

**A Report by the Staff of the
Public Utilities Commission of Ohio**

In the matter of the investigation of Columbia Gas of Ohio related
to compliance with the Natural Gas Pipeline Safety standards

Case Number 20-1759-GA-GPS

December 3rd, 2020

**BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO**

In the matter of the investigation of)
Columbia Gas of Ohio related to)
compliance with the Natural Gas)
Pipeline Safety standards)

Case No. 20-1759-GA-GPS

To the Honorable Commission:

Staff conducted an investigation of the above matter and hereby submits its findings and recommendations in this Gas Pipeline Safety Staff Report.

The findings and recommendations reached in this Staff Report are presented for the Commission's consideration and do not purport to reflect the views of the Commission, nor should any party consider the Commission as bound in any manner by the findings and recommendations set forth herein.

Respectfully submitted,



Peter A. Chace
Chief, Facility Operations & Field Division
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TABLE OF CONTENTS

	Page(s)
I. Background.....	3
II. Summary of Events Leading to the Natural Gas Incident	3
III. Staff Investigation	5
IV. Discussion of Violations.....	7
V. History of Previous Violations.....	9
VI. Conclusion and Recommendations.....	11
Appendix – Exhibits	12

Appendix – Exhibits

Exhibit 1	COH Kitts Hill – Staff Investigation Report
Exhibit 2	Columbia Response to Staff data request 11-2-2020
Exhibit 3	NTSB Merrimack Valley Findings & Recommendations
Exhibit 4	COH Zanesville MAOP excursion – Staff Investigation Report
Exhibit 5	COH Zanesville – Notice of Probable Noncompliance
Exhibit 6	COH Zanesville – Columbia response to Staff Notice of Probable Noncompliance

I. Background

Columbia Gas of Ohio (Columbia or COH) provides natural gas service to approximately 1.38 million customers through 20,147 miles of pipeline. Columbia is a natural gas company¹ subject to the jurisdiction of the Public Utilities Commission of Ohio (Commission) under Title 49 of the Ohio Revised Code (R.C.) and rules adopted by the Commission in the Ohio Administrative Code (Ohio Adm. Code).²

The Commission's rules adopt the federal gas pipeline safety regulations contained at 49 C.F.R. 40, 49 C.F.R. 191, 49 C.F.R. 192, and 49 C.F.R. 199 (Pipeline Safety Regulations).³ The Pipeline Safety Regulations require gas pipeline operators to provide notice of any malfunction or operating error that causes gas pressure inside a line to exceed the pipeline's maximum allowable operating pressure.⁴ Therefore, this case was initiated after the Commission's Gas Pipeline Safety Staff (Staff) was notified by Columbia and subsequently conducted an investigation of a pipeline over-pressurization that occurred on October 1, 2020 at Columbia's Kitts Hill Road Compressor Station, 8358 State Route 141, Kitts Hill, OH (Lawrence County).

Staff has concluded that the over-pressurization in question was caused by a regulator sensing line becoming depressurized during the process of a line abandonment.⁵ The depressurized sensing line caused the regulator to malfunction and fail in the open position, exposing downstream piping to upstream gas pressure and causing the over-pressurization. The root cause of this event was the failure of Columbia to develop and follow a tie-in plan which is required by Columbia procedures and would have specified a plan for the line abandonment that should have included taking the sensing line connected to the depressurized line into account.⁶ A contributing factor was the failure of Columbia's employees at the site to recognize the work being performed was creating a hazardous condition despite the sensing line in question being above ground and in plain sight.⁷

II. Summary of Events Leading to the Natural Gas Incident

The Kitts Hill regulator station supplies gas from a 20" transmission pipeline operated by Columbia Gas Transmission to a distribution system supplying gas to 105 customers.⁸ Gas

¹ See R.C. 4905.03(E).

² See, e.g., Ohio Adm.Code 4901:1-16.

³ See Ohio Adm.Code 4901:1-16-03.

⁴ See 49 C.F.R. 191.23(a)(6).

⁵ See Exhibit 1, Staff Investigation Report – Pipeline Failure Investigation Report at page 1.

⁶ See Exhibit 1, Staff Investigation Report – Pipeline Failure Investigation Report at page 3.

⁷ See Exhibit 1, Staff Investigation Report – Appendix B: Photo of regulator station inside piping.

⁸ See Exhibit 1, Staff Investigation Report – Appendix K: Map of Kitts Hill system.

pressure regulators are mechanical devices that reduce the gas pressure from an upstream source to a desired output pressure. The pressure regulators at the Kitts Hill station reduced gas pressure from approximately 550 pounds per square inch gauge (psig) in the Columbia Gas Transmission line to a pressure of approximately 120 psig in the COH distribution system.⁹

Pressure regulators operate by using feedback from downstream and in some cases upstream pressure in order to maintain a constant downstream gas pressure. Feedback is delivered by small pipelines referred to as sensing lines or control lines that allow the regulator control mechanism to sense downstream and/or upstream pressure.

The work performed by Columbia at the Kitts Hill regulator station involved transferring the station to a new source of supply. Columbia Gas Transmission intended to abandon the segment of transmission line supplying the Kitts Hill regulator station known as the R-501 line. The station would be connected to a temporary source of supply line known as the R-601 line, which occupies a common pipeline corridor with R-501 and operates at a similar pressure and capacity. Columbia's plan was to permanently connect the Kitts Hill station to the R-601 line after completing additional upstream work.¹⁰

Records obtained from Columbia¹¹ and Columbia Gas Transmission¹² show the change to the Kitts Hill source of gas supply was planned as part of Columbia Gas Transmission's Buckeye Express Pipeline project. This project involved abandoning the R-501 line and replacing it with a new pipeline (R-801). Stations supplied by R-501 would be switched to line R-601, which is a pre-existing line that shares a common right-of-way with R-501. E-mail correspondence shows Columbia was aware on or before May 1, 2020 that the project called for work at the Kitts Hill station to disconnect it from line R-501 and connect it to line R-601.

On Wednesday September 30, 2020, Columbia employees disconnected the Kitts Hill regulator station from the segment of pipeline connecting it to R-501 and connected the station to R-601 through a temporary piping connection.¹³ The work was completed at approximately 11:00 A.M. After the R-601 temporary connection was installed, a valve was closed that isolated the segment of piping that connected R-501 to the regulator station inlet so that gas was no longer being supplied. The upstream pressure sensing control lines used by the regulators at the

⁹ See Exhibit 1, Staff Investigation Report – Appendix A: Diagram drawing of station piping.

¹⁰ See Exhibit 1, Staff Investigation Report – Appendix P: Columbia communication with Columbia Gas Transmission.

¹¹ See Exhibit 1, Staff Investigation Report – Appendix P: Columbia communication with Columbia Gas Transmission.

¹² See Exhibit 1, Staff Investigation Report - Appendix I: Columbia Gas Transmission written statements and project timeline.

¹³ See Exhibit 1, Staff Investigation Report – Appendix J: Columbia M&R employee written statements.

station were connected to the segment that was isolated. These control lines were not relocated as part of the work completed at Kitts Hill, and as a result they continued to sense pressure from the isolated segment of piping connecting the station to R-501.

The Columbia employees remained at the Kitts Hill station for approximately 90 minutes after the connection to the new source of supply was complete to monitor system pressure, and left the scene at approximately 12:30 P.M. The pressure regulators appeared to be operating normally, because the isolated pipeline segment connected to the control lines was not vented or depressurized so the control lines continued to sense an upstream pressure of approximately 550 psig. This situation continued as the residual gas pressure in the isolated line segment slowly decreased.

On Thursday October 1, 2020 at 1:46 A.M., Columbia received a high-pressure alarm from an electronic pressure recorder at the Kitts Hill regulator station. The pressure on the distribution system piping was approximately 143 psig. Pressure continued to rise and exceeded the 175 psig maximum allowable operating pressure (MAOP) of the distribution system by 1:58 A.M. Columbia responded to the high-pressure alarm and was able to start relieving pressure from the line at approximately 2:40 AM when pressure reached its maximum recorded value of 420 psig. Line pressure fell below the system MAOP of 175 psig at approximately 5:00 A.M.¹⁴

Once pressure was reduced, Columbia began performing a complete leak survey of the distribution system piping and reviewed the system for the presence of components that could have been damaged by the high pressure.¹⁵ Because the pressure on this system was typically around 120 psig, customers had a “step-down” regulator that reduced the pressure to a lower pressure at the service line, then another regulator at the house that further stepped the pressure down to a pressure typically used by house piping and household appliances. The investigation revealed that these service regulators were all able to protect customer piping from the over-pressurization event. After replacement of certain customer service regulator internal components and other pipeline components, gas service was restored to the majority of the 105 customers supplied by the system between October 9 and October 12, 2020.

III. Staff Investigation

When a gas-related incident or event such as Kitts Hill occurs, Staff investigates the event concurrently with the natural gas company. The purpose of the investigation is to determine the root cause of the event and to identify steps to be taken to prevent similar events from

¹⁴ See Exhibit 1, Staff Investigation Report – Appendix R: Columbia final update timeline.

¹⁵ See Exhibit 1, Staff Investigation Report – Appendix S: First cut regulator inventory; See also Exhibit 1, Staff Investigation Report – Appendix O: Components exceeding design pressure.

occurring in the future. In this case, Staff's focus was on Columbia's actions, policies, and procedures and how they contributed to the over-pressurization event.

Staff concludes that the over-pressurization event at Kitts Hill was caused by the pressure regulator control lines remaining connected to an isolated segment of piping supplying gas from R-501, instead of being relocated to sense pressure on the regulator stations new source of supply from R-601. This segment of pipeline was not vented or depressurized so the pressure regulators continued to sense adequate upstream pressure. The gas pressure in the isolated segment of piping slowly lowered over a period of approximately 15 hours due to gas seepage to the point where the lower pressure interfered with the operation of the pressure regulators and caused them to fail open, over-pressurizing the downstream piping.

Operators are required to have procedures in place for operations and maintenance activities as well as standards and specifications for construction activities. Columbia gas standard GS1680.010 "Tie-ins and Tapping Pressurized Pipelines"¹⁶ defines a "Tie-in Plan" as "a written document that includes requirements and steps for tie-ins and tapping of pressurized pipeline facilities,"¹⁷ which would apply the tie-in of the Kitts Hill regulator station to the temporary R-601 source of supply. This gas standard requires a written Tie-in Plan for the scope of work at Kitts Hill,¹⁸ which includes both an engineering design review and a field checklist.

Instructions for the Tie-in Plan include a requirement to address "Safety precautions to prevent abnormal operating conditions, such as the following: a. Identification and protection of control lines and tap locations."¹⁹ The written Tie-in Plan template provided in the document specifically mentions a requirement to "Trace all lines planned for abandonment to confirm appropriate action taken for any control lines or service lines" in the Planning section,²⁰ and a requirement in the Construction/Field Operations section to "Locate control lines at regulator stations identified by Engineering."²¹

A written Tie-in Plan was never prepared for the work at the Kitts Hill regulator station.²² Columbia's gas standard 1680.010 required a written Tie-in Plan for this work, and guidelines for writing a Tie-in Plan specifically address the identification and relocation of control lines. It is Staff's conclusion that if a written Tie-in Plan was prepared for this work in accordance with

¹⁶ See Exhibit 1, Staff Investigation Report – Appendix R.

¹⁷ See Exhibit 1, Staff Investigation Report – Appendix R at page 1.

¹⁸ See Exhibit 1, Staff Investigation Report – Appendix R at page 7.

¹⁹ See Exhibit 1, Staff Investigation Report – Appendix R at page 7.

²⁰ See Exhibit 1, Staff Investigation Report – Appendix R at page 23.

²¹ See Exhibit 1, Staff Investigation Report – Appendix R at page 26.

²² See Exhibit 2, Columbia Answer to PUCO data request 11-2-2020.

Columbia's procedures the need to relocate the station control lines would have been identified and addressed. Staff was unable to determine why a Tie-in Plan was not prepared.

A photograph of the Kitts Hill regulator station shows that the control lines in question were located above ground entirely within the regulator station building.²³ The Columbia employees performing the work were qualified by Columbia's Operator Qualification program to perform the work²⁴ and should have recognized that the control lines were not relocated along with the station source of supply. This failure to recognize a potentially hazardous condition and stop work was a contributing factor towards the over-pressurization event and potentially points to flaws in Columbia's Operator Qualification program.

Staff concludes that Columbia's initial response to the over-pressurization was appropriate, and the work performed to restore the distribution system at Kitts Hill was compliant with the requirements of the Pipeline Safety Regulations and adequate to ensure the safety of the system.

IV. Discussion of Violations

After reviewing the results of the investigation, Staff concludes that the following violations of the Pipeline Safety Regulations (49 C.F.R. 192) caused or contributed to the over-pressurization event that occurred at the Kitts Hill regulator station:

49 C.F.R. 192.13(c) *Each operator shall maintain, modify as appropriate, and follow the plans, procedures, and programs that it is required to establish under this part.*

Columbia did not follow its gas standard GS 1680.010 which required a written Tie-in Plan to be prepared. Section 4 of GS 1680.010 requires a written Tie-in Plan in the following instances:

4. WRITTEN TIE-IN PLAN

A Tie-in Plan shall be prepared for tie-in operations on the following types of work.

1. Designed capital mainline installations, replacement and/or abandonment work.
2. Designed capital installations, replacements and/or abandonments of measurement, regulation, or measurement and regulation (M&R) stations.
3. Emergency work, either capital or operations and maintenance (O&M), involving the replacement of mains, temporary bypass of a mainline or a mainline to be temporarily taken out of service. The Tie-in Plan for emergency work may be

²³ See Exhibit 1, Staff Investigation Report – Appendix B: Photo of regulator station inside piping.

²⁴ See Exhibit 1, Staff Investigation Report – Appendix U: Haaser OQ; See also Exhibit 1, Staff Investigation Report – Appendix Y: Harper OQ.

expedited and consolidate multiple elements such as the Advance and Execution Briefings (see Section 5.1 below). However, safety cannot be compromised.

4. Maintenance operations that require a temporary bypass of a mainline or require a mainline to be temporarily taken out of service.

The failure to create and follow a written Tie-in Plan caused pressure regulator control lines to remain connected to an isolated segment of piping instead of the station's actual source of supply.

49 C.F.R. 192.805 *Qualification program.*

Each operator shall have and follow a written qualification program. The program shall include provisions to:

- (a) Identify covered tasks;*
- (b) Ensure through evaluation that individuals performing covered tasks are qualified;*
- (c) Allow individuals who are not qualified pursuant to this subpart to perform a covered task if directed and observed by an individual that is qualified;*
- (d) Evaluate an individual if the operator has reason to believe that the individual's performance of a covered task contributed to an incident as defined in Part 191;*
- (e) Evaluate an individual if the operator has reason to believe that the individual is no longer qualified to perform a covered task;*
- (f) Communicate changes that affect covered tasks to individuals performing those covered tasks;*
- (g) Identify those covered tasks and the intervals at which evaluation of the individual's qualifications is needed;*
- (h) After December 16, 2004, provide training, as appropriate, to ensure that individuals performing covered tasks have the necessary knowledge and skills to perform the tasks in a manner that ensures the safe operation of pipeline facilities;*
and
- (i) After December 16, 2004, notify the Administrator or a state agency participating under 49 U.S.C. Chapter 601 if the operator significantly modifies the program after the administrator or state agency has verified that it complies with this section. Notifications to PHMSA may be submitted by electronic mail to InformationResourcesManager@dot.gov, or by mail to ATTN: Information Resources Manager, DOT/PHMSA/OPS, East Building, 2nd Floor, E22-31, New Jersey Avenue SE., Washington, DC 20590.*

The Pipeline Safety Regulations defines “Qualified” in 49 C.F.R. 192.803 as an individual who has “been evaluated and can: (a) Perform assigned covered tasks; and (b) Recognize and react to abnormal operating conditions,” and further defines an Abnormal Operating Condition as “a condition identified by the operator that may indicate a malfunction of a component or deviation from normal operations that may (a) Indicate a condition exceeding design limits; or (b) Result in a hazard(s) to persons, property, or the environment.” The control lines at the Kitts Hill regulator station were above ground, adjacent to the pressure regulators, and clearly visible. The Columbia employees performing the work should have recognized the control lines needed to be relocated along with the station source of supply.

V. History of Previous Violations

On September 13, 2018 at about 4:00 P.M. local time, a series of structure fires and explosions occurred after high pressure natural gas was released into a low-pressure natural gas distribution system supplying 10,894 customers in the northeast region of the Merrimack Valley in Massachusetts. This system was operated by Columbia Gas of Massachusetts, a subsidiary of NiSource, Inc. who also operates Columbia Gas of Ohio. One person was killed and 22 individuals, including three firefighters, were transported to local hospitals due to injuries; seven other firefighters incurred minor injuries. The fires and explosions damaged 131 structures, including at least 5 homes that were destroyed in the city of Lawrence and the towns of Andover and North Andover. Most of the damage occurred from fires ignited by natural gas-fueled appliances; several of the homes were destroyed by natural gas-fueled explosions.

This incident was investigated by the National Transportation Safety Board (NTSB), an independent Federal agency that investigates transportation accidents, determines the probable causes of the accidents, issues safety recommendations, studies transportation safety issues, and evaluates the safety effectiveness of government agencies involved in transportation. The NTSB issued a report of its findings on September 24, 2019²⁵ and summarized its conclusions as follows: “The National Transportation Safety Board determines that the probable cause of the over-pressurization of the natural gas distribution system and the resulting fires and explosions was Columbia Gas of Massachusetts’ weak engineering management that did not adequately plan, review, sequence, and oversee the construction project that led to the abandonment of a cast iron main without first relocating regulator sensing lines to the new polyethylene main. Contributing to the accident was a low-pressure natural gas distribution system designed and operated without adequate overpressure protection.”²⁶

²⁵ See Exhibit 3, NTSB Merrimack Valley Findings & Recommendations.

²⁶ See Exhibit 3, NTSB Merrimack Valley Findings & Recommendations at page vii.

The scale of the over-pressurization event at Kitts Hill is not the same as Merrimack Valley, and there are some other differences. Merrimack Valley was a low pressure system where the gas pressure in the distribution main is the same as that provided to the customer, whereas the Kitts Hill system is a high pressure system that had customer service regulators that ultimately protected the customers on the system from the effects of the over-pressurization. The control lines for the affected regulator station at Merrimack Valley were buried and their location was uncertain, whereas at Kitts Hill the control lines were above ground and their connection point was easily visible. The basic cause for these two events is the same however, pressure regulator control lines were left connected to abandoned segments of piping during a construction project instead of being relocated to sense pressure on appropriate new piping.

One of the recommendations issued to NiSource by the NTSB was to “Apply management of change process to all changes to adequately identify system threats that could result in a common mode failure.”²⁷ In response to this recommendation, NiSource developed its Gas Standard GS 1680.010 “Tie-ins and Tapping Pressurized Pipelines,” which was designed to prevent future over-pressurization events caused by inadvertently isolating or depressurizing control lines.²⁸ GS 1680.010 was supposed to have been followed at Kitts Hill but was not.

On May 9, 2019, a similar over-pressurization event occurred in Zanesville, Ohio which caused gas pressure in a low-pressure gas system to climb to approximately 4 psig and required a system shutdown resulting in a service outage to 562 customers. This over-pressurization event was caused by a Columbia employee performing maintenance work on a gas pressure regulator.²⁹ The employee closed a valve which isolated the pressure regulator control line from downstream piping during the work and failed to open the valve once work was completed. Pressure slowly seeped from the regulator control line resulting in the regulator reading lower downstream pressure and opening to allow more gas to pass through. This condition was fortunately detected and corrected by Columbia before any significant damage to customer appliances occurred. Staff issued a violation letter to Columbia³⁰ because of the incident. At the time, Columbia was in the process of implementing its corrective action plan in response to the Merrimack Valley incident and the NTSB recommendations, and as an additional corrective action agreed to modify applicable procedures so that construction and maintenance work on low pressure regulator systems would be performed by two or more qualified individuals.³¹

²⁷ See Exhibit 3, NTSB Merrimack Valley Findings & Recommendations at page 36.

²⁸ See Exhibit 3, NTSB Merrimack Valley Findings & Recommendations at page 36.

²⁹ See Exhibit 4, COH Zanesville MAOP excursion – Staff Investigation Report.

³⁰ See Exhibit 5, COH Zanesville – Notice of Probable Noncompliance.

³¹ See Exhibit 6, COH Zanesville – Columbia response to Staff Notice.

The history of previous violations shows that Columbia has shown a pattern of over-pressurization events caused by inadvertently isolating or depressurizing gas pressure regulator control lines, and that the corrective action plan implemented by Columbia was not followed by company employees in this instance.

VI. Conclusion and Recommendations

Columbia did not have or follow a written Tie-in Plan for the work performed at the Kitts Hill regulator station. The requirement for a written Tie-in Plan was developed by NiSource, parent company of Columbia, in response to a significant over-pressurization incident at Merrimack Valley and associated recommendations by the NTSB. Columbia's failure to successfully implement the corrective action recommended by the NTSB may lead to similar over-pressurization events in the future.

Based on the results of this investigation, Staff recommends Columbia perform the following actions:

- Columbia must conduct an internal investigation to determine why a written Tie-in Plan was not created or followed at Kitts Hill as required by Columbia's Gas Standard GS 1680.010 and report these findings to the Commission within 90 days of the Commission issuing a Finding and Order in this case.
- Columbia must conduct an internal audit of the effectiveness of the procedures in place to ensure construction plans are reviewed by all applicable departments for accuracy, completion, and correctness. This audit should include a GAP analysis of policies, programs, procedures, and practices used for planning new construction against API Recommended Practice 1173, "Pipeline Safety Management Systems," and report these findings to the Commission within 90 days of the Commission issuing a Finding and Order in this case.
- Columbia must review its Operator Qualification training programs to ensure individuals qualified to work on gas pressure regulators are able to recognize instances where control lines may be isolated or depressurized during construction.

Finally, given the severity of the violations, Staff recommends that a forfeiture of \$250,000 be assessed pursuant to R.C. 4905.95(B)(1)(b) against Columbia for failure to follow its own procedures put into place in response to a significant over-pressurization incident in Merrimack Valley. Future instances of over-pressurizing gas piping systems due to regulator failure during construction may pose a serious danger to the public.

Appendix – Exhibits

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Summary: Staff Report of Investigation electronically filed by Mr. Thomas E Stikeleather on behalf of PUCO Staff.