The Commonwealth of Massachusetts

DEPARTMENT OF PUBLIC UTILITIES

D.P.U. 18-GLR-01 December 27, 2018

Report on the Prevalence of Natural Gas Leaks in the Natural Gas System to the Joint Committee on Telecommunications, Utilities, and Energy, and the Joint Committee on Public Safety and Homeland Security, pursuant to An Act Relative to Natural Gas Leaks, St. 2014, c. 149, § 9.

REPORT TO THE LEGISLATURE ON THE PREVALENCE OF NATURAL GAS LEAKS IN THE NATURAL GAS SYSTEM

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I. INTRODUCTION

Pursuant to An Act Relative to Natural Gas Leaks, St. 2014, c. 149, § 9 ("Section 9" of the "Act"), the Department of Public Utilities ("Department") submits an annual report addressing the prevalence of natural gas leaks in the natural gas system to the House and Senate Chairs of the Joint Committee on Telecommunications, Utilities and Energy, and the House and Senate chairs of the Joint Committee on Public Safety and Homeland Security annually, on or before December 31. Specifically, the report must include, but not be limited to, the following: (1) the total number of Grade 1, Grade 2, and Grade 3 leaks as classified in G.L. c. 164, § 144 and reported in the previous year; (2) estimates for lost and unaccounted-for natural gas ("LAUF") and methane emissions as a result of such Grade 1, Grade 2, and Grade 3 leaks; and (3) the time and cost estimates for eliminating the backlog of Grade 1, Grade 2, and Grade 3 leaks. St. 2014, c. 149, § 9. The Department is pleased to present this report to the Joint Committee on Telecommunications, Utilities and Energy and the Joint Committee on Public Safety and Homeland Security.

Natural gas leaks occur in the gas distribution system for a number of reasons, including the age of the infrastructure, corrosion, and damage from other underground construction projects, also referred to as encroachment.[1] A significant reason for the occurrence of natural gas leaks in Massachusetts is the presence of certain aging, leak-prone

[1] Encroached pipe includes cast-iron pipe, eight inches or less in diameter, that has been exposed and undermined by a trench crossing the pipeline or by an adjacent, parallel excavation. 220 CMR 113.06, 113.07.

infrastructure, including non-cathodically protected steel,[2] cast iron,[3] and wrought iron.[4] A 2014 study commissioned by the Department estimated that there were over 6,000 miles of aging infrastructure in Massachusetts comprising materials that are vulnerable to natural gas leakage. ICF International, Report on Lost and Unaccounted for Gas (December 23, 2014) [www.mass.gov/eea/docs/dpu/gas/icf-lauf-report.pdf]. The Department has recognized that there may be public safety, service reliability, and environmental issues associated with the continued existence and aging of leak-prone facilities in gas companies' distribution systems. New England Gas Company, D.P.U. 10-114, at 56 (2011); Bay State Gas Company, D.P.U. 09-30, at 133 (2009). The Department has also determined that a sustained replacement of aging infrastructure facilities is appropriate and desirable from a public policy

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[2] Cathodic protection is a technique to reduce the corrosion of a metal surface by making that surface work as the cathode of an electrochemical cell. NACE International SP0169-2007, at § 2, Standard Practice, "Control of External Corrosion on Underground or Submerged Metallic Piping Systems," reaffirmed March 15, 2007, available at, https://www.nace.org/uploadedFiles/Corrosion_Central/Industries/SP016907PHMSA.pdf (last visited September 6, 2018).

[3] Gray cast iron is a cast ferrous material in which a major part of the carbon content occurs as free carbon in the form of flakes interspersed through the metal. Because the carbon flakes do not bond with the ferrous material on the molecular level, the metal is brittle and susceptible to stress cracking under pressure situations. American Gas Association, Gas Piping Technology Committee.

[4] Together with cast iron, wrought iron pipelines are among the oldest energy pipelines constructed in the United States. The degrading nature of iron alloys, the age of the pipelines, and the pipe joint designs have greatly increased the risk involved with the continued use of such pipelines. Pipeline Replacement Updates, United States Department of Transportation, Pipeline & Hazardous Materials Safety Administration, http://opsweb.phmsa.dot.gov/pipeline_replacement/default.asp (last visited September 6, 2018).

perspective, given the potential benefits to public safety, service reliability, and the environment. Boston Gas Company/Colonial Gas Company/Essex Gas Company, D.P.U. 10-55, at 121 (2010); D.P.U. 10-114, at 56; D.P.U. 09-30, at 133-134.

As discussed below, pursuant to Section 9, the Department has gathered data from local gas distribution companies and municipal gas operators regarding the following: the number of Grade 1, Grade 2, and Grade 3 gas leaks on the Commonwealth's natural gas system as reported in 2017; estimates of LAUF and methane emissions; and estimated time and costs to eliminate identified Grade 1, Grade 2, and Grade 3 leaks. It is important to note that while this report provides the total number of Grade 1, Grade 2, and Grade 3 leaks identified during 2017, as required by Section 9, this data does not represent the number of ongoing, unrepaired leaks as of the date of this report. Rather, the actual number of natural gas leaks may change daily as gas distribution companies and municipal gas operators repair identified leaks,[5] and where, because of the nature of certain aging infrastructure as well as other causes of natural gas leaks, new leaks are identified and classified. The number of Grade 1, Grade 2, and Grade 3 gas leaks reported in 2017 is presented in Section II, below, and in Appendix A.

The Department and the gas industry are addressing the challenges posed by certain aging infrastructure in several ways. First, recognizing the public safety and environmental

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[5] Gas distribution companies are required to repair Grade 1 leaks, which present an existing or probable hazard, as immediately as possible and to take continuous action until conditions are no longer hazardous, and to repair Grade 2 leaks, which are non-hazardous but justify repair based on probable future hazard, within twelve months from the date of classification. G.L. c. 164, § 144(b)(2) & (3).

issues posed by natural gas leaks, the Department has taken proactive steps to address issues regarding the replacement or repair of leak-prone infrastructure. In the early 1990s, the Department promulgated regulations (220 CMR 113.00) prohibiting the installation of cast-iron pipe for the distribution of gas after April 12, 1991. Beginning in 2009, the Department began approving targeted infrastructure replacement factor programs ("TIRFs") for several gas distribution companies to accelerate the replacement of leak-prone infrastructure. Similarly, pursuant to G.L. c. 164, § 145 (added by St. 2014, c. 149, § 2), gas distribution companies may, in the interest of public safety and to reduce LAUF, submit to the Department accelerated infrastructure replacement plans to replace aging natural gas pipeline infrastructure. On October 31, 2014, seven of the Commonwealth's gas distribution companies submitted to the Department their first annual accelerated infrastructure replacement plans,[6] referred to as gas system enhancement plans ("GSEPs").[7] The Department approved the first GSEPs (for 2015) on April 30, 2015. The Department has since approved the seven gas distribution companies' 2016, 2017, and 2018 GSEPs, on or

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6 The seven gas distribution companies in Massachusetts are: The Berkshire Gas Company; Bay State Gas Company d/b/a Columbia Gas of Massachusetts; Liberty Utilities (New England Natural Gas Company) Corp. d/b/a Liberty Utilities; Boston Gas Company and Colonial Gas Company each d/b/a National Grid; NSTAR Gas Company d/b/a Eversource Energy; and Fitchburg Gas and Electric Light Company d/b/a Unitil.

7 Under the GSEPs, the seven gas distribution companies plan to replace a total of approximately 6,023 miles of aging infrastructure in Massachusetts over 20 years (beginning in 2015), with the exception that Colonial Gas Company intends to complete replacement of its aging infrastructure within eleven years, and NSTAR Gas Company and Boston Gas Company plan to complete their replacements within 25 years.

about April 30 of those years.[8] Because the intent of the pipeline replacement programs is to reduce the number of natural gas leaks in the natural gas system, as well as to reduce LAUF and methane emissions, we discuss the GSEPs in more detail in Section III, below.[9]

Further, G.L. c. 164, § 144 prescribes a timeline in which gas distribution companies must repair or monitor natural gas leaks depending on the hazard posed by the leak. The Department initiated a rulemaking proceeding, Investigation of the Department of Public Utilities, on its own motion, Instituting a Rulemaking Establishing Requirements for Uniform Natural Gas Leaks Classification, D.P.U. 16-31 (2016), to adopt these requirements. On August 8, 2016, Governor Baker signed into law An Act to Promote Energy Diversity ("Energy Diversity Act"). Section 13 of the Energy Diversity Act, requires the Department, in consultation with the Massachusetts Department of Environmental Protection ("DEP"), to open an investigation to establish specific criteria to identify Grade 3 gas leaks (classified pursuant to G.L. c. 164, § 144) that have significant environmental impact, and to establish a plan to repair leaks that are determined to have a significant environmental impact. St. 2016, c. 188, § 13. To incorporate the requirements of Section 13 of the Energy Diversity Act, the Department issued a straw proposal that proposes a plan for identifying and repairing or eliminating environmentally significant Grade 3 leaks. Following the receipt of comments on both the proposed gas leak regulations and the straw proposal, the Department instituted a

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8 The Department is currently reviewing the gas distribution companies' 2019 GSEPs and will issue final Orders on them no later than April 30, 2019.

9 Section III also provides information on the amount of leak-prone infrastructure within each gas distribution company's system.

rulemaking on the proposed revised regulations, with comments due November 7, 2017. D.P.U. 16-31-B (September 14, 2017). The Department held a public hearing on the matter on October 25, 2017, reviewed the comments received, and is in the process of issuing the final regulations. We discuss uniform gas leak classification requirements in more detail in Section IV, below.

For purposes of this report, the Department gathered data from each local gas distribution company and each municipal gas operator in the Commonwealth, as follows: The Berkshire Gas Company ("Berkshire"); Blackstone Gas Company ("Blackstone"); Bay State Gas Company d/b/a Columbia Gas of Massachusetts ("Bay State"); Liberty Utilities (New England Natural Gas Company) Corp. d/b/a Liberty Utilities ("Liberty Utilities"); Boston Gas Company and Colonial Gas Company d/b/a National Grid ("National Grid"); NSTAR Gas Company d/b/a Eversource Energy ("NSTAR"); Fitchburg Gas and Electric Light Company d/b/a Unitil ("Unitil"); Holyoke Gas & Electric Department ("Holyoke"), Middleborough Gas & Electric Department ("Middleborough"), Wakefield Municipal Gas and Light Department ("Wakefield"), and Westfield Gas & Electric Light Department ("Westfield"). The data included: (i) the total number of Grade 1, Grade 2, and Grade 3 leaks classified pursuant to G.L. c. 164 and reported in 2017;[10] (ii) estimates for methane

[10] In late 2016/early 2017, the Department's Pipeline Engineering and Safety Division directed the gas distribution companies to begin providing quarterly reports of gas leak information, including total numbers of leaks by grade. In addition, pursuant to G.L. c. 164, § 144 (added by St. 2014, c. 149, § 2), the gas companies are required to report in their annual service quality reports the location of each Grade 1, Grade 2, and Grade 3 leak existing as of the date of the report, the date each leak was

emissions and LAUF resulting from the Grade 1, Grade 2, and Grade 3 leaks; and (iii) the time and cost estimates for eliminating the backlog of Grade 1, Grade 2, and Grade 3 leaks that existed on each entities distribution system at the end of 2017.[11]

II. PREVALENCE OF NATURAL GAS LEAKS IN THE NATURAL GAS SYSTEM

A. Introduction

General Laws c. 164, § 144, requires the gas distribution companies to grade all reported natural gas leaks based on the hazard posed by the leak, and it prescribes a timeline for gas distribution companies and municipal gas operators to repair or monitor natural gas leaks depending on the hazard posed by the leak, as follows:

- A Grade 1 leak represents an existing or probable hazard to persons or property, and requires repair "as immediately as possible," continuous action until the conditions are no longer hazardous, and continuous surveillance until the hazard or source of the leak is eliminated. G.L. c. 164, § 144(b)(2).

- A Grade 2 leak is recognized as non-hazardous to persons or property at the time of detection, but justifies scheduled repair based on probable future hazard. This grade of leak must be repaired, or the main replaced, within twelve months from the date of classification, and must be re-evaluated at least once every six months until eliminated. G.L. c. 164, § 144(b)(3).

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classified, and the dates of repairs performed on each Grade 1, Grade 2, and Grade 3 leak.

[11] The Department issued information requests to the companies regarding estimates for LAUF, methane emissions, and time/costs to eliminate the backlogs. The companies' responses to those information requests are posted on the Department's website, http://web1.env.state.ma.us/DPU/FileRoom/dockets/bynumber (enter "18-GLR-01"). The Department also reviewed the LAUF estimates that each operator submitted in the Massachusetts addendum to its Form PHMSA F 7100.1-1, which each operator files annually with the Pipeline and Hazardous Materials Safety Administration ("PHMSA") of the U.S. Department of Transportation, pursuant to 40 CFR Part 191.

- A Grade 3 leak is recognized as non-hazardous to persons or property at the time of detection and can be reasonably expected to remain non-hazardous. This grade of leak must be re-evaluated during the next scheduled survey or within twelve months from the date last evaluated, whichever occurs first, until the leak is eliminated or the main replaced. G.L. c. 164, § 144(b)(4).

Section II.B, below, presents a summary of company/operator-specific gas leaks data, as follows: (1) Grade 1, Grade 2, and Grade 3 gas leaks in calendar year 2017 as reported to the Department; (2) estimates for LAUF and methane emissions; and (3) the time and cost estimates for eliminating the backlog of Grade 1, Grade 2, and Grade 3 leaks. Appendix A, attached to this report, sets forth the company/operator-specific information regarding gas leaks, LAUF, methane emissions, and time/cost estimates.

The Department notes three significant aspects of this report. First, the total number of natural gas leaks discussed below does not represent the number of ongoing, unrepaired leaks as of the date of this report. The number of gas leaks on the gas distribution system may fluctuate daily for a number of reasons, including the following: (1) gas distribution companies are required to repair Grade 1 leaks "as immediately as possible;" (2) gas distribution companies engage in ongoing repair of other Grade 2 and Grade 3 leaks; and (3) new Grade 1, Grade 2, and Grade 3 leaks generally occur as a result of encroachment or certain aging infrastructure. Accordingly, the data provided in this report should be viewed as a cumulative total of Grade 1, Grade 2, and Grade 3 leaks as reported in calendar year 2017, along with the associated cost estimates to fix the unrepaired leaks that existed on each reporting entity's gas distribution system as of the end of calendar year 2017. The report

also identifies the number of unrepaired leaks, by grade, existing as of the end of calendar year 2017.

Second, there is no standard industry approach for calculating LAUF or methane emissions by leak grade (i.e., LAUF or methane emissions associated only with Grade 1, Grade 2, or Grade 3 leaks that exclude other causes).[12] Therefore, the LAUF and methane values contained in this report are not broken down by leak grade. Further, the Department has determined that the LAUF value associated with leakage, as reported to the Department by each gas distribution company and municipal gas operator annually, is the appropriate measurement to include in this report.[13]

Third, all gas distribution companies and municipal operators report methane emissions in accordance with the Department of Environmental Protection's 310 CMR 7.71, Reporting of Greenhouse Gas Emissions, most recently amended in August 2017.[14] The gas distribution companies and municipal gas operators state that it is the most widely accepted method used by the natural gas industry to estimate methane emissions from natural gas

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12 Pursuant to Chapter 227 of the Acts of 2018, An Act to Advance Clean Energy, the Department is commencing a rulemaking to promulgate regulations requiring all gas companies to report LAUF annually to the Department in a uniform manner.

13 In some cases, the company/municipal operator did not break down LAUF by cause; thus, the reported LAUF may be attributable not only to leakage but also to such causes as third-party damage, meter error, or theft.

14 Where applicable, this regulation requires gas distribution companies and operators to estimate the average volume of methane emissions by applying the leak factors identified in the Greenhouse Gas regulations, 40 C.F.R. Part 98, subpart W, Table W-7, to various types of pipe material.

facilities and, therefore, all leakage on the natural gas system. See Gas Leaks Report, D.P.U. 15-GLR-01, at 10 (2015). Finally, to present the data in a consistent manner, the Department reports LAUF in million British Thermal Units ("MMBTU") and methane emissions in metric tons ("MT").

B. Gas Leaks on Gas Distribution Company and Municipal Gas Operator Distribution Systems

Collectively, the gas distribution companies and municipal operators reported a total of 34,369 leaks on the gas distribution system in 2017, broken down as follows: (1) 7,437 Grade 1 leaks; (2) 6,393 Grade 2 leaks; and (3) 20,539 Grade 3 leaks (see Appendix A). At the end of 2017, a total of 16,765 gas leaks remained on the gas distribution system, broken down as follows: (1) 30 Grade 1 leaks; (2) 1,148 Grade 2 leaks; and (3) 15,587 Grade 3 leaks. The gas distribution companies and municipal gas operators estimate that it will cost approximately $65,975,894 to repair the remaining backlog.[15] As calculated and described above, the gas distribution companies and municipal operators

[15] While there were 16,765 leaks remaining on the distribution system at the end of 2017, the companies/operators have already repaired or eliminated a portion of those leaks during 2018; thus, the repair costs may reflect only the backlog that existed at the time of the discovery responses. Further, NSTAR Gas provided cost information only on Grade 2 leak repairs, stating that Grade 3 leaks are not typically repaired because of the time and expense, but are eliminated through replacement (Exh. DPU-NSTAR 1-1). The time estimates, reported in various ways by each company, are contained in Appendix A.

estimate a total of 1,499,054 MMBTU of LAUF related to leakage, and a total of 55,293.95 MT of methane emissions in 2017.[16]

The data demonstrate that while the gas distribution companies and municipal gas operators reported numerous Grade 1, Grade 2, and Grade 3 leaks during calendar year 2017, gas distribution companies and municipal gas operators also continuously engaged in the ongoing repair of these leaks, specifically prioritizing Grade 1 leaks, but also repairing significant numbers of outstanding Grade 2 leaks as well as Grade 3 leaks. The vast majority of unrepaired leaks as of the end of calendar year 2017 are those specifically classified as non-hazardous. Additionally, except for Bay State and National Grid, all the gas distribution companies and municipal gas operators repaired their 2017 Grade 1 leaks by the end of 2017. Bay State and National Grid reported outstanding Grade 1 leaks at the end of 2017 but have since repaired them (Exhs. DPU-Bay State 1-1; DPU-National Grid 1-1). Accordingly, any Grade 1 leaks identified in this report have now been repaired.

As discussed above, a significant reason that Grade 1, Grade 2, and Grade 3 gas leaks continue to be identified and reported is that large portions of the gas distribution system comprise certain aging infrastructure. We turn now to a discussion of pipeline replacement programs that are designed to accelerate the repair or replacement of leak-prone pipe and will, accordingly, repair or eliminate many natural gas leaks.

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16 See Appendix A for company-specific information regarding gas leaks, LAUF, methane emissions, and time/cost estimates.

III. PIPELINE REPLACEMENT PROGRAMS

A. Introduction

The Department has recognized that there may be public safety, service reliability, and environmental issues associated with the continued existence and aging of leak-prone facilities in gas companies' distribution systems. New England Gas Company, D.P.U. 10-114, at 56 (2011); Bay State Gas Company, D.P.U. 09-30, at 133 (2009). The Department has concluded that a sustained replacement of leak-prone facilities is appropriate and desirable from a public policy perspective given the potential benefits to public safety, service reliability, and the environment. D.P.U. 10-114, at 56; Boston Gas Company/Colonial Gas Company/Essex Gas Company, D.P.U. 10-55, at 121 (2010); D.P.U. 09-30, at 133-134. In the early 1990s, the Department promulgated regulations (220 CMR 113.00) that prohibit the installation of cast iron pipe for gas distribution after April 12, 1991. These regulations required that each gas distribution company develop and implement cast iron replacement programs. The regulations also included a mandatory provision requiring gas distribution companies to immediately replace cast iron pipe that has been encroached upon.

Beginning in 2009, the Department approved TIRF programs by which gas distribution companies could accelerate the repair or replacement of certain types of aging infrastructure. Specifically, the Department approved Bay State's proposal to implement a TIRF program in 2009, National Grid's proposal to implement a TIRF program in 2010, and Liberty Utilities' proposal to implement a TIRF program in 2010. D.P.U. 10-55, at 122;

D.P.U. 09-30, at 134; D.P.U. 10-114, at 56, 76-77. The TIRF program allowed these companies to recover the revenue requirement (including depreciation, return on investment, and property taxes) on investments made to replace leak-prone mains, services, and other facilities through a reconciling mechanism outside of base rates. D.P.U. 10-55, at 137-138, 145; D.P.U. 10-114, at 35; Bay State Gas Company, D.P.U. 13-75, at 21 (2014). Through the TIRFs, National Grid, Bay State, and Liberty Utilities replaced significant amounts of leak-prone infrastructure.[17] The TIRF programs are being phased out as the gas distribution companies have transitioned to GSEPs for accelerated pipe replacement, and the TIRF dockets are used only to reconcile remaining pipe replacement costs.

As demonstrated by the TIRFs and now the GSEPs, and as discussed in greater detail below, Massachusetts has set a course to eliminate leak-prone infrastructure on an accelerated basis.

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[17] Specifically, between 2010 and 2013, Boston Gas eliminated 335 miles of cast iron and non-cathodically protected steel mains, along with 8,000 services, and Colonial Gas eliminated 154 miles of cast iron and non-cathodically protected steel mains, along with 969 services. Boston Gas Company/Colonial Gas Company, D.P.U. 14-132, at 10 n.14 (2015). Between 2010 and 2013, Bay State eliminated 177 miles of cast iron and non-cathodically protected steel mains, along with 10,079 services. Bay State Gas Company d/b/a Columbia Gas of Massachusetts, D.P.U. 14-134, at 9 n.13 (2015). Finally, between 2010 and 2013, Liberty Utilities eliminated approximately 25 miles of non-cathodically protected steel or cast iron/wrought iron mains, along with replacement of 1,994 services. Liberty Utilities (New England Natural Gas Company) Corp., D.P.U. 14-133, Exh. LU-1, at 4 (2015).

B. GSEPs

1. Overview

Pursuant to G.L. c. 164, § 145 (added by St. 2014, c. 149, § 2), each gas distribution company may annually submit a plan to accelerate the replacement of leak-prone infrastructure.[18] Any plan filed with the Department shall include, but not be limited to the following: (i) eligible infrastructure replacement of mains, services, meter sets and other ancillary facilities composed of non-cathodically protected steel, cast iron and wrought iron, which are prioritized to implement the federal gas distribution pipeline integrity management plan annually submitted to the Department and consistent with the requirements of 49 C.F.R. § 192.1001 through 192.1015; (ii) an anticipated timeline for the completion of each project; (iii) the estimated cost of each project; (iv) rate change requests; (v) a description of customer costs and benefits under the plan; and (vi) any other information the Department considers necessary to evaluate the plan. G.L. c. 164, § 145(c). Additionally, the Act required that the initial plan include a timeline for removing all leak-prone infrastructure on an accelerated basis specifying an annual replacement pace and program end date with a target end date of either (i) not more than 20 years or (ii) a reasonable target end date considering the allowable cost recovery cap established pursuant to subsection (f). G.L. c. 164, § 145(c).[19]

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[18] For those gas distribution companies operating under a TIRF, the GSEP replaced the TIRF for replacement of eligible infrastructure as of January 1, 2015.

[19] G.L. c. 164, § 145 further provides that annual changes in the revenue requirement eligible for recovery pursuant to the plan shall not exceed (i) 1.5 percent of the gas

If a plan complies with Section 145 and the Department determines that it reasonably accelerates eligible infrastructure replacement and provides benefits to customers, the Department must preliminarily accept the plan either in whole or in part. G.L. c. 164, § 145(e). The gas distribution company may begin recovering the estimated plan revenue requirement on May 1 of the year following submission of the plan. G.L. c. 164, § 145(e). Subsequently, on or before May 1 of each year, the gas distribution company must file final project documentation for construction completed the previous calendar year to demonstrate substantial compliance with the plan and to demonstrate that the costs were reasonably and prudently incurred. G.L. c. 164, § 145(f).

On October 31, 2014, the seven gas distribution companies noted above (Unitil, Berkshire, Liberty Utilities, National Grid,[20] Bay State, and NSTAR) submitted to the

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company's most recent calendar year total firm revenues, including gas revenues attributable to sales and transportation customers, or (ii) an amount determined by the Department that is greater than 1.5 percent of the gas company's most recent calendar year total firm revenues, including gas revenues attributable to sales and transportation customers. G.L. c. 164, § 145(f). The Department may modify a plan prior to approval at the request of a gas company, or it may make other modifications to a plan as a condition of approval. G.L. c. 164, § 145(d). The Department is required to consider the costs and benefits of the plan including, but not limited to, impacts on ratepayers, reductions of LAUF through a reduction in natural gas system leaks, and improvements to public safety. G.L. c. 164, § 145(d). The Department is also required to give priority to plans narrowly tailored to addressing leak prone infrastructure most immediately in need of replacement. G.L. c. 164, § 145(d).

[20] Boston Gas Company and Colonial Gas Company submitted a joint GSEP under one docket number.

Department their first annual GSEPs.[21] As part of its proposed GSEP, each company, among other things, (1) submitted a plan to repair or replace eligible leak-prone infrastructure during calendar year 2015, (2) estimated a revenue requirement associated with that replacement, and (3) provided a timeline to repair or replace all leak-prone infrastructure in its gas distribution system. On April 30, 2015, the Department approved each company's initial GSEP. The gas distribution companies have submitted their annual GSEPs on each October 31st thereafter, and the Department has approved them, subject to further review and investigation, for effect May 1st of the following year. The Department is currently reviewing the companies' fifth annual GSEPs.[22]

Additionally, on or about April 29, 2016, pursuant to G.L. c. 164, § 145(f), these same gas distribution companies submitted to the Department their first annual GSEP reconciliation filings ("GRECs"), wherein each company reconciled its actual investments with its planned investment for calendar year 2015. The Department approved the GRECs, in substantial part, on October 31, 2016. In the GRECs, the gas distribution companies reported that, through their 2015 GSEPs, they collectively spent $291.6 million dollars to

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21 Blackstone did not submit a GSEP because its gas distribution system contains no leak-prone infrastructure.

22 Additionally, pursuant to G.L. c. 164, § 145(c), each of these gas distribution companies has submitted a five-year update of its GSEP, which provides a summary of the progress that the company has made to date replacing leak-prone infrastructure, a summary of the work to be completed under its GSEP for the next five years, and a discussion of GSEP issues that the companies have identified as impacting the continued effectiveness of GSEPs. The Department is reviewing each company's five-year update within the company's open GSEP proceeding.

replace 221.24 miles of leak-prone mains and 11,119 leak-prone services throughout Massachusetts in calendar year 2015. See Fitchburg Gas and Electric Light Company, D.P.U. 16-GREC-01, at 10 (2016); Berkshire Gas Company, D.P.U. 16-GREC-02, at 10 (2016); Boston Gas Company and Colonial Gas Company, D.P.U. 16-GREC-03, at 16 (2016); Liberty Utilities (New England Natural Gas Company) Corp., D.P.U. 16-GREC-04, at 11 (2016); Bay State Gas Company, D.P.U. 16-GREC-05, at 18 (2016); NSTAR Gas Company, D.P.U. 16-GREC-06, at 17 (2016).

The same companies filed their second annual (2016) GRECs on or about May 1, 2017, wherein each company reconciled its actual investments with its planned investment for calendar year 2016. The Department approved these 2016 GRECs, in substantial part, on October 31, 2017. In the 2016 GRECs, the gas distribution companies reported that, through their 2016 GSEPs, they collectively spent approximately $356 million dollars to replace 250 miles of leak-prone mains and 16,804 leak-prone services, plus related work (e.g., meter replacements), throughout Massachusetts in 2016. See Fitchburg Gas and Electric Light Company, D.P.U. 17-GREC-01, at 11 (October 31, 2017); Berkshire Gas Company, D.P.U. 17-GREC-02, at 20 (October 31, 2017); Boston Gas Company and Colonial Gas Company, D.P.U. 17-GREC-03, at 18 (October 31, 2017); Liberty Utilities (New England Natural Gas Company) Corp., D.P.U. 17-GREC-04, at 16 (October 31, 2017); Bay State Gas Company, D.P.U. 17-GREC-05, at 23 (2016); NSTAR Gas Company, D.P.U. 17-GREC-06, at 22 (October 31, 2017).

These companies filed their third annual (2017) GRECs on or about May 1, 2018, wherein each company reconciled its actual investments with its planned investment for calendar year 2017.[23] In the 2017 GRECs, the gas distribution companies reported that they collectively spent approximately $416.7 million dollars to replace 280.3 miles of leak-prone mains and 18,708 leak-prone services, plus related work (e.g., meter replacements), throughout Massachusetts through their 2017 GSEPs. See Fitchburg Gas and Electric Light Company, D.P.U. 18-GREC-01 (October 31, 2018); Berkshire Gas Company, D.P.U. 18-GREC-02 (October 31, 2018); Boston Gas Company and Colonial Gas Company, D.P.U. 18-GREC-03 (October 31, 2018); Liberty Utilities (New England Natural Gas Company) Corp., D.P.U. 18-GREC-04 (October 31, 2018); Bay State Gas Company, D.P.U. 18-GREC-05 (October 31, 2018); NSTAR Gas Company, D.P.U. 18-GREC-06 (October 31, 2018).

Based on each gas distribution company's most recently approved GSEP, the following provides a current summary of the amount of leak-prone infrastructure on each company's system, the infrastructure that each company anticipates replacing during calendar year 2018, the revenue requirement associated with the 2018 GSEP, and the company's anticipated timeline to repair or replace all leak-prone infrastructure.

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[23] The Department approved these 2017 GRECs, in substantial part, on October 31, 2018.

2. Unitil

Unitil distributes natural gas to approximately 16,064 customers in six communities in Massachusetts. Fitchburg Gas and Electric Light Company, D.P.U. 17-GSEP-01, at 5 (April 30, 2018). Unitil owns and operates approximately 275 miles of distribution mains and 10,953 services. D.P.U. 17-GSEP-01, at 5. Unitil states that approximately 2.10 percent of its distribution system mains (5.78 miles) are composed of unprotected bare or coated steel, and approximately 19.55 percent of its distribution system (53.75 miles) is composed of cast or wrought iron, which means that approximately 21.65 percent of the distribution system mains (59.53 miles) are composed of leak-prone materials. D.P.U. 17-GSEP-01, at 5-6. Unitil states that these facilities account for approximately 63 percent of the hazardous (Grade 1) leaks occurring on Unitil's mains in a year. D.P.U. 17-GSEP-01, at 6.

Historically, since 2000, Unitil replaced a minimum of two miles of leak-prone pipe per year. D.P.U. 17-GSEP-01, at 6. Unitil's GSEP established a program to replace all eligible leak-prone infrastructure, including mains, services, meter sets, and other ancillary facilities, over a 20-year period, with an anticipated replacement rate of 3.5 miles per year. D.P.U. 17-GSEP-01, at 6. Under its approved GSEP, Unitil anticipates replacing 3.55 miles of leak-prone mains and 271 associated services in 2018. D.P.U. 17-GSEP-01, at 6.

3. Berkshire

Berkshire distributes natural gas to 40,000 customers in Berkshire county and portions of Hampshire and Franklin counties. The Berkshire Gas Company, D.P.U. 17-GSEP-02,

at 4 (April 30, 2018). Berkshire operates a network of approximately 764 miles of natural gas mains and over 32,049 active services. D.P.U. 17-GSEP-02, at 4. Berkshire states that about 14 percent of its system mileage consists of leak-prone mains and services comprising cast iron, bare steel, and non-cathodically protected coated steel pipe. D.P.U. 17-GSEP-02, at 4-5. Berkshire further states that these cast iron and unprotected steel facilities accounted for approximately 65 percent of all leaks that occurred on its system in 2016. D.P.U. 17-GSEP-02, at 5.

Historically, Berkshire has replaced these leak-prone mains at a rate of 3.4 to 4.4 miles per year. D.P.U. 17-GSEP-02, at 5. Berkshire anticipates replacing 109 miles of leak-prone cast iron and bare steel infrastructure on an accelerated basis through its GSEP over 20 years, beginning January 1, 2015, and ending December 31, 2034. D.P.U. 17-GSEP-02, at 5. Berkshire intends to retire approximately 5.5 miles of main each year of the GSEP, depending on a variety of factors and opportunities. D.P.U. 17-GSEP-02, at 5.

4. National Grid

In Massachusetts, National Grid distributes natural gas to approximately 908,000 customers in 116 cities and towns. Boston Gas Company and Colonial Gas Company, D.P.U. 17-GSEP-03, at 6 (April 30, 2017). National Grid owns and operates approximately 11,098 miles of distribution mains and over 746,000 services. D.P.U. 17-GSEP-03, at 6. For Boston Gas, National Grid states that approximately 16 percent of the distribution system mains are composed of non-cathodically protected steel

and 26 percent of the distribution system mains are composed of cast iron and wrought iron; thus, approximately 42 percent of the distribution system mains are composed of leak-prone pipe. D.P.U. 17-GSEP-03, at 6-7. For Colonial Gas, National Grid states that approximately three percent of the distribution system mains are composed of non-cathodically protected steel and two percent of the distribution system mains are composed of cast iron and wrought iron; thus, approximately five percent of the distribution system mains are composed of leak-prone pipe. D.P.U. 17-GSEP-03, at 7.

Between 2010 and 2014, Boston Gas replaced an average of 82.8 miles of leak-prone pipe per year, and Colonial Gas replaced an average of 40 miles of leak-prone pipe per year, pursuant to National Grid's TIRF program. D.P.U. 17-GSEP-03, at 7. Pursuant to the approved National Grid GSEP, Boston Gas anticipates replacing all eligible leak-prone facilities by 2039, and Colonial Gas anticipates replacing all eligible leak-prone facilities by 2025. D.P.U. 17-GSEP-03, at 7-8. Under the approved GSEP, Boston Gas anticipates replacing 105 miles of leak-prone mains and associated services in 2018, and Colonial Gas anticipates replacing 39 miles of leak-prone mains and associated services in 2018. D.P.U. 17-GSEP-03, at 8.

5. Liberty Utilities

Liberty Utilities distributes natural gas to approximately 55,440 customers in the Fall River, North Attleboro, Plainville, Swansea, Somerset, and Westport communities of Massachusetts. Liberty Utilities (New England Natural Gas Company) Corp., D.P.U. 17-GSEP-04, at 5 (April 30, 2018). Approximately 14.41 percent of Liberty

Utilities' distribution system is composed of non-cathodically protected steel and approximately 18.24 percent is composed of smaller diameter cast iron and wrought iron, which means that slightly less than one-third of the system (32.65 percent) is composed of relatively higher risk materials. D.P.U. 17-GSEP-04, at 5-6. Liberty Utilities states that when large diameter cast iron mains are included, approximately 33.4 percent of the distribution system qualifies as "leak prone" by industry standards. D.P.U. 17-GSEP-04, at 6. Approximately 32 percent of the services existing on the Liberty Utilities distribution system are composed of non-cathodically protected steel. D.P.U. 17-GSEP-04, at 6.

Under the GSEP, Liberty Utilities anticipates replacing over 210 miles of leak-prone or priority mains and approximately 11,706 leak-prone services on the Company's system over a 20-year period. D.P.U. 17-GSEP-04, at 6. Liberty Utilities anticipates replacing 14.5 miles of leak-prone mains and 700 leak-prone services in 2018. D.P.U. 17-GSEP-04, at 6.

6. Bay State

Bay State distributes natural gas to approximately 314,000 customers in 61 communities in three operating areas in Massachusetts: Brockton, Springfield, and Lawrence. Bay State Gas Company, D.P.U. 17-GSEP-05, at 5 (April 30, 2018). Bay State owns and operates 4,971 miles of distribution mains and 268,547 services. D.P.U. 17-GSEP-05, at 5. Bay State states that approximately 5.2 percent of Bay State's distribution system mains (260 miles) are composed of unprotected bare steel and approximately 10.1 percent (501 miles) are composed of cast iron or wrought iron, which

means that approximately 15.3 percent of the distribution system mains is composed of leak-prone materials. D.P.U. 17-GSEP-05, at 5-6.

Pursuant to its established GSEP, Bay State anticipates replacing an average of 50.89 miles per year of eligible aging infrastructure over a 20-year period, from 2015 through 2033. D.P.U. 17-GSEP-05, at 6. Bay State anticipates replacing 55 to 59 miles of leak-prone mains and 4,180 leak-prone services in 2018. D.P.U. 17-GSEP-05, at 6.

7. NSTAR

NSTAR distributes natural gas to approximately 300,000 customers in 51 communities in central and eastern Massachusetts. NSTAR Gas Company, D.P.U. 17-GSEP-06, at 6 (April 30, 2018). NSTAR owns and operates approximately 3,265 miles of distribution mains and 201,674 services. D.P.U. 17-GSEP-06, at 6. NSTAR states that approximately 21.1 percent of its distribution system mains (691 miles) is composed of non-cathodically protected steel and wrought iron, and approximately 10.7 percent of its distribution system (351 miles) is composed of cast iron or wrought iron, which means that approximately 31.8 percent of the distribution system mains (1,042 miles) are composed of leak-prone materials. D.P.U. 17-GSEP-06, at 6.

Historically, NSTAR replaced an average of 25 miles of leak-prone pipe per year. D.P.U. 17-GSEP-06, at 6. Pursuant to its established GSEP, NSTAR estimates that it will replace all eligible leak-prone infrastructure, including mains, services, meter sets and other ancillary facilities, over a 25-year period, with an anticipated replacement rate of 50 miles per year following an initial five-year ramp-up period. D.P.U. 17-GSEP-06, at 6. Under its

approved GSEP, NSTAR anticipates replacing 45 miles of leak-prone mains and 3,500 associated services in 2018. D.P.U. 17-GSEP-06, at 6.

IV. UNIFORM GAS LEAK CLASSIFICATION AND ENVIRONMENTALLY SIGNIFICANT GRADE 3 LEAKS

As discussed above, G.L. c. 164, § 144 provides for a uniform gas leak classification based on the hazard presented by a gas leak. Depending on the hazard presented, a leak will be classified either as a Grade 1, Grade 2, or Grade 3 leak. Based upon that classification, and as discussed above, G.L. c. 164, § 144 provides a timeline for repairing Grade 1 through Grade 3 gas leaks, and for Grade 2 and Grade 3 leaks (which are deemed nonhazardous), further outlines ongoing monitoring and re-evaluation requirements until the leak is fixed.

Additionally, G.L. c. 164, § 144(d) requires prioritizing repairs of gas leaks detected within a school zone, and G.L. c. 164, § 144(e) requires the gas distribution companies to report in their annual service quality reports the location of each Grade 1, Grade 2, and Grade 3 leak existing as of the date of the report, the date each leak was classified, and the dates of repairs performed on each Grade 1, Grade 2, and Grade 3 leak.

On May 18, 2016, the Department issued an Order instituting a rulemaking pursuant to G.L. c. 30A, § 2 and 220 CMR 2.00, establishing 220 CMR 114.00, Uniform Natural Gas Leaks Classification, for the purpose of adopting uniform natural gas leak classification requirements. The Department docketed this rulemaking proceeding as D.P.U. 16-31. On July 14, 2016, the Department held a public hearing to receive oral comments. The

Department accepted initial written comments through July 5, 2016, and reply comments through August 3, 2016.

Prior to the Department's finalizing the uniform gas leak classification rulemaking, Governor Baker signed into law the Energy Diversity Act, St. 2016, c. 188. Section 13 of the Energy Diversity Act required the Department, in consultation with DEP, to develop a straw proposal related to the identification and repair or elimination of Grade 3 leaks determined to have significant environmental impact. On December 14, 2016, the Department issued the associated Order and straw proposal, including revised draft regulations, in D.P.U. 16-31-A. Following receipt of comments on the straw proposal, the Department issued an Order, D.P.U. 16-31-B, instituting a formal rulemaking to adopt both the uniform gas leak classification requirements as well as requirements related to the identification and repair or elimination of environmentally significant Grade 3 gas leaks. The Department has reviewed the comments received and will issue a final order in the rulemaking addressing both uniform gas leak classifications and the identification and repair or elimination of environmentally significant Grade 3 leaks. The Department anticipates that adopting the final regulations will, among other things, result in a uniform gas leak classification system and an actionable plan by which the gas distribution companies and municipal gas operators identify and repair or eliminate environmentally significant Grade 3 gas leaks.

V. CONCLUSION

Pursuant to Section 9 of the Act, the Department has gathered data from gas distribution companies and municipal gas operators regarding the prevalence of natural gas leaks on the natural gas system. As indicated above, that data represent the total, cumulative leaks by grade during calendar year 2017, as well as system-wide LAUF and methane emissions. The data demonstrate that while the gas distribution companies and municipal gas operators identified numerous Grade 1, Grade 2, and Grade 3 leaks during calendar year 2017, the gas distribution companies and municipal gas operators have also continuously engaged in the ongoing repair of these leaks. More specifically, the gas distribution companies and municipal gas operators have specifically prioritized repair of Grade 1 leaks, which are defined as hazardous leaks, but have also repaired significant numbers of outstanding Grade 2 leaks as well as Grade 3 leaks, both of which are defined as nonhazardous leaks. With the exception of Bay State and National Grid, all Grade 1 leaks that existed on the gas distribution system during calendar year 2017 had been repaired by the end of 2017.[24]

As discussed above, a major reason that natural gas leaks occur on Massachusetts' natural gas distribution system is because significant portions of the system are composed of certain types of older infrastructure, including non-cathodically protected steel, cast iron pipe, and wrought iron pipe. The Department has historically recognized public safety and

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[24] As noted above, Bay State and National Grid have since repaired the Grade 1 leaks that existed on their gas distribution systems at the end of 2017 (Exhs. DPU-Bay State 1-1; DPU-National Grid 1-1).

environmental issues posed by natural gas leaks, and it is confident that those issues are being addressed in several ways, including through implementation of a cast iron replacement program and the accelerated replacement of aging infrastructure under the GSEPs submitted by seven of the eight gas distribution companies. The Department will continue to monitor the progress of the gas distribution companies in replacing aging infrastructure through review of the gas distribution companies' annual GSEP filings, which detail plans to repair or replace aging or leak-prone infrastructure the following calendar year, and through review of the companies' annual GREC filings, which detail the repair or replacement work performed in the previous calendar year. Finally, the Department anticipates that the adoption of regulations regarding uniform gas leak classification and the identification and repair or elimination of environmentally significant Grade 3 gas leaks will improve Massachusetts' natural gas distribution system by further reducing natural gas leaks as well as by reducing LAUF and methane emissions.

The Department thanks the Joint Committee on Telecommunications, Utilities and Energy and the Joint Committee on Public Safety and Homeland Security for the opportunity to present this report addressing gas leaks in the natural gas distribution system. As discussed above, the Department will continue to monitor and work with the gas distribution

companies to ensure that gas leaks are repaired in a timely and cost-efficient manner and to ensure continued public safety in the Commonwealth of Massachusetts.

By Order of the Department,

/s/
Angela M. O'Connor, Chairman

/s/
Robert E. Hayden, Commissioner

/s/
Cecile M. Fraser, Commissioner

VI. APPENDIX A: 2017 GAS LEAKS INFORMATION

	Leaks Carried Forward from CY2016	New Leaks Identified on System	Total Leaks on System (B+C)	Leaks Repaired or Eliminated (including reclassified leaks)	Leaks Pending At End of CY2017	LAUF (MMBTU)	Total Methane Emissions (MT)	Backlog Repair Cost Estimates	
								Time	Costs
The Berkshire Gas Company									
Grade 1	0	60	60	60	0				
Grade 2	69	166	235	174	62				
Grade 3	303	68	371	155	215				
Totals	372	294	666	389	277	35,511.0	549.00	5-6 months	$1,271,500
Blackstone Gas Company									
Grade 1	0	0	0	0	0				
Grade 2	0	2	2	4	0				
Grade 3	0	31	31	62	0				
Totals	0	33	33	66	0	240.1	4.70	n/a	n/a
Bay State Gas Company d/b/a Columbia Gas of Massachusetts									
Grade 1	0	1,384	1,384	1,378	6				
Grade 2	525	1,835	2,360	1,586	774				
Grade 3	2,263	543	2,806	1,089	1,717				
Totals	2,788	3,762	6,550	4,053	2,497	239,024.00	4,530.79	123,936 hours	$36,798,585
NSTAR Gas Company d/b/a Eversource Energy									
Grade 1	0	699	699	699	0				
Grade 2	24	662	686	652	34				
Grade 3	4,011	777	4,788	1,169	3,619				
Totals	4,035	2,138	6,173	2,520	3,653	220,518.0	4,427.09	12 months (Gr. 2 only)	$41,505 (Gr. 2 only)
Holyoke Gas & Electric Dept.									
Grade 1	0	49	49	44	0				
Grade 2	0	48	48	62	1				
Grade 3	207	159	366	138	218				
Totals	207	256	463	244	219	19,477.0	366.20	7774.5 hours	$763,215
Liberty Utilities (New England Natural Gas Company) Corp. d/b/a Liberty Utilities									
Grade 1	0	103	103	104	0				
Grade 2	52	153	205	171	49				
Grade 3	498	136	634	65	553				
Totals	550	392	942	340	602	54,284.0	27,895.00	14,448 hours	$1,511,020
Middleborough Gas & Electric Dept.									
Grade 1	0	6	6	6	0				
Grade 2	0	8	8	7	1				
Grade 3	0	2	2	2	0				
Totals	0	16	16	15	1	3,630.0	58.16	< 1 day	$2,982
Boston Gas Company and Colonial Gas Company, each d/b/a National Grid									
Grade 1	14	4,962	4,976	4,952	24				
Grade 2	182	2,465	2,647	3,223	175				
Grade 3	9,336	1,951	11,287	1,417	9,119				
Totals	9,532	9,378	18,910	9,592	9,318	917,990.0	17,350.00	10 years	$24,800,000
Fitchburg Gas and Electric Light Company d/b/a Unitil									
Grade 1	0	149	149	150	0				
Grade 2	10	82	92	95	0				
Grade 3	32	25	57	19	21				
Totals	42	256	298	264	21	1,376.0	31.20	30 days	$150,000
Wakefield Gas & Electric									
Grade 1	0	3	3	3	0				
Grade 2	60	15	75	28	47				
Grade 3	90	17	107	28	79				
Totals	150	35	185	59	126	4,349.0	81.81	940 hours	$350,253
Westfield Gas & Electric Dept.									
Grade 1	0	8	8	8	0				
Grade 2	4	31	35	30	5				
Grade 3	64	26	90	44	46				
Totals	68	65	133	82	51	2,065-2,655	54.17	304	$286,834
TOTALS									
Grade 1	**14**	**7,423**	**7,437**	**7,404**	**30**				
Grade 2	**926**	**5,467**	**6,393**	**6,032**	**1,148**				
Grade 3	**16,804**	**3,735**	**20,539**	**4,188**	**15,587**				
Totals	**17,744**	**16,625**	**34,369**	**17,624**	**16,765**	**1,499,054.1**	**55,293.95**		**$65,975,894**