion of our States natural gas pipeline infrastructure. The focus was a general review of pipeline safety risks observed in Colorado. These comments are not an exhaustive review of each pipeline system found in our State since operators of pipeline systems are required to identify and reduce specific pipeline integrity risks on their intrastate piping. Also, included in this presentation is an update of the San Bruno, CA high pressure supply line incident of September 9, 2010 and recent cast iron incidents in Philadelphia and Allentown, Pennsylvania.

The ability to communicate "lessons learned" from any incident or accident is critical in performing a meaningful process, procedural, and training review for all pipeline operators in order to minimize occurrence or re-occurrence of a pipeline incident. A review of 10 year Colorado incident statistics shows an average of 2.2 incidents, 0.1 fatalities, and 1.3 injuries per year (federal statistics). Due to the low level of distribution incidents in Colorado, this discussion does not pursue the use of that statistic.

On April 18, 2011, a Pipeline Safety Forum was convened by U.S. Transportation Secretary Ray LaHood, to discuss our nation's pipeline infrastructure and bring a focus on the known high risk systems. This forum brought in many comments from my fellow state and federal pipeline safety managers, and industry trade organizations. The Forum comment information has been posted at the DOT website at **http://opsweb.phmsa.dot.gov/pipelineforum/forum-2011/**

A primary failure mechanism affecting all underground utilities is excavation damage. That mode of failure, causes, and path forward is best addressed by a future, independent review of the topic.

II. Operators: Transmission and Local Distribution Companies

The Federal and State pipeline safety codes refer to "operators". Operators are also referred to as utilities under the Commissions CCR 723-4 regulations. Operators are those utilities who operate natural gas transmission and/or natural gas distribution systems. As you are aware distribution operators are referred to as Local Distribution Companies (LDC's). The largest LDC's in Colorado are PSCo, Blackhills Energy, Atmos Energy, SourceGas, and Colorado Natural Gas. Also, the municipal operated gas systems in Colorado are Colorado Springs Utilities, Trinidad, Walsenburg, Aguilar, Fort Morgan, Center, Ignacio, Walden, and Rangely. None of the Colorado LDC's operate interstate gas pipeline systems.

The transmission operators are those gas utilities which are the suppliers of natural gas to the LDC's across Colorado. The primary intrastate natural gas transmission operators are PSCO, BlackHills Energy, and SourceGas. In Table 1, CY 2010 system statistics of miles operated in Colorado by the respective intrastate operators can be found. Table 2 shows the occurrences of incidents in Colorado distribution company pipeline systems.

The PUC is Certificated through the Pipeline and Hazardous Materials Safety Administration (PHMSA) also referred to as the Office of Pipeline Safety to perform audits and inspections of companies operating intrastate natural gas systems. PHMSA regulates all intrastate liquid, interstate liquid and natural gas pipeline operators in Colorado.

History- Metro Denver Natural Gas System

The Denver Metro areas natural gas supply system is the oldest and largest in Colorado. The LDC serving Denver is Public Service Company of Colorado (PSC0). PSCo, a Xcel Energy Company based in Minnesota, provides natural gas and electricity to many Front Range and rural customers in Colorado. PSCo's roots go back to 1869 when the Denver Gas Company was incorporated for street lighting. From 1869 to the mid-1890's, several mergers of Denver gas and electric companies resulted in the creation of the Denver Gas and Electric Company. Several additional mergers eventually lead to the creation of Public Service Company of Colorado in 1927. The early PSCo gas system was supplied by the newly discovered Fort Collins/Wellington gas field and from Colorado Interstate Gas (CIG) interstate pipeline from the Texas gas fields. A later PSCo subsidiary, Western Slope Gas Company, began building its intrastate gas transmission system throughout the Front Range and eventually into western Colorado. Today, the Western Slope Gas Company, later named WestGas, has been merged into the PSCo system and supplies transmission and distribution services to approximately 1.1 million gas customers in Colorado.

III. What is Cast Iron?

Cast iron pipe was the predominant material that was available to build the Colorado water and gas systems in the 1890's. Some eastern U.S. cast iron (CI) systems date back to the 1830's. The replacement of cast iron by steel and plastic piping began to take place after World War II. Two cast iron manufacturing processes were in place: either sand casted or later by centrifugal casting methods in the 1920's. The centrifugal casting method, in addition to developing manufacturing standards, resulted in a consistent wall thickness. Cast iron is a known brittle material and later in its life cycle a "flaking or layered corrosion" can develop due to its metallurgy and corrosive makeup. Early cast iron pipe, due to its sometimes thicker wall thickness had a stronger "beam" or bending strength than some of the later centrifugal manufactured cast iron pipe.

Cast iron looses the little ductility or ability to bend when the pipe material becomes "graphitized" leading to cracks. The cause of cast iron graphitization is due to the iron-carbon metallurgical make up of the material. Through and electro-chemical reaction process called electrolysis, graphitization results when iron leaves the pipe leaving behind a carbon (graphite) matrix. The area that has become graphitized can be over a general area or localized depending on the surrounding soil environment. More corrosive soils (low resistivity-clay soils) tend to accelerate corrosion and high resistant type sandy soils tend to slow the corrosion graphitization process. A newer threat to accelerated corrosion on all metallic piping is the use of liquid magnesium chloride replacing sand or sand/salt mixtures to combat snow and ice on city streets.

Cast iron was manufactured in varying lengths ranging from around 12 to 15 feet. Manufacturing processes and the length of rail cars, wagons, and trucks used to transport pipe were primary factors. Short pipe lengths resulted in many more joints. Joints were made by either mechanical couplings, threaded, or by sealing the "bell and spigot" joints with jute and lead wool.

Due to its material and joining methods, cast iron leakage is found in the body of the pipe cracks) or at the joint (failure of the joining seal). Repair methods of clamping, when possible, pipe insertion, or pipe replacement for cracked or graphitized segments are repair options. Repair methods are driven by condition of the pipe and the cause of leakage. PUC Staff does not allow internal pipe liners (in-situ repair) since code does not recognize maximum allowable operating pressure calculations for in-situ type liners with no outer pipe wall support.

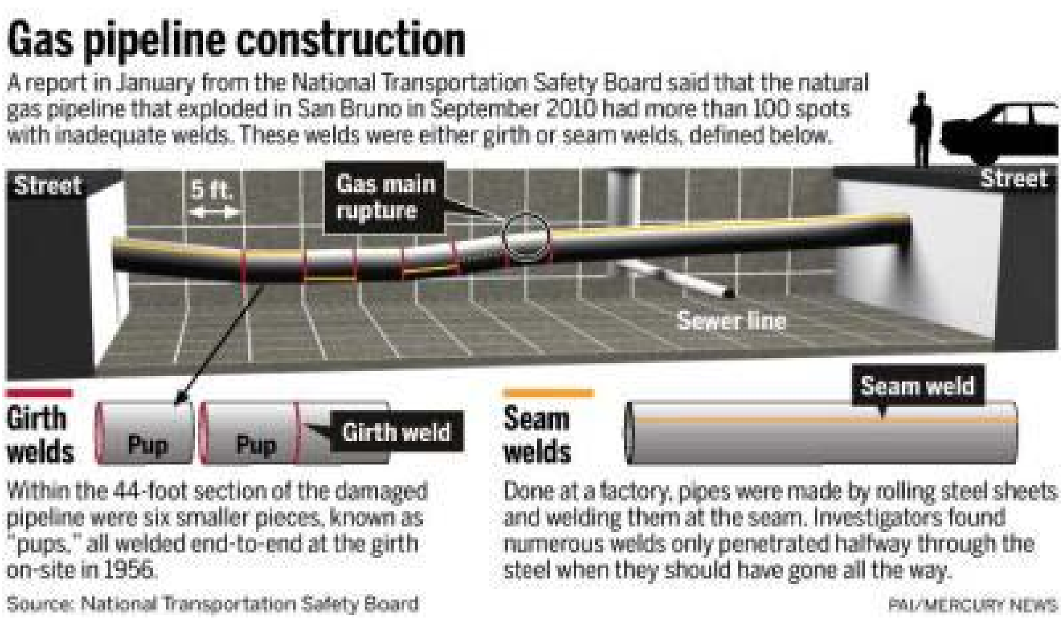
Due to wall thickness and extent of graphitization, some cast iron pipe systems have been in use for 100 years - as long as no external forces disturb this type of piping. As previously mentioned, graphitization results in a weaker wall or bending strength resulting in an increasing threat of cracking or wall collapse. Catastrophic pipe failures consist of a large amount of gas leakage in a short period of time. External forces which can result in cast iron pipe failure are pipe support methods when originally installed, diameter, wall thickness, corrosion/graphitization, joint method, frost heave, water leakage undermining pipe support, construction activity near the pipe, and traffic loading.

VII. Recent Incident Discussion-San Bruno, CA and Cast Iron

San Bruno, CA

Note: The source of the following is based on the preliminary National Transportation Safety Board (NTSB) report of October 14, 2010 and media reports. No final determination is available from the NTSB, PHMSA, or the California Public Utilities Commission. The incident investigation is currently open and a cause has not been determined.

On September 9, 2010 a 30 inch diameter steel natural gas transmission pipeline ruptured. The pressure at the time of failure is unknown due to a pressure regulator controller failure shortly before the rupture. Pacific Gas and Electric (PG&E) of California is the operator of this pipeline. According to the National Transportation Safety Board (NTSB) interim incident report, the pipeline had a maximum allowable operating pressure of 400 psig. This pipeline had a normal operating pressure of 375 psig during normal high load use periods, and less at other times. The released gas ignited and the resulting fire burned and destroyed 37 homes and damaged 18. Eight people were killed. The specifications of the ruptured pipe segment were short segments, referred to as pups, making up part of the 44 foot long segment removed by the NTSB during their incident investigation. During relocation of this pipeline in 1956, 1700 feet was moved to allow for the construction of the new Glenview neighborhood surrounding the failure area. The rupture location was under an asphalt paved street in a residential area south of San Francisco, CA.



Subsequent reports indicate a longitudinal seam defect in one of the pups installed in the rupture area was the failure point of origin. The seam welds were made at a pipe mill and not by PG&E or contractor welders. The seam welds appear to have insufficient weld penetration from the outside weld and a radial offset on the inside seam joint but with no consistent internal weld.

On January 10, 2011 the PHMSA issued an *Advisory Bulletin* to remind operators of their responsibilities, under the Federal Integrity Management (IM) regulations, to perform detailed threat and risk analysis that integrate accurate data and information from the entire pipeline system (distribution and transmission systems). To adequately evaluate risk, it is necessary to identify and evaluate the physical and operational characteristics of each individual pipeline system, including its surrounding geographical location. The NTSB and the PHMSA were not clear if pressure fluctuations, seismic activity near the San Andreas fault line, or both, resulted in the PG&E San Bruno point fatigue initiated failure.

The incident is under the jurisdiction of the California Public Utilities Commission. The Commission is holding hearings on deficient PG&E recordkeeping which, along with operating procedures, may have contributed to this pipeline failure. Additional background information on seam failure research can be found at
http://opsweb.phmsa.dot.gov/pipelineforum/reports-and-research/seam-weld/

Pennsylvania (Philadelphia and Allentown)

Note: The source of the following is based on media reports. No information is available from the NTSB, PHMSA, or the Pennsylvania Public Utilities Commission. The incident investigation is currently open and a cause has not been determined.

Philadelphia: On January 18, 2011 emergency repair crews from Philadelphia Gas Works (PGW) responded to gas odor complaints in a residential neighborhood in Philadelphia. Crews found a leak in a 12 inch diameter cast iron gas main. While attempting to control the gas flow the released gas migrated into a nearby structure and ignited. The resulting explosion killed a PGW employee and injured six (four were fellow workers and two fire fighters). The fire spread to three houses and took about three hours to extinguish.

Allentown: On February 9, 2011 an "imperfection" in a 12 inch cast iron main caused a gas release and explosion of two townhouses, severe damage to six homes, and killing 5. A UGI Utilities, Inc. utility crew performing a routine inspection the previous day did not find any gas leakage.

Hanoverton, Ohio

On February 12, 2011 a rural natural gas transmission pipeline ruptured. El Paso Energy Corp. operates the Tennessee Gas Pipeline that was in-line inspected in 2005. No anomalies that required immediate action were detected during the 2005 inspection.

Denver, CO

On April 7, 2011 a fire involving natural gas was reported at 1060 W. Virginia Avenue. There was one serious injury, and a structure destroyed in a resulting fire and explosion. The incident is under investigation by the PUC Safety Staff. Cast iron was not involved.

Table 1 Colorado Local Distribution Companies (LDC's)

Operator	Services	Main Miles	Transmission
Xcel Energy	1,077,825	21,667	2251
CO Spgs. Utilities	164,451	2371	
Atmos Energy	94,128	3433	
SourceGas	87,208	2822	520
Black Hills Energy	62,348	2987	124
Colo. Natural Gas	14,320	829	
E. Colo. Utilities	3964	205	
Ft. Morgan	4130	102	
Trinidad	4414	74	

Walsenburg	1578	38	
Walden	590	44	8
Rangely	1118	32	
Center	806	12	
Ignacio	421	10	
Aguilar	242	8	

Table 2 Colorado Gas Distribution Incidents: 2001-2010

Year	Number	Fatalities	Injuries
2001	4	0	2
2002	2	0	0
2003	0	0	0
2004	2	0	0
2005	2	0	1
2006	1	0	0
2007	4	0	0
2008	2	1	7
2009	3	0	2
2010	2	0	1
Totals	22	1	13

Appendix - Definitions (49 C.F.R Part 192.3)

Distribution line means a pipeline other than a gathering or transmission line.

Gathering line means a pipeline that transports gas from a current production facility to a transmission line or main.

Main means a distribution line that serves as a common source of supply for more than one service line.

Service line means a distribution line that transports gas from a common source of supply to an individual customer, to two adjacent or adjoining residential or small commercial customers, or to multiple residential or small commercial customers served through a meter header or manifold. A service line ends at the outlet of the customer meter or at the connection to a customer's piping, whichever is further downstream, or at the connection to customer piping if there is no meter.

Transmission line means a pipeline, other than a gathering line, that: (1) Transports gas from a gathering line or storage facility to a distribution center, storage facility, or large volume customer that is not down-stream from a distribution center; (2) operates at a hoop stress of 20 percent or more of SMYS; or (3) transports gas within a storage field.