



The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

PIPELINE ENGINEERING AND SAFETY DIVISION

INCIDENT REPORT

Primary Valve Incident
Hildreth Street, Dracut, Massachusetts
April 16, 2009

PIPELINE ENGINEERING AND SAFETY DIVISION

Accident File

Primary Valve Incident

Location: Dracut, Massachusetts

Date of Accident: April 16, 2009

Gas Company: National Grid

Report Issued - April 14, 2011

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I. INTRODUCTION

A. Scope of the Investigation

The Massachusetts Department of Public Utilities (“Department”), Pipeline Engineering and Safety Division (“Division”), pursuant to G.L. c. 164, § 105A and a Federal Certification Agreement as provided for in 49 U.S.C. § 60105, has investigated a natural gas (“gas”) release at Hildreth Street, Dracut, on April 16, 2009 (“Incident”).¹ The release of gas resulted in two employees being hospitalized. The operator of the gas system is Boston Gas Company, Essex Gas Company, and Colonial Gas Company, each d/b/a National Grid (“National Grid” or “Operator”).

As part of the Department’s annual certification process by the United States Department of Transportation (“U.S. DOT”), the Department must report to the U.S. DOT

each accident or incident . . . involving a fatality, personal injury requiring hospitalization, or property damage or loss of more than an amount the Secretary establishes... and any other accident the [Department] considers significant, and a summary of the investigation by the [Department] of the cause and circumstances surrounding the accident or incident. 49 U.S.C. § 60105(c).

The purpose of this report is to inform the U.S. DOT as to the cause and circumstances surrounding the Incident.

¹ Incident means any of the following events:

- (1) An event that involves a release of gas from a pipeline or of liquefied natural gas or gas from an LNG Facility and
 - (i) A death, or personal injury necessitating in-patient hospitalization; or
 - (ii) Estimated property damage, including cost of gas lost, of the operator or others, or both, of \$50,000 or more.
- (2) An event that results in an emergency shutdown of an LNG facility.
- (3) An event that is significant, in the judgment of the operator, even though it did not meet the criteria of paragraphs (1) or (2). 49 C.F.R. Part 191, § 191.3.

The Department has established procedures for determining the nature and extent of violations of codes and regulations pertaining to safety of pipeline facilities and the transportation of gas, including but not limited to, 220 C.M.R. §§ 101.00 through 113.00. See 220 C.M.R. § 69.00 et seq. The Division also enforces the U.S. DOT safety standards for gas pipeline systems as set forth in 49 C.F.R. Part 192 ("Part 192"). G.L. c. 164, § 105A.

B. Overview of Incident

On April 16, 2009, at approximately 10:00 a.m., National Grid was performing scheduled maintenance on a four-inch primary valve at the intersection of Pleasant and Hildreth Streets, Dracut, Massachusetts (Exh. 1). This maintenance involved exposing the primary valve, and attempting to operate the valve by loosening the valve cover bolts (id.). During a prior inspection of the valve, the crew attempted to grease the valve and was unsuccessful (id.).

National Grid reported that the primary valve cover on its 60 pounds per square inch gauge ("PSIG")² distribution system blew off during this maintenance activity (Exh. 1). The incident caused injuries to two employees that required hospitalization and the evacuation of 100 -150 people from 11 buildings (Exh. 2). National Grid stated that it installed a new primary valve and returned service to customers at 9:45 p.m. (id.).

² PSIG refers to the pressure expressed in pounds exerted on one square inch of surface area. The designation "gauge," indicates the readings are already adjusted to ignore the surrounding atmospheric pressure, which is 14.7 psi at sea level. If psig gauge were not connected to any pressure source, it would read zero even though it is actually sensing 14.7 psi at sea level.

National Grid had previously visited the site and was unable to grease the valve (Exh. 1). The crew returned the day of the Incident to excavate the valve and operate the valve by loosening the valve cover bolts (id.). Upon inspection of the exposed valve, the crew discovered that the button head fitting was corroded (id.). The crew did not have a plug onsite to plug off the valve once the button head fitting was removed (id.). While waiting for the button head fitting to be delivered, they loosened the bolts (id.). Once loosened, the crew struck the valve with a three pound sledge hammer (id.). When the crew struck the valve, the cover blew off releasing uncontrolled gas into the atmosphere (id.).

At approximately 10:00 a.m., the Dracut Fire Department (“Dracut FD”) received a call from the police reporting a gas related incident (Exh. 3). The Dracut FD reported the Incident to National Grid and a company representative was onsite at 10:30 a.m. (id.). The Dracut FD evacuated all residents within a 500 foot radius of the incident (id.).

National Grid shut down the main at 12:36 p.m. (Exh. 4). The Operator replaced the valve and completed repairs by 6:47 p.m. (id.). At 9:45 p.m., the Operator restored mostly all accounts except for locations that National Grid could not gain access to (id.).

II. THE DIVISION'S INVESTIGATION

A. Background

Pleasant Street and Hildreth Street are located in a business and residential area of Dracut. In 1985, the Operator installed under Hildreth Street a four-inch coated steel gas main (Exh. 5). In 1999, the Operator installed a transition to a four-inch plastic main (id.). The maximum operating pressure of the main is 60 PSIG (id.). The operating pressure of the main was approximate 58 PSIG (Exh. 6). The four-inch Nordstrom, quarter turn plug valve manufactured in 1953 by the Flow Control Division of Rockwell International, and has a working pressure rating of 200 PSIG (Exh. 2). The valve consists of a steel body with an iron plug (id.).

B. Primary Valve Maintenance History

Part 192, § 192.747, requires operators to perform maintenance of its primary valves once each calendar year not to exceed 15 months. Over the last three years, the Operator inspected the four-inch primary valve involved in the Incident on August 18, 2006, January 4, 2007, and January 24, 2008 (Exhs. 7, 8). The valve was due to be inspected no later than April 24, 2009.

C. Routine Primary Valve Maintenance

On April 16, 2009, National Grid performed routine maintenance on its four-inch primary valve (Exh. 1). Routine maintenance requires the primary valve to be lubricated by injecting a sealant through a button head fitting located on the stem of the valve (id.). The sealant is injected under pressure by a hand or hyper gun supplied by the valve manufacturer

(id.). During sealant injection, the pressure gauge on the gun is used as a diagnostic tool. If there is no build up of pressure, that is an indication that the button head fitting is clogged or the residual sealant inside the valve is hardened (id.). The old button head fitting is replaced with a new fitting and the valve is injected with valve purging compound to purge out the residual sealant and debris (id.). It may take up to twenty four hours to work and dissolve blockage due to the hardened sealant. The valve is then injected with sealant and then operated (Exh. 1).

The manufacturer states that after lubricating the valve, it is still found to be inoperable, that is an indication of a seized plug in the bottom of the valve (Exh. 1). Under this condition, the manufacturer recommends that the cover bolt be loosened one eighth turn to release the seized plug (id.). If the valve remains inoperable then the manufacturer is to be consulted or the valve should be removed and isolated for maintenance (id.).

National Grid's employees performing the maintenance on the valve did not replace the button head fitting that they found to be corroded prior to loosening the bolts on the valve (Exh. 1). National Grid states that this was inconsistent with company procedures and manufacturer recommendations which require a series of steps to be taken prior to loosening the valve cover (id.).

D. Training

Gas company personnel must be qualified to perform valve maintenance activity. Part 192, § 192.805. The qualifying training is hands on, and reviews the use of, setup, and breakdown of the equipment simulated on live pipelines that are pressurized with air (Exh. 9).

The training provided to the employees also addressed the removal of valve covers (id.).

Employees are taught never to remove the bolts on a valve while the valve is under pressure (id.). The instructor also covers the key components of the valve inspection (id.).

In addition, personnel are required to take tests to ensure their knowledge of the task (Exh. 10). The two employees involved in the incident were both qualified in 2008 in the following tasks: Task 41 – Inspect and Operate Valves; Task 42 – Repair and Maintain Distribution Line Valves; and Task 43 – Lubricate Distribution Line Valves. The employees’ requalification date is in 2013 (id.). The qualification test only has one question that addresses the lubrication of a valve (id.). The question addressed what information is important when lubricating a valve (id.). The training did not address what actions to take when a valve is found to be inoperable, and the hazards associated with the repair.

E. Failure Analysis of Valve

Massachusetts Materials Research, Inc (“MMR”) conducted failure analysis of the four-inch plug valve involved in the incident on Hildreth Street, Dracut, and issued a report³ (“MMR Report”).⁴ The Operator provided MMR with the following items for testing, two bonnet bolts, a Sealweld Super Gun and associated grease and purging compounds. The fittings were provided because neither of the bolts nor the original rotten button fitting were

³ National Grid performed an examination of the valve, which included a leak test and disassembly of the valve, in its New York testing facility prior to the MMR testing (Exh. 1).

⁴ To obtain a copy of the MMR Report contact Veda-Anne Ulcickas, MMR, Inc. 1500 Century Drive, P.O. Box 810, West Boylston, MA 01583

recovered after the Incident. The purpose of the failure analysis is to document the condition of the evidence and to determine the cause of the Incident.

MMR conducted a visual examination, leak test, and microscope examination. Its analysis and testing found:

- The cleaned plug and valve body were lightly greased with a hand-applied film of fresh grease and reassembled for leak testing. The majority of the dried grease in the valve bottom well was left in-situ. The bolts and button fitting were re-inserted as before.
- The valve was plumbed to a nitrogen source, immersed in water and leak tested at 60 PSIG. The valve exhibited no leaks.

(MMR Report at 3).

Based on the analysis, MMR concluded the following:

The most likely reason for the failure of the valve to actuate in the field is the sticky grease plus purging compound residue in the grease channels of the body and plug, in addition to hardened dried grease in the well region at the bottom of the valve. Some minor scoring on the plug, if present prior to the incident, would have contributed slightly to elevated starting torque on this valve, but would not have been sufficient to prevent actuation by itself.

No debris was observed in the bonnet bolt hole threads that would indicate that the bolts present in the field stripped out of the holes. The condition of these threads indicates that it is more likely the incident bolts were unscrewed. Note that this observation and others made during the investigation would have been affected by the examination and testing activities of National Grid.

The results of the investigation indicated no flaws in the valve that would have prevented actuation if purging compound had been injected and allowed to work.

(id.).

III. FINDINGS AND CONCLUSIONS

A. Findings

1. A four-inch coated steel gas main, installed in 1985 that transitions to a four-inch plastic main, installed in 1999, underlies Hildreth Street.
2. The maximum operating pressure of the Hildreth Street main is 60 PSIG. The operating pressure of the main on the day of the incident was approximately 58 PSIG.
3. The Hildreth Street primary valve is a four-inch Nordstrom, quarter turn plug valve manufactured in 1953. The valve has a pressure rating of 200 PSIG. The valve consists of a steel body with an iron plug.
4. The Hildreth Street primary valve, was previously maintained on the following dates: August 18, 2006, January 4, 2007 and January 24, 2008.
5. On April 16, 2009, National Grid performed maintenance on a four-inch primary valve at the intersection of Pleasant and Hildreth Streets, Dracut, MA.
6. Prior to this maintenance activity on April 16, 2009, National Grid visited the site to perform the scheduled maintenance and was unable to grease the valve.
7. The crew excavated the primary valve and discovered that the grease stem was rotted. Prior to replacing the rotted grease stem, National Grid loosened the valve cover bolts and hit it with a three pound sledge hammer. The valve the cover blew off releasing uncontrolled gas into the atmosphere.
8. The incident caused injury to two National Grid employees, and the evacuation of 100 -150 people from 11 buildings.
9. On April 16, 2009, at approximately 10:00 a.m., the Dracut Fire Department received a call from the police reporting a gas related incident.
10. National Grid shutdown the main at 12:36 p.m. The valve was replaced and repairs were complete by 6:47 p.m. At 9:45 p.m., all accounts were restored except for the locations that they could not gain access to at that time.
11. Routine maintenance requires the primary valves to be lubricated by injecting a sealant through a button head fitting located on the stem of the valve. If the button head fitting is clogged, or the residual sealant inside the valve is hardened, the old

button head fitting must be replaced with a new fitting and the valve is injected with valve purging compound to purge out the residual sealant and debris.

12. The button head fitting on the four-inch primary valve was corroded.
13. National Grid did not replace the button head fitting prior to loosening the bolts on the valve.
14. National Grid installed a new primary valve and placed it into service at 9:45 p.m.
15. National Grid's employees received training for the maintenance of primary valves.
16. The training program states that the bolts on a valve should never be removed while the valve is under pressure.
17. National Grid's employees were qualified to inspect the primary valve involved in the incident.

B. Conclusions

The National Grid crew failed to follow manufacturer and company procedures, which required the crew to replace the corroded button head fitting and inject purging compound into the valve. The crew was to wait 24 hours after injecting purging compound into the valve and before operating the valve. The manufacturer only allows the bolts on the valve to be loosened after those steps have been followed. The crew's failure to follow company and manufacturer procedures resulted in the release of gas, and two National Grid employees being injured and sent to the hospital.

The analysis in the MMR Report was based upon substantial evidence and the report's conclusions are reasonable.

IV. NATIONAL GRID ACTIONS

On February 28, 2011, pursuant to G.L. c. 164, § 105A and 220 C.M.R. §§ 69.00 et seq., the Department concluded an enforcement action with National Grid. National Grid, D.P.U. 09-PL-12. National Grid agreed to: (1) stop the practice of loosening valve covers bolts to release seized plugs; (2) review its training and qualification procedures for its primary valves maintenance program; (3) introduce a valve recognition program; (4) utilize skilled personnel for valve maintenance; (5) ensure that all trucks carry proper button head fittings; (6) review maintenance procedures for sealant injection; (7) re-train personnel for sealant injection; (8) train crews to check for corrosion before proceeding to any maintenance; and (9) use DVD resources for valve maintenance.