Commonwealth of Massachusetts
Assessment of Pipeline Safety

Phase 1 Summary Report

Document type	Technical Report
Project name	Massachusetts Gas Pipeline Safety Assessment
Date	May 13, 2019
Document status	Final Report
Revision	0
Prepared for	Commonwealth of Massachusetts, Department of Public Utilities
Project number	19DPUWGAMY4
Prepared by	Dynamic Risk Assessment Systems, Inc.
Project number	SOMA_2018_01

Suite 1110, 333 – 11th Avenue SW
Calgary, Alberta, Canada
T2R 1L9
Phone: (403) 547-8638

www.dynamicrisk.net

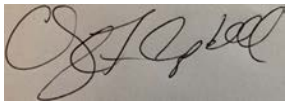
Waterway Plaza Two, Suite 250
10001 Woodloch Forest Drive
The Woodlands, TX 77380
Phone: (832) 482-0606

This document contains 54 pages.

Revision Log

Rev.	Date	Description of Revision
0	May 13, 2019	Final Report

Signatures

Prepared for	Company Name
Contributing author	Signature 
	Elizabeth Herdes, Contractor, Dynamic Risk
Contributing author	Signature 
	Cheryl Campbell, Contractor, Dynamic Risk
Contributing author and Approved by	Signature 
	Patrick Vieth Executive Vice President, Dynamic Risk

Document Control	
☐	No distribution without permission from Client.
☐	Unrestricted Distribution. No distribution without permission from Client and Dynamic Risk.
☒	Unrestricted Distribution.
☒	Copyrighted © Dynamic Risk 2019

Disclaimer

This report presents findings and recommendations based on technical services performed by Dynamic Risk Assessment Systems, Inc. ("Dynamic Risk"). The work presented herein has been performed according to the contributors and authors' knowledge and experience and in accordance with commonly accepted standards of practice. It is not, or does not, constitute a guaranty or warranty of any kind, either express or implied.

The analysis and conclusions provided in this report are for the sole use and benefit of the party contracting with Dynamic Risk to produce this report (the "Client"). No information or representations contained herein are for the use or benefit of any other party other than the Client.

The scope of use of the information presented herein is limited to the facts as presented and examined, as outlined in this document. No additional representations are made as to matters not specifically addressed within this report. Any additional facts or circumstances in existence but not described or considered within this report may change the analysis, outcomes and representations made in this report. Any use of or reliance on this document by any party other than the Client shall be at the sole risk of such party. In no event will Dynamic Risk, its directors, officers, shareholders, and employees, contractors or its subsidiaries' directors, officers, shareholders, and employees or contractors be liable to any other party regarding any of the findings and recommendations in this report, or for any use of, reliance on, accuracy, or adequacy of this report.

Executive Summary

Introduction

In November 2018, the Massachusetts Department of Public Utilities (DPU) selected and contracted with Dynamic Risk Assessment Systems, Inc. (Dynamic Risk) to conduct an independent statewide examination of the safety of the Commonwealth's natural gas distribution system (Assessment). The Commonwealth asked that this Assessment be a comprehensive and technical safety review resulting in recommendations for improvement.

This Phase 1 Summary Report presents a summary of the work performed in Phase 1 and provides initial observations and recommendations from Phase 1. This executive summary provides a high-level summary of the principle areas covered in the Phase 1 Summary Report including:

- Scope of this Assessment;
- The Panel;
- Guiding Principles;
- Phase 1;
- Context for Phase 1 Summary Report;
- Perspectives Considered in Phase 1;
- Initial Observations; and,
- Preliminary Recommendations.

Further detail on each topic is found in the body of the Phase 1 Summary Report.

Phase 2 is anticipated to continue the assessments from Phase 1 and build upon the information collected to date. Phase 2 will include field visits with each gas company to better understand their programs and practices. A Final Report will be produced at the end of this project and will encompass the work performed in both Phase 1 and Phase 2.

Scope of this Assessment

This Assessment, conducted in Phases 1 and 2, includes evaluating the physical integrity and safety of the Commonwealth's gas distribution systems operated by the seven investor-owned gas distribution companies and four municipal gas companies (collectively, the Gas Companies) and the operations and maintenance policies and practices of those Gas Companies. In the course of conducting this assessment, the Panel is evaluating the effectiveness of organizations, programs and processes being employed by the Gas Companies as well as elements of the safety culture. The Panel also offers observations regarding various organizations involved in pipeline safety within the Commonwealth, such as the DPU, the Attorney General's Office, and other Interested Parties.

The Panel

Dynamic Risk assembled an Independent Review Panel (the Panel) comprised of recognized experts with diverse professional experience required for the successful and timely execution of this project. This Panel and the project team, which is comprised of well-qualified technical experts, bring unique experience, expertise and perspectives to this project. Members (names and information) of the Panel and project team are set forth Appendix B.1.

Guiding Principles

The principles guiding the Panel in conducting this Assessment are independence, accuracy, and transparency. The Panel is committed to following the facts derived during the Phase 1 and Phase 2 work to develop its observations, findings and recommendations. Inherent in this approach is the Panel's neutrality relative to the desire of any particular group and to any specific outcome. The primary goal of the Panel in conducting this Assessment is to provide recommendations that, if implemented, will enhance the safety of the natural gas pipeline distribution systems in the Commonwealth.

Phase 1

Phase 1, which is the subject of this report, includes a program level assessment and evaluation of each Gas Company as well as an initial assessment of those programs' effectiveness. This was largely performed through initial meetings with the Gas Companies, interviews with the DPU personnel, review of documents produced by the DPU and the Gas Companies, listening sessions with Stakeholder Groups, and individual meetings with the Gas Companies. It also included a review of assessments and inspections performed by others, such as third-party audits by outside experts or insurance companies, and researching and analyzing laws, regulations, data, and other materials.

Based on the work in Phase 1, the Panel developed sufficient confidence in selected initial observations to create preliminary recommendations for the Commonwealth's consideration in this report (see Sections 7 and 8).

Context for Phase 1 Summary Report

This report provides initial observations and selected recommendations that are based upon information compiled and reviewed as part of Phase 1. The statements, observations and recommendations in this Phase 1 Summary Report:

- Are subject to change pending the results from Phase 2;
- Should be read in the full context of the report; and,
- Are generalized, especially those related to the Gas Companies. Specific assessments of individual Gas Companies are anticipated to be completed in Phase 2.

Perspectives Considered In Phase 1

The Panel relied upon the contributions of various parties that each brought a unique perspective to this Assessment. The parties that contributed to this Assessment, or that bring a perspective considered by the Panel, include the following:

- Project Technical Support Team. Dynamic Risk staff and contractors that have provided technical support and resources;
- DPU and EEA Project Managers. Executive Office of Energy and Environmental Affairs (EEA) and the Department of Public Utilities (DPU) provided Project Managers who provided oversight and are actively engaged to support the Panel and Project Team to meet the objectives;
- DPU personnel. Individuals from the DPU office supporting pipeline safety and rate cases who were interviewed by the Panel;
- Gas Companies. Leadership, staff and contractors from each of the 11 gas companies;
- Stakeholder Groups. The three Stakeholder Groups included the Elected Officials Group (see Appendix B.5.1), Community Representatives Group (see Appendix B.5.2), and the Industry Representatives Group (see Appendix B.5.3). These groups provided perspectives to the Panel through two listening sessions; and,
- Interested Parties. Individuals and organizations that can affect gas pipeline safety include State Legislators, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA), the Massachusetts DPU, Massachusetts Attorney General's (AG) Office's Ratepayer Advocate, Unions working at Gas Companies, Environmentalists, Ratepayers, and Municipal Governments.

The Panel formally recognizes and offers its appreciation for the candid participation of the Stakeholder Groups, Gas Companies, and individuals at the Massachusetts government agencies that contributed to this Assessment. The Panel considered input from each group throughout this assessment. However, the Panel is solely responsible for the assessments, observations, and preliminary recommendations set forth in this report.

Initial Observations

Based on the work completed in Phase 1, the Panel developed initial observations summarized into these categories:

- Natural gas pipeline infrastructure in Massachusetts;
- Gas Companies, in general;
- Interested Parties;
- Massachusetts Gas Safety Enhancement Program (GSEP);
- DPU;
- Role of the AG's Ratepayer Advocate; and,
- Other topics related to gas safety.

The specific observations in each of these categories and the discussion of each observation are set forth in Section 7 of the report.

Preliminary Recommendations

Preliminary recommendations arising from the Phase 1 work include the following:

1. Take steps to improve gas company emergency response plans, including:
    a. Develop and incorporate a common understanding of the Incident Command System (ICS), including communication protocols, common terminology, and accountabilities for each ICS function and role; and,
    b. Identify individuals and appropriate training protocols for each function and implement the training.
2. Conduct tabletop and field emergency response preparedness drills, including:
    a. Consult a third party to organize and grade the drills;
    b. Exercise unified command structure and mutual aid with Gas Companies, fire departments and government;
    c. Consider communication protocols and technology needs; and,
    d. Follow up with a lessons-learned session for all participants to develop next steps for continued improvement.
3. Establish programs and training for process safety hazard identification in the field, specifically for live gas work to:
    a. Change the mindset of personnel in the field regarding potential impacts of work;
    b. Encourage personnel to actively look for and identify hazards to the gas system before starting field work; and,
    c. Promote a continued focus on personal and public safety rather than compliance.
4. Review the Professional Engineer (PE) requirement and in the short term, enhance or supplement current guidance to add value and to reduce disruption in upcoming construction seasons;
5. Consider whether resources expended in Gas Safety Enhancement Program (GSEP) regulatory process provide good value for effort and cost and whether the process can be made more efficient;
6. Develop a collaborative approach to consider further accelerating pipeline replacement. This includes:
    a. Involving all stakeholders;
    b. Collaborating to address the primary barrier of the qualified workforce; and,
    c. Assessing risks of all potential changes to the pace of replacement.
7. Consider providing additional financial resources to enhance recruitment and retention of individuals with pipeline safety experience and expertise in government agencies, divisions, and/or departments;

8. Ensure that pipeline safety is a significant consideration across all relevant government agencies, divisions, and/or departments, including in the ratemaking process;
9. Further consider organizational goal conflicts and how best to resolve them. Identify accountability and responsibility within government agencies, divisions, and/or departments;
10. Consider extending the meter replacement program beyond seven years:
    a. Use moving meters outdoors in GSEP (where feasible) as an opportunity to re-evaluate costs and safety impacts;
    b. Recognize this is an opportunity to demonstrate the ability of Gas Companies and the Interested Parties to collaborate and solve an issue;
    c. Raise awareness of jurisdictional boundaries of the Gas Companies and responsibilities of customers; and,
    d. Address meter accuracy concerns and perceived indirect safety benefits separately. Evaluate the following:
        i. Meter accuracy for consumer protection, not safety; and,
        ii. Indirect safety benefits may include ad-hoc gas inspections inside residences and could be managed without removing meters.
11. Specifically consider gas pipelines and gas pipeline safety in the transition plan to achieve 80% reduction of greenhouse gases by 2050:
    a. Any transition plan should consider pipeline risk and societal impacts (public safety and pipeline safety);
    b. Varying priorities may adversely affect gas pipeline safety and gas supply reliability; and,
    c. Ensure that all policies and regulations fully consider gas pipeline safety and changes in risk.

Contents

Figures

Tables

Appendices

1 Introduction

In November 2018, the Massachusetts Department of Public Utilities (DPU) selected and contracted with Dynamic Risk Assessment Systems, Inc. (Dynamic Risk) to conduct an independent statewide examination of the safety of the Commonwealth's natural gas distribution system (Assessment)[1]. The Commonwealth asked that this Assessment be completed in two phases and represent a comprehensive and technical safety review resulting in recommendations for improvement.

This Phase 1 Summary Report presents a summary of the work performed in Phase 1 and provides initial observations and recommendations from Phase 1. Phase 2 is anticipated to continue the assessments from Phase 1 and build upon the information collected to date. Phase 2 will include field visits with each gas company to better understand the effectiveness of their programs and practices. A Final Report will be produced at the end of this project and will encompass the work performed in both Phase 1 and Phase 2.

[1] Through authority granted by Governor Baker under a State of Emergency declared on September 14, 2018, the DPU's Chair directed that the natural gas distribution companies operating in the Commonwealth cooperate with and pay for this Assessment.

2 Background

2.1 Scope of this Assessment

This Assessment, conducted in Phase 1 and Phase 2, will include evaluating the physical integrity and safety of the Commonwealth's gas distribution systems operated by the seven investor-owned gas distribution companies and four municipal gas companies (collectively, the Gas Companies)[2], and the operations and maintenance policies and practices of the Gas Companies[3].

While not limited to these, the six main focus areas for assessing the Gas Companies, as presented in Figure 1, include:

1. Pipeline safety management systems;
2. Risk management program;
3. Integrity management program;
4. Operations and maintenance (O&M) procedures;
5. Construction procedures; and,
6. Incident/crisis management.

Figure 1: Assessment Main Focus Areas

In conducting this Assessment, the Panel is also evaluating the effectiveness of organizations, programs and processes being employed by the Gas Companies, and elements of the safety culture. The Panel also offers observations regarding various organizations involved in pipeline safety within the Commonwealth, such as the DPU, the Attorney General's Office, and Interested Parties[4].

[2] Find a list of the 11 Gas Companies included in this Assessment in Appendix B.4.

[3] This Assessment will complement, but not duplicate, the investigation led by the National Transportation Safety Board, which is focused on the September 13, 2018 gas incident in Merrimack Valley region and its potential causes.

[4] The role of Stakeholders and Interested Parties is expanded upon in Sections 4 and 5 of this report.

In addition, the DPU provided a list of questions to be answered in the course of this Assessment. Of these questions:

- Four focused on the physical integrity of the gas distribution assets and inspections; and,
- Eight focused on the programs and processes used by the Gas Companies.

These questions will be answered by the completion of Phase 2.

In conducting this Assessment, the Panel will develop observations, which in turn, will enable the Panel to make final recommendations for action.

2.2 The Panel

Dynamic Risk assembled an Independent Review Panel (the Panel) comprised of recognized experts with diverse professional experience required for the successful and timely execution of this project. This Panel and the project team, which is comprised of well-qualified technical experts, bring unique experience, expertise and perspectives to this project. Members (names and information) of the Panel and project team are set forth Appendix B.1.

2.3 Phase 1 and Phase 2

To meet the milestones set by the Commonwealth, this Assessment is being conducted in two phases.

In Phase 1, which is the subject of this Phase 1 Summary Report, a program level assessment and evaluation of each Gas Company was undertaken. This was largely performed through initial meetings with the Gas Companies, interviews with the DPU personnel, initial document requests to the DPU and the Gas Companies, listening sessions with Stakeholders, and individual meetings with the Gas Companies for extensive discussions.

Phase 1 work also included a review of assessments and inspections of the Gas Companies performed by others, such as third-party audits by outside experts or insurance companies, and researching and analyzing laws, regulations, data, and other materials.

Based on the work in Phase 1, the Panel developed sufficient confidence in selected initial observations to create preliminary recommendations for the Commonwealth's consideration. The initial observations and recommendations are contained in Section 7 and Section 8 of this report.

In Phase 2, the Panel will continue to build on the work performed in Phase 1 and use the Phase 1 work to prioritize upcoming field assessments. The field assessments of the Gas Companies will include field personnel interviews, work and construction assessments, and meetings at company locations to help evaluate elements of the work being performed by the Gas Companies in the field. This evaluation includes assessing elements of the company's safety culture in offices and the field, the application of the company's processes and procedures by those in the field, and the level of commitment to personnel and public safety. Phase 2 will also continue the evaluation of those organizations involved in pipeline safety within the Commonwealth and further develop the preliminary recommendations formulated in Phase 1.

At the end of Phase 2, the Panel will produce a Final Report that will include observations, findings and recommendations for action. The results of the Phase 2 evaluation also will include Gas-Company-specific observations.

2.4 The Panel's Guiding Principles

The principles guiding the Panel in conducting this Assessment are independence, accuracy, and transparency. The Panel is committed to following the facts derived during the Phase 1 and Phase 2 work to develop its observations, findings and recommendations. Inherent in this approach is the Panel's neutrality relative to the desire of any particular group and/or any specific outcome. The primary goal of the Panel in conducting this Assessment is to provide recommendations that, if implemented, will enhance the safety of the natural gas pipeline distribution systems in the Commonwealth.

2.5 Context for Phase 1 Summary Report

This report provides initial observations and selected recommendations that are based upon information compiled and reviewed as part of Phase 1. The statements, observations and recommendations in this Phase 1 report:

- Are subject to change pending the results from Phase 2;
- Should be read in the full context of the report; and,
- Are generalized, especially those related to the Gas Companies. The Panel expects to complete specific assessments of individual Gas Companies during Phase 2.

3 Work Performed in Phase 1

In November 2018, the Panel commenced this Assessment. A critical part of this initial phase was the development of the appropriate Guidelines for Engagement with the DPU, Gas Companies and with the Stakeholder Groups. These guidelines help facilitate the process, provide transparency and help ensure the independence of the Panel during this Assessment. The guidelines, which set out the Panel's expectations and proposed boundaries, including the handling of potentially sensitive information, as between the Panel and each of these groups, and between each of the groups, were discussed with the relevant parties and subsequently provided to them.

Among other topics, the Guidelines stated that discussions held as part of this Assessment would be conducted under Chatham House Rules. These are rules of engagement in which participants in a meeting, including Panel members, are free to use the information received, but neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed. Chatham House Rules are often used in settings in which candid and open discussion by participants is required. Moreover, while Chatham House Rules allow information provided in any presentation or discussion to be shared with others outside the group, the Panel also encouraged all participants to exercise discretion in sharing the information learned during this Assessment to preserve the integrity of this Assessment and ensure that information and results are provided in full context.

Other work completed in 2018 included:

- Interviewing select personnel at the DPU;
- Developing and issuing an information request to the DPU;
- Leading videoconferencing calls with executives and teams from each of the 11 Gas Companies to initiate the project, make introductions, discuss proposed Guidelines, and establish dates on which the Gas Companies would meet in person with the Panel for a discussion, and for a presentation by the Gas Companies to the Panel;
- Developing an information request to the Gas Companies for documents in these 17 categories of interest:
    1. Organizational structure;
    2. Leadership;
    3. System overviews;
    4. Asset management;
    5. Plans and procedures for distribution integrity management;
    6. Pipeline risk management;
    7. Pipeline Safety Management System plans, if any;
    8. Emergency Response (ER) plans;
    9. Construction processes;
    10. O&M manuals;
    11. Information on leak history;
    12. Reportable incidents;

13. Dig Safe;
14. Enforcement actions by the DPU;
15. Audit reports (internal and external);
16. Rate case history; and,
17. Work force demographics and records.

- Developing the Assessment Work Plan for Phase 1 to set out timelines and plans for conducting Phase 1; and,
- Providing the Gas Companies with the *Information Request*, *Guidelines for Engagement*, and the *Work Plan*.

In early January 2019, the DPU and each of the Gas Companies uploaded documents responsive to the information requests each had received in December. Collectively these responses totaled tens of thousands of pages. The Panel began the review and assessment of these documents in Phase 1. Review of these documents will continue into Phase 2.

In addition, work completed in January 2019 included:

- Establishing the members of each Stakeholder Group and sharing the Guidelines with participants;
- Participating in the first listening session with each Stakeholder Group;
- Developing a detailed list of topics for discussion at meetings with each individual Gas Company and providing those topics to each Gas Company the week before their scheduled presentation; and,
- Meeting with several individual Gas Companies. Meetings began at 8 a.m., included a lunch break, and typically ended at 4 p.m. Several companies elected to meet for an additional half day.

In February, March and April 2019, work that was performed included:

- Completing the meetings between the Panel and remaining individual Gas Companies;
- Reviewing PHMSA incident and asset data for the United States (US), the Northeast[5], and Massachusetts;
- Continuing review and analysis of materials produced in response to information requests and other relevant information;
- Participating in the second listening sessions with each of the three Stakeholder Groups on March 11 and 12, 2019. Stakeholders were invited to attend this listening session in person. Some Stakeholders participated via videoconferencing; and,
- Provided an oral presentation to the DPU and EEA on March 14, 2019 to discuss work to date and next steps to produce a Phase 1 summary report.
- Held discussions with DPU and EEA on producing the Phase 1 report.

[5] For the purposes of this Assessment, the following nine states are considered to be in the Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont.

4 Stakeholder Groups Participating in this Assessment

In addition to the technical aspects of this Assessment, the DPU and the Panel recognized the need to conduct this Assessment with transparency and stakeholder engagement to help build and enhance public trust and confidence in the work product(s) produced by this Assessment. Accordingly, three Assessment Stakeholder Groups were established:

1. Elected Officials (see Appendix B.5.1)

   This group comprises elected and appointed officials, including Massachusetts legislative leadership, Merrimack Valley officials, and town mayors.

2. Community Representatives (see Appendix B.5.2)

   This group comprises utility union representatives, interested members from the general public, the Massachusetts Attorney General's office, the State Fire Marshall, and/or other individuals with subject matter expertise.

3. Industry Representatives (see Appendix B.5.3)

   This group comprises select executives from natural gas companies across the US, key pipeline industry associations and/or experts working in complex operations in other industries such as nuclear power and commercial aviation.

Each of the Stakeholder Groups is comprised of individuals with a stake in the outcome of this Assessment. Appendix B.5 lists the names and titles of individuals who graciously shared their time and energy towards improving the pipeline safety in the Commonwealth of Massachusetts.

The role of each Stakeholder Group member was to participate fully in listening sessions and specifically to:

- Provide input, ideas and considerations as the Panel progresses through this Assessment;
- Ensure the Panel discusses and includes relevant issues in this Assessment; and,
- Respect boundaries regarding sharing information about the Stakeholder Groups, participants and discussions.

To this end, a separate listening session was held in mid-January and early March 2019 with each of the three groups. Topics of interest and concern raised by the stakeholders related to the scope of this Assessment included:

- Individual Gas Companies:
  - Physical characteristics of the natural gas distribution system.

    This included concerns about the age of the assets, sources of gas leaks, the timing and extent of replacement of leak prone pipes in the Gas Safety Enhancement Program (GSEP), and the use, or lack of use, of current technology.

  - Personnel and training.

    This included concerns about staffing levels, adequate training, system knowledge transfer, use of contractors versus employees, impacts of multi-national organizations, and impacts of former employees working as regulators.

- Procedures and programs.

  This included the adequacy of specific procedures, such as operating and maintenance procedures, and whether following procedures is sufficient to achieve pipeline safety, and the role of management of change[6] in procedures and other contexts.

- Performance and execution of O&M activities. This included:
  - Compliance with regulations;
  - Success of repairs;
  - Construction mistakes;
  - The need for increased company inspections;
  - The need for additional quality assurance programs across the operational spectrum;
  - The role of requirements regarding permits;
  - Safe and effective execution of projects; and,
  - The role of industry best practices.
- Risk management practices (i.e., understanding and managing risk in gas systems). This included:
  - If Gas Companies know their systems sufficiently to identify and mitigate risks;
  - Understanding the most significant risks faced by natural gas distribution companies within the industry and in the Northeast;
  - Understanding the risks of excavation damage and the role of statutory exemptions in increasing risk; and,
  - Understanding the need to assess the state of in-place Gas Company records, processes, and efforts to improve recordkeeping each time Gas Company work uncovers a pipe.

- Role of the Regulator in pipeline safety and the effect of regulation on the Gas Companies. This included:
  - The effectiveness of DPU inspections;
  - If current MA requirements are the most effective use of resources to achieve safer operations;
  - Compliance with rate case settlements;
  - Impacts of self-reporting on penalties;
  - The rate-making process;

[6] The term "Management of Change" describes a leading practice used to ensure that safety, health, and environmental risks and hazards are properly controlled when an organization makes a change to their facilities, operations, or personnel. It involves a number of steps including planning and communications before the change is made, actively monitoring, managing and implementing the change (including training), and then reviewing the effectiveness of the change to continually improve the process of managing the change.

  - The need to find the balance between affordability and the benefit of Gas Companies being able to make plans for investments in their gas pipeline systems; and,
  - The impact of focusing on compliance.
- Preparedness of the Gas Companies and the Commonwealth for emergency response. This included:
  - The level of preparedness to respond to a serious gas emergency;
  - The knowledge and appropriate levels of participation in an Incident Command Structure;
  - Knowledge of assets and communities;
  - Communication protocols;
  - Preparation for a broad spectrum of possible events;
  - Appropriate levels of investment in preparedness; and,
  - Appropriate uses of technology.
- Reliability of gas supply and resiliency of citizens to widespread gas outages without notice; and,
- Desire for the results of this Assessment to provide basis for sound policy decisions.

Stakeholder concerns also included:

- The specific goals and methods of this Assessment; and,
- The manner in which the Panel would be reporting its recommendations to the DPU and the expectation that this Assessment will help legislators and citizens understand the current status of pipeline safety within the Commonwealth, including how to better assess risk and safety, and to provide a path forward to improve it.

The Panel formally recognizes and thanks each participant in each Stakeholder Group. Each participant dedicated time thoughtfully and provided valuable input to the Panel. The Panel found their full and candid participation during the listening sessions most helpful.

While active engagement of Stakeholder Groups was a critical element during Phase 1 of this Assessment and will continue to be essential throughout this process, the Panel is solely responsible for the assessments, observations, and preliminary recommendations set forth in this report.

5 Interested Parties

Several entities, groups of people and organizations play a fundamental role in natural gas pipeline safety within the Commonwealth. For the purposes of this Assessment, the Panel refers to these entities and groups as Interested Parties. Many, but not all, of the Interested Parties are participating in aspects of this Assessment as members of the Stakeholder Groups or otherwise. Each of the Interested Parties may have many different roles and responsibilities.

For clarity and purposes of discussion within this Assessment, the following is a brief description of the Interested Parties, and their key organizational goals or objectives that impact natural gas pipeline safety within the Commonwealth:

- State Legislators

  Enact legislation and otherwise make or influence public policy.

- MA Executive Office of Energy and Environmental Affairs (EEA)

  Responsible for overseeing energy and environmental policies for the Commonwealth.

- Department of Environmental Protection (DEP)

  Promote laws and policies to protect the environment and reduce greenhouse gas emissions, among other responsibilities[7].

- MA's Department of Public Utilities (DPU)

  Enforce pipeline safety regulations and provide oversight of Gas Companies, among other responsibilities[8].

- U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA)

  Provide federal oversight and enforcement of federal pipeline safety laws, issue advisory bulletins, collect annual report and incident data, and establish new regulations. As permitted under federal law, PHMSA has delegated its oversight and enforcement of federal pipeline safety laws related to intrastate pipelines like those operated by the Gas Companies to the MA DPU;

- Attorney General's (AG) Office, Ratepayer Advocate

  Intervene in Gas Company matters, including rate case matters before the DPU; scrutinize Gas Company budgets and operating proposals to keep rates as low and as steady as possible[9].

[7] The Department of Public Utilities and the Department of Environmental Protection are just two of the many departments and divisions that EEA oversees. For more information on the breadth of activity undertaken and overseen by the EEA, see the listing of organizations and divisions listed on the EEA's website. https://www.mass.gov/topics/executive-office-of-energy-and-environmental-affairs

[8] The Department of Public Utilities (DPU) is an adjudicatory agency led by a three-member Commission. The Pipeline Safety Division is just one division of many in the DPU. Among its roles and responsibilities, the DPU "oversees investor-owned electric power, natural gas, and water companies in Massachusetts. The DPU regulates the safety of passenger-for-hire bus companies, provides oversight of moving companies, tow companies, and transportation network companies. In addition, the DPU is charged with developing alternatives to traditional regulation, monitoring service quality, regulating safety in public transportation and gas pipelines, and the siting of energy facilities." DPU 2017 Annual Report, page 6.

- Utility Unions

  Promote fair and equitable treatment of members, and safety and safe work environments for members.

- Environmentalists

  Advocates, including concerned citizen groups, with a mission to reduce fossil fuel use and transition away from hydrocarbons. Advocates for lower greenhouse gas emissions by eliminating gas leaks, among other measures.

- Gas Companies

  Provide safe and reliable natural gas service to homes and businesses based on public policy and demand, and within financial recovery parameters allowed by the Commonwealth.

- Customers

  Desire safe, reliable and affordable natural gas to cook food, heat homes and run businesses.

- Municipal Governments

  Establish local permitting and requirements for pipeline safety work activities.

[9] Massachusetts law requires an office of ratepayer advocacy within the office of the attorney general. The law permits the office of ratepayer advocacy to intervene, appear and participate in state or federal administrative, regulatory, or judicial proceedings on behalf of any group of consumers in connection with any matter "involving rates, charges, prices and tariffs" of a variety of entities including gas companies. MA General Laws, Part 1, Title 2, Chapter 12, Section 11E.

6 Pipeline Safety Basics

Gas Companies are accountable for safely operating their natural gas distribution systems to reliably deliver natural gas to customers. They operate, however, in a complex setting in which there may be many competing internal and external goals that can distract from the requisite focus on pipeline safety, and the necessary commitment to continually learn and improve. As discussed in this report, in addition to the Gas Companies each of the Interested Parties plays a role in gas pipeline safety. Each can improve pipeline safety.

6.1 Enhancing Pipeline Safety Culture

Enhancing pipeline safety requires leadership. It also requires the discipline by all involved parties to remain focused on pipeline safety despite many workplace distractions and competing priorities. Pipeline safety requires each person involved – both inside and outside Gas Companies – to be aware of the role their own priorities play and the impact of those priorities and choices in, and on, increasing or decreasing risks related to the safe and reliable delivery of natural gas to homes and business. At its heart, developing and maintaining a strong pipeline safety culture requires all involved to have a shared focus on a single goal: enhancing pipeline safety through continuous improvement.

In addition, enhancing pipeline safety requires people to be informed about the complex operations of pipeline systems and how managing risk enhances pipeline safety. To this end, Section 6.2 provides background about baseline requirements for pipeline safety. The Panel recognizes that, for some readers, this topic may already be well known.

6.2 Identifying and Managing Threats to Pipeline Safety[10]

Safely operating a natural gas pipeline system is a complex endeavor. It requires Gas Companies to know their systems and actively take steps to identify and reduce or eliminate threats to safe product delivery. Pipeline integrity management (integrity), which is the conventional, primary method for accomplishing this goal, requires Gas Companies to identify and manage potential threats to pipeline integrity and reduce risks on pipeline systems. Integrity management considers:

- Physical assets, such as leak prone pipe;
- Other risks, such as weather, dig-ins, and terrorism;
- Threat-based analysis and mitigation efforts; and,
- The distinct threats and risks that different assets face.

[10] The word “threats” as used herein is a term specific to pipeline integrity management. It means those characteristics or actions that if left unmitigated could potentially represent a threat to the structural integrity of the pipeline and reduce its ability to contain the product being transported.

Based on a well-established and recognized engineering standard, the pipeline industry categorizes threats to the structural integrity of pipelines like this:

- Time-Dependent:
  - External corrosion;
  - Internal corrosion; and,
  - Stress corrosion cracking.
- Resident:
  - Manufacturing-related defects (manufacturing flaws or defects in the pipe or other materials);
  - Welding/fabrication related defects (pipe fusion; coupling failures, faulty T-joints); and,
  - Equipment malfunction (control/pressure relief equipment malfunction).
- Time-Independent:
  - Third party/mechanical damage;
  - Incorrect operations; and,
  - Weather-related and outside forces (e.g., frost heave).

These threats are managed and mitigated by Gas Companies to prevent failures.

7 Initial Observations

Based on the work completed in Phase 1, the Panel developed initial observations, preliminary recommendations, and areas for additional inquiry in Phase 2. The initial observations are summarized into these categories:

- Natural gas pipeline infrastructure in Massachusetts;
- Gas Companies, in general;
- Interested Parties;
- Massachusetts Gas Safety Enhancement Program (GSEP);
- Department of Public Utilities (DPU);
- Role of the Massachusetts Attorney General's Office (AG's) Ratepayer Advocate; and,
- Other topics related to gas safety.

These initial observations for each category are described in Sections 7.1 through Section 7.7.

7.1 Initial Observations about Massachusetts Gas Distribution Assets

As part of the process of understanding the nature of the natural gas distribution pipeline assets located in Massachusetts, the Panel undertook a review of data collected by PHMSA from individual gas company annual reports. As background, Gas Companies are required to report certain information to PHMSA each year. This information, submitted in the form of an Annual Report, provides detailed information related to the gas pipeline infrastructure for each Gas Company. These Annual Reports offer details related to the 1.3 million miles of mains and the 68.6 million services that operate across the country[11]. A summary of the mains and services by each state in the northeast US is provided in Table 1 and Table 2, respectively. These mains and services are also summarized for each of the gas companies operating in Massachusetts (see Table 3).

For the purposes of this Assessment, the Panel adopted the definition of *leak prone pipe* as it is generally used in the MA Gas Safety Improvement Program (GSEP). The pipe, which has the characteristic of being more likely to develop a gas leak, includes cast iron or wrought iron pipe and unprotected steel pipe.

7.1.1 Massachusetts has a higher proportion of leak prone pipe when compared to its share of total pipeline miles.

Based on the most recent PHMSA database information in 2017, Massachusetts has a higher proportionate share of leak prone pipe in both gas mains and gas services when compared to its overall share of gas distribution pipe in the US with similar characteristics. As a summary, the approximate breakdown by type of pipe is as follows:

1. Mains:

- MA has 1.7% of the total miles of mains in the US
  - 21,669 miles of 1.30 million miles (approx.).
- MA has 12.4% of the cast iron mains in the US
  - 3,049 miles of 24,493 miles.

[11] Distribution gas systems are comprised of mains which generally distribute gas into a given area whereas the gas service line delivers gas from the main to home or business.

- MA has 4.1% of the steel (unprotected) mains in the US
  - 2,251 miles of 54,887 miles.

2. Services:

- MA has 1.9% of the services in the US
  - 1.3 million of 68.6 million services, (approx.).
- MA has 18% of the cast iron services in the US
  - 1,397 of 7,652 services.
- MA has 6.4% of the steel (unprotected) services in the US
  - 200,000 of 3.1 million services, (approx.).

This summary of the mains and services shows that MA has a greater proportion of leak prone pipe (cast iron and unprotected steel services and mains) when compared to other states across the US.

7.1.2 Northeast US has a higher proportion of leak prone pipe when compared to its share of total pipeline miles.

There is a higher proportion of leak prone pipe in the Northeast[12] when compared to its share of total main miles of gas distribution pipe in the US. Based on the PHMSA database information from 2017, the Northeast has over 60% of all cast-iron main pipe in the nation, even though it has only 13% of the total main pipe miles in the US. The following provides numbers for the total leak prone gas mains in the Northeast:

- 13% of total main mileage (170,000 in the Northeast of 1.30 million US miles, approx.);
- 63% of cast iron main mileage (15,000 miles in the Northeast of 25,000 US miles, approx.); and,
- 34% of steel (unprotected bare) main mileage (19,000 miles in the Northeast of 55,000 miles, approx.).

Table 1 puts these numbers into context.

Of the total pipeline miles within Massachusetts, approximately 24% of mains were characterized as leak prone as of 2017 (cast iron or steel), and about 15% of services were leak prone as of 2017 (cast iron or steel). The percentages presented in parentheses in Table 1 and Table 2 identify percentages within each state.

[12] The States considered to be in the Northeast include are those represented by the Northeast Gas Association (NGA). NGA represents natural gas distribution companies, transmission companies, liquefied natural gas importers, and associate member companies. These companies provide natural gas to over 12 million customers in nine states (Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island and Vermont). NGA was established on January 1, 2003. Its predecessor organizations were The New England Gas Association (founded in 1926) and the New York Gas Group (founded in 1973). (https://www.northeastgas.org/about_intro.php).

Table 1: PHMSA Data of Mains in Northeast (2017)

State	Miles Main (% Total Main)		
	Total Main	**Cast Iron**	**Steel (Unprotected)**
NY	49,126	3,420 (7%)	6,522 (13%)
PA	48,346	2,661 (6%)	7,681 (16%)
NJ	34,961	4,143 (12%)	1,688 (5%)
MA	21,669	3,049 (14%)	2,251 (10%)
CT	8,109	1,251 (15%)	188 (2%)
RI	3,205	730 (23%)	395 (12%)
NH	1,968	86 (4%)	22 (1%)
ME	1,239	39 (3%)	13 (1%)
VT	848	---	---
NE Total	**169,472**	**15,378 (9%)**	**18,760 (11%)**
US	1,296,215	24,493	54,847
NE % of US	13% of US	63% of US	34% of US
MA % of US	2% of US	12% of US	4% of US

Table 2: PHMSA Data of Services in Northeast (2017)

State	Count of Services (% Total Services)		
	Total Services	**Cast Iron**	**Steel (Unprotected)**
NY	3,241,702	4,449 (0.1%)	369,316 (11%)
PA	2,879,281	73 (0%)	309,229 (11%)
NJ	2,389,910	---	163,642 (7%)
MA	1,336,678	1,397 (0.1%)	199,010 (15%)
CT	450,680	22 (0%)	52,023 (12%)
RI	196,505	129 (0.1%)	42,969 (22%)
NH	93,963	16 (0%)	6,473 (7%)
ME	36,511	26 (0%)	205 (1%)
VT	39,818	---	---
NE Total	**10,665,048**	**6,112**	**1,142,867**
US	68,636,596	7,652	3,095,829
NE % of US	16% of US	80% of US	37% of US
MA % of US	1.9% of US	18.3% of US	6.4% of US

Table 3: PHMSA Data of Mains and Services for Massachusetts Gas Companies (2017)

Doc ID Prefix	PHMSA ID	Total Main			Total Services		
		Total Main	Cast Iron	Steel (Unp)	Total Services	Cast Iron	Steel (Unp)
Investor-Owned Local Distribution Companies (7)							
CGM	1209	4,985	471	218	271,552	-	37,002
BER	1344	761	58	34	32,155	1	2,915
BLA	1504	55	-	-	1,440	-	-
EVE	2652	3,280	335	666	203,472	8	31,285
LIB	31770	619	110	83	36,687	-	10,840
NGC		-	-	-	-	-	-
BOS	1640	6,367	1,768	1,087	506,905	1,368	98,873
ESS	4547	866	73	18	52,100	4	4,296
COL	11856	1,397	90	66	77,525	-	4,761
CAP	2066	2,475	0	48	117,390	15	3,317
UNI	5200	274	49	5	11,046	-	2,316
Municipal Gas Companies (4)							
HOL	7330	186	53	-	7,949	-	1,275
MID	12444	106	7	1	4,750	-	196
WAK	22035	87	1	24	5,000	-	930
WES	22511	209	34	-	8,707	1	1,004
TOTAL		**21,666**	**3,049**	**2,251**	**1,336,678**	**1,397**	**199,010**

7.1.3 History and pace of replacement are factors in MA and the Northeast having higher proportionate share of leak prone pipe.

Massachusetts and the Northeast were settled earlier than other parts of the US. Cast iron, and then unprotected bare steel pipe, were the materials of choice at the time of installation.

While the natural gas distribution systems in Massachusetts are generally reliable, it is recognized that leak prone pipe should be replaced for safety, reliability, and environmental reasons. PHMSA first identified the need to remove cast iron pipe from natural gas distribution systems in an alert bulletin issued in October 1991 and again in June 1992[13]. This was based on the national data which supported a higher risk of failure for cast iron pipe in distribution systems. As part of its efforts to track the current status of cast iron and bare steel pipes across the country, PHMSA reports that by the end of 2017, approximately 97% of natural gas distribution pipelines in the US were made of plastic or steel. Twenty-one states, plus one territory (Puerto Rico) no longer have any cast-iron mains in their distribution systems[14].

[13] See, PHMSA Alert Notices ALN– 91–02 dated October 11, 1991 and ALN–92– 02 dated June 26, 1992.

[14] See PHMSA website, Pipeline Replacement Update at: https://opsweb.phmsa.dot.gov/pipeline_replacement/
The states and territories include: AK, AZ, , CO, HI, IA, ID, MT, NM, NC, ND, NV, OK, OR, PR, SC, SD, UT, VT, WA, WI, WY.

In 2009, the Commonwealth established a program allowing Gas Companies to recover costs related to replacement of leak prone pipe, which likely increased the pace of replacement to some degree. As discussed in more detail below, the State legislature sought to accelerate the pace of replacement when it enacted new law introducing the Gas Safety Enhancement Program (GSEP) in 2014 under which investor-owned Gas Companies began accelerating their pace of replacing leak prone pipe in 2015. This resulted in investor-owned Gas Companies generally adopting a plan to replace the remaining leak prone pipe over the next 20 years.

7.2 Initial Observations about Gas Companies, in General

Based on the Phase 1 process, and with the caveat that additional work is required in Phase 2, the Panel provides initial observations that are generally applicable to the Gas Companies. These initial observations address the Gas Companies' participation in this Assessment, their focus on regulatory compliance, examples of best practices among the Gas Companies, the benefits of improving emergency response capabilities, opportunities for improving operating and maintenance procedures, the status of Dig Safe enforcement, and other opportunities for improvement.

7.2.1 Gas Companies were responsive and fully engaged with the Panel and this Assessment process.

The Panel found the Gas Companies welcomed this Assessment and were responsive to requests for calls, meetings, and document production. Discussions were extensive and candid. Every company attended with members of their senior leadership team, and an array of management and experts to answer questions from the Panel.

7.2.2 Gas Companies are generally focused on regulatory compliance.

Federal and state regulations set the minimum standards for pipeline safety. The Panel found several trends in Phase 1 suggesting that the focus among many Gas Companies was on achieving these compliance obligations. In general, Gas Company plans that appeared to be focused on meeting compliance obligations included distribution integrity management plans, operation and maintenance procedures, public awareness plans, and emergency response plans.

While these examples do not apply to all of the Gas Companies, Phase 1 indicated a focus on compliance may not address all of the threats to pipeline integrity and the resulting possible consequences of loss of containment. Other initial observations include:

- Risk management efforts, especially as set forth in gas company Distribution Integrity Management Plan, are focused primarily on leak-prone pipe rather than all potential threats; and,
- Consideration for the identification of low probability, high impact events is minimal.

In each of these instances, there are opportunities to move beyond compliance, which can help to improve gas pipeline safety and reliability of natural gas supply.

7.2.3 The Panel found many examples of Gas Companies using leading industry practices.

In Phase 1, the Panel found some Gas Companies were using some approaches the Panel considers leading practices within the industry. Leading practices are typically unique to each Gas Company. The following lists examples of some of the observed industry leading practices:

- Conduct leak surveys more frequently than required by regulation[15];
- Repair Grade 2 leaks faster than required by regulation based on potential consequences;
- Ensure company inspector to construction crew ratios of 1:1 or 1:2;
- Adopt several innovative approaches to address workforce availability and knowledge transfer concerns (e.g. two-year shadow; cadet program with college scholarships and work programs);
- Upgrade LNG facilities to prepare for peak shaving and potential supply shortage;
- Integrate records into a Geographical Information System (GIS) that is easily accessible and can be updated with new information while in the field; and,
- Assign emergency response roles when hiring personnel and then conducting emergency response training as part of initial on-boarding process for new employees.

These best practices, when applied to address certain risk for a Gas Company, can help to improve gas pipeline safety and reliability of natural gas supply.

7.2.4 Emergency response improvements would strengthen the response to a level 3 (or greater) gas emergency.

The Panel found that all Gas Companies had opportunities to improve preparedness to respond to a Level 3 or greater gas emergency. These opportunities relate to the emergency response (ER) plans including both table top and field mock emergency drills, and communication protocols and technology choices. The ER plans, which were generally compliant with regulatory requirements, provided insufficient detail and guidance to be fully useful in the midst of an emergency. Plans would benefit from:

- Reviewing thoroughly to ensure focus is on an effective, coordinated response with outside agencies when warranted versus a focus on compliance with regulations;
- Adopting more consistently the Incident Command Structure (ICS) and the adoption of common terminology, functions/position titles, accountabilities, and incident typing;
- Naming specific individuals, capabilities and functions, and providing contact information for those individuals;
- Recognizing outside responders and the necessary coordination that will be required with outside agencies, such as local police or fire departments;

[15] The purpose of a gas leak survey is to inspect portions of gas systems to determine if a leak is occurring. Gas leak surveys can be accomplished through various means of manpower and technology. In general, PHMSA and state regulations require gas leak surveys be conducted on a specified interval based on the location being within or outside of a business district as well as some types of pipe materials. An example is that operators are required to conduct a gas leak survey inside a business district once every calendar year, but not to exceed once every 15 months. Increasing the leak survey frequency reduces risk for certain pipe types and conditions. For example, leak surveying an area with cast iron pipe after frost in and after frost out (fall and spring) identifies leaks that might have occurred due to ground movement caused by frost heave.

- Reviewing outside resources that may be useful in an incident, particularly for municipal Gas Companies that may be able to draw on city/township resources; and,
- Adding and meeting new training requirements of emergency response and ICS training for all named participants.

More specifically, Gas Companies would benefit from actively participating in more mock emergency desktop and field exercises, and drills. Most of the Gas Companies have not practiced drills – neither desktop drills or in the field drills – and those that have practiced could, at least to some extent, benefit from additional drills. To be ready to respond to an emergency, organizations must practice and drill until the response becomes second nature. This should include all departments and individuals who have accountabilities in the emergency response plan. There is much work to be done in the journey of continuous improvement on this front.

In addition, communication protocols and use of technology can be improved. Almost all of the Gas Companies:

- Can improve their emergency communication practices and protocols with customers, elected officials, and the media; and,
- Are overly dependent on cell phones to manage critical emergency response communications, with few backup plans should cell coverage become unavailable.

The Panel notes that those Gas Companies that are part of an organization that also operate electric companies have had more exposure to practicing emergency response drills by virtue of the number of storms that cause electric outages. There are, however, some significant factual differences between an electric power outage emergency and a gas emergency. These include:

- Electric outages usually occur after a few days' notice of a storm warning, which allows time to prepare and stage resources for a faster response time. Gas emergencies generally occur with no such advanced warning or planning opportunity;
- Electric infrastructure enables electric grid operators to determine the parameters of the outage based on meters that are no longer active. Gas infrastructure has no similar feature to determine who is with or without gas. Instead, a Gas Company representative must visit each house and business to determine who has gas service and who does not. After the scope of the outage is known, a plan can be created to restore service;
- When an electric outage occurs, it fails in a "safe mode" – that is, the public is generally not at risk from being electrocuted in an outage situation (with the exception of live downed electric wires). In a gas emergency, the public may be at risk during a gas outage because gas may be actively leaking into homes and businesses. This creates an urgency for gas leak detection, and the need to focus efforts and resources on first evacuating people and on making the area safe for others to enter; and,
- Restoring electrical power usually does not require entry into customer's homes. Gas outages require entry into customers' homes when meters are located inside, and regardless of meter location, a second visit is needed to turn the gas back on and perform relights in many cases.

Thus, even Gas Companies that manage electric power may not have the required experience and practice to respond appropriately to gas emergencies.

7.2.5 Developing Process Safety Hazard Processes

The Panel found developing and rigorously adopting a process safety hazard identification process, which is beyond regulatory compliance, could enhance safe work execution. While promoting process hazard identification across an entire organization should occur over the long term, putting the priority on focused training with field personnel performing live gas work in the short term would be advantageous to enhancing pipeline safety in the Commonwealth.

The development of a robust process safety hazard identification process would require all personnel at all job sites to stop before beginning work to assess the situation for hazards. This focus on recognizing hazards and perceiving safety risks are fundamental steps to effective safety management. It helps focus the mind of the person(s) who are about to perform the task to the specifics of the task at hand. It moves the mind away from potential distractions to the potential hazards and barriers to those hazards. When hazards remain unrecognized or the associated safety risk remains unperceived by the worker, the likelihood of human error increases.

A process safety hazard identification process prompts the practitioner to observe and analyze their surroundings. This can be done by asking: *what is the worst thing that could happen? What are the barriers of protection? If it happens, what actions will I take to mitigate the situation? What are the barriers of protection and how do I engage them?*

Developing and implementing a robust process safety hazard identification process for field activities involving live gas work is likely the most direct and impactful change to help to improve gas pipeline safety.

7.2.6 Company O&M policies and procedures appear to meet compliance requirements, but there are many opportunities for improvement.

A review of the operations and maintenance manuals (O&M manuals) for the Gas Companies generally revealed that the O&M manuals would benefit from:

- Providing more detailed information that would be useful for the practitioner to identify more precisely what and how to perform work;
- Clarifying contents with images and adding lists; and,
- Clarifying communications about, use of, and changes to, O&M using, for instance, a rigorous management of change protocol[16].

These changes would provide an opportunity for the Gas Companies to move beyond compliance, which can help to improve gas pipeline safety.

7.2.7 Gas Companies appear to be compliant with Dig Safe requirements but some statutory exemptions and excavators, especially repeat offenders may be adding risk.

Based on the Phase 1 work, the Panel found no reason to believe any Gas Company was out of compliance with the Dig Safe requirements[17]. On the contrary, the Gas Companies generally

[16] See Footnote 6 for a discussion of a management of change protocol.

recognized the threat posed by excavations and possible third-party damage. Initial indications, however, suggest the Gas Companies' public awareness programs are designed and implemented to comply with requirements rather than to ensure efficient and effective communication with the communities they serve.

The concerns about Dig Safe arise because of the statutory exemptions that permit certain entities (e.g., municipal water companies) to conduct excavations without making a Dig Safe notification to 811 to help make sure assets are located and marked by Gas Companies before excavation occurs. Additionally, it is unclear what actions the DPU takes when Gas Companies report an excavator, especially repeat offenders, for digging without having made the required call to 811. Even if the maximum penalties are being assessed, the amount of the penalty does not seem to deter excavators who face greater impacts by stopping work than by paying a fine.

Undertaking efforts to deter excavators who are repeat offenders can help improve gas safety.

7.2.8 Other general opportunities exist for Gas Companies to improve.

Several other opportunities for improvement were identified in Phase 1. These include improving records, developing and enhancing GIS, and increasing the number of company inspectors. Sections 7.2.8.1 to 7.2.8.6 briefly discuss observations to date. Each will be further explored and expanded upon in Phase 2.

7.2.8.1 Improving records related to the assets.

Gas Companies have the opportunity to improve their recordkeeping related to their assets. These opportunities include improving quality, accessibility to records, and better establishing and documenting methods of updating records based on findings in the fields. Each Gas Company needs to know its systems sufficiently well to identify and mitigate all the threats to pipeline integrity and to make good operational decisions. They also would benefit from having processes in place to improve recordkeeping each time a pipe is uncovered.

7.2.8.2 Developing GIS and improved interaction between numerous databases.

Gas Companies can benefit by developing GIS[18] and improved interaction between numerous databases. A few companies have developed this capability, and some are working at improving the interaction between numerous existing databases. All Gas Companies would benefit from robust GIS systems, which improve an operator's understanding of the location of gas assets and provide context to all maintenance and inspection information.

7.2.8.3 Increasing number and use of Gas Company inspectors in the field.

Gas Companies can benefit from increasing the number and frequency of use of company inspectors for work performed in the field. This is true for company inspection of both employee and

[17] Dig Safe® is a not-for-profit clearinghouse used by Massachusetts, Maine, New Hampshire, Rhode Island and Vermont. When a person calls 8-1-1 before digging or making any excavation, Dig Safe notifies participating utility companies of the plans to dig. In turn, these utilities (or their contract locating companies) respond to mark out the location of their underground facilities. Dig Safe is a free service, funded entirely by its member utility companies. Other states and the federal government often refer to this as a "one-call" service. Dig Safe or one-call systems are used to help prevent Dig Ins.

[18] A GIS (Geographic Information System) is a vital tool for data creation, analysis, maintenance and storage in the pipeline industry.

contractor work. The inspectors should be independent from the personnel performing the work. Gas companies often establish a QA/QC (quality assurance/quality control) department for inspectors that is separate from the workforce performing the work.

7.2.8.4 Further consideration of all threats to enhance pipeline integrity management.

Sound risk management practices require full consideration of all different types of threats that could adversely impact pipeline safety. Implementation of a Distribution Integrity Management Plan (DIMP) should be accompanied by a full consideration of all threats; not purely focused more narrowly on leak prone pipe. Thoughtful analysis and consideration must be given to what is currently unknown and what might constitute a future threat.

7.2.8.5 Considering how to reduce the potential for distraction during the adoption of API RP 1173.

A pipeline safety management system, such as the one embodied in API RP 1173, is an excellent tool to help gas companies better embrace the mindset of continuous improvement. Adopting and operationalizing a safety management system within gas companies is a long journey of continued improvement over time. The Panel expects that the proposed adoption of API RP 1173 by the Gas Companies[19] will ultimately have long-term effectiveness.

Based on the Phase 1 work, the Panel observes that very few Gas Companies are currently ready to implement API RP 1173. Three have taken some steps to prepare to move in the direction of adopting a safety management system; others have more fundamental opportunities to address to improve pipeline safety in the near term. Because every company has limited resources to implement new initiatives, consideration should be given to how best to reduce the current distractions away from making short-term improvements likely to arise from the adoption of API RP 1173 at this time.

7.2.8.6 Creating outage management systems to manage data currently residing in various databases.

When a Gas Company responds to an emergency, one early step in the response is assessing the extent of the gas outage and ensuring the gas has been turned off at each home and business. There are technology tools available from which Gas Companies could develop an outage management system that integrates the customer and asset data most likely contained in various databases.

Undertaking this effort while not operating in emergency response mode could help accelerate the recovery time and assist in responding to a Level 3 (or greater) gas emergency.

7.2.9 Gas Companies are expending resources, time and focus on the meter replacement program despite limited safety benefits.

Gas Companies are expending notable resources, time and focus on the Commonwealth's seven-year meter replacement program. Enacted in 1934, the program requires meters to be removed from service and tested every seven years. This replacement timeline is out of line with industry practices and current technologies and has not been shown to generate improved gas pipeline

[19] In the aftermath of the tragedy in the Merrimack Valley region, the EEA requested that the Gas Companies consider adopting API RP 1173. The Gas Companies agreed and the Northeast Gas Association, a trade organization that represents the Gas Companies as well as other companies that operate natural gas pipeline infrastructure in the Northeast region, agreed to hire a third-party contractor to help the Gas Companies adopt and "operationalize" API RP 1173. This effort is currently underway.

safety. Moreover, it consumes resources that could be redirected to more impactful pipeline safety activities. The program is an inconvenience to customers; yet, these are the same customers who pay for the program.

The current meter replacement program does provide a level of assurance about meter accuracy to protect the customer from being over-billed, although the meters that are found to be inaccurate is a small fraction of those removed and tested. Most states have well established programs to protect customers from meter inaccuracy through a sampling process, and analysis to identify certain meters that could be more problematic than others.

The meter replacement program also provides an opportunity for a Gas Company employee to be inside a customer's home when the meter is located inside to discern possible gas risks in the home (e.g., leaking furnaces or gas stoves). However, these in-home safety checks are outside of a Gas Company's jurisdiction and the potential ancillary safety benefits of the seven-year meter replacement program can be met by increasing the frequency of gas leak surveys or, through other programs[20]. Additionally, with GSEP moving meters (where feasible) from inside to outside homes and businesses, this potential benefit will continue to diminish.

Lastly, because meter replacement involves performing live gas work, this work adds risk but does not enhance pipeline safety.

7.2.10 Additional guidance is needed for implementing the PE requirement.

The Commonwealth's new law[21] requires that a professional engineer (PE) review and approve plans for natural gas pipeline work that might pose a material risk to the public. The safety value and benefits of this legislation should be further reviewed, and all options considered. It is plausible that alternative approaches would better accomplish the intended objectives of this legislation. For instance, while a PE provides certain qualifications, it's important to recognize that PEs are licensed in fields of expertise that are more general, and not necessarily specialized in gas pipelines (e.g. Chemical or Mechanical engineers).

In the short term, additional guidance is needed to not only obtain some of the benefits envisioned, but also to reduce the disruption and introduction of uncertainty into the 2019 construction season. As one example, there may be benefits to limiting a PE review to reviewing and approving the design of a new or complex gas facility while requiring the implementation of the process safety hazard identification process, as discussed in Section 7.2.5 to address concerns about field work being performed safely. If timely, DPU could solicit additional input from the public and the Gas Companies on the PE requirement and provide further guidance through its rulemaking process in DPU Docket #19-34.

[20] For example, the DPU could require gas companies to conduct gas leak surveys in areas with indoor meters more frequently than currently required by regulation or, alternatively, could require gas companies to conduct an indoor leak survey following a customer request. The terms and conditions of providing such services, along with the rate recovery, would have to be determined.

[21] Following the tragic incident in the Merrimack Valley Region, the National Safety Transportation Board provided preliminary findings and recommendations in its report dated November 15, 2018. The NTSB report stated that "it is critical for an engineer with appropriate qualifications and experience to review engineering plans". In January 2019, the Massachusetts Governor signed the bill into law. See Chapter 339 of the Acts of 2018.S. Subsequently, the DPU issued initial guidance to gas companies on how to implement the law and has opened a rulemaking process to develop the regulations and guidance to the Gas Companies.

7.3 Initial Observations about the Interested Parties

While each gas company is accountable for safely operating gas distribution systems to reliably deliver natural gas to customers, there are a number of Interested Parties with a wide variety of key goals and objectives that impact natural gas pipeline safety within the Commonwealth. These varied goals and interests and can distract from and result in a reduced focus on pipeline safety and solid commitment to continually learning and improving.

7.3.1 Organizational goals can conflict with gas pipeline safety.

Each of the Interested Parties has organizational goals that can conflict with one another. These varying goals range from keeping rates affordable, adding more jobs, and reducing greenhouse gas emissions. While these are all worthy goals, they are often in conflict and can distract from enhancing gas pipeline safety. An example are the constraints placed on increasing the pace of replacing leak-prone pipe resulting, in part, because of the organizational goal conflicts that are present, as further described in Section 7.4.5. Recognizing the existence of these conflicting goals is the first step in addressing and resolving potential or perceived conflicts.

7.3.2 Focus has been more on electrical power safety and reliability than on gas pipeline safety.

It appears that many of the Interested Parties have been more focused in recent years on promoting the safe and reliable delivery of electrical power rather than on the safe and reliable delivery of natural gas. While there may be other explanations for this confluence, the Panel identified three factors that may have contributed to the focus on electric energy instead rather than natural gas in recent years:

1. The robustness and steadiness of the natural gas distribution system over the years to reliably provide gas heating and energy needs for homes and businesses prior to the tragic events in the Merrimack Valley region[22];
2. Storms in the Commonwealth that cause electric power outages have become more common. This resulted in increased preparedness of electric companies in terms of predicting the likelihood of an upcoming storm and preparations to quickly address resulting, predicted, electrical outages[23]; and,
3. The role of electricity in reducing greenhouse gas emissions in energy transition planning[24].

Overall, this focus on electrical power may have reduced the amount of focus, time and energy spent on pipeline safety.

7.3.3 Pipeline safety may not have been fully considered while addressing climate change.

As the Commonwealth of Massachusetts leads efforts to address climate change, many Interested Parties have been focused on addressing climate change. As part of this effort, Interested Parties, including the government, private organizations and certain individuals advocate for the need to reduce the amount of fossil fuels used to meet the energy needs of Massachusetts residents. For

[22] While there have been 28 PHMSA reportable incidents in the Commonwealth in the time period from 2010-2017, which undoubtedly were important and impactful to those involved, mostly affected individuals or business in a localized area.

[23] See the DPU Annual Reports for 2018 and earlier reports.

[24] Id. Over the last number of years, many resources have been devoted to analyzing the fuel shortages for electric generation.

example, in August 2008, the Commonwealth passed the Global Solutions Warming Act, which requires the Commonwealth to reduce greenhouse emissions by 80% by 2050[25].

To date, it appears the Commonwealth is in the process of developing a transition plan under which the citizens of the Commonwealth can access energy to provide necessary heating, cooling, and cooking to people in homes and businesses. In this transition plan, the safety and reliability of natural gas service during the transition away from fossil fuels may not have been a focus.

7.4 Initial Observations about GSEP

The Massachusetts State legislature enacted a new law introducing the Gas Safety Enhancement Program (GSEP) in 2014. Gas Companies increased the pace of replacement of leak-prone pipe under GSEP's rate recovery mechanism. Gas Companies generally adopted a plan to replace the remaining leak prone pipe over the next 20 years. Observations related to GSEP and the process for support and executing this program are provided below (see sections 7.4.1 to 7.4.6).

7.4.1 GSEP is an example of a legislative and regulatory success.

The Panel's initial observation is that GSEP is an example of a legislative and regulatory success. Enacted in 2014, GSEP was intended to increase the pace of replacement of leak prone pipe by Gas Companies by adopting a method by which Gas Companies can recover the costs of the replacement work, capped at a certain percentage of a company's annual revenue, in a timely manner[26]. Based on the work to date, GSEP seems to be accomplishing these goals.

This rate recovery mechanism benefits Gas Companies and customers by enabling companies to more effectively plan ahead, by obtaining materials, acquiring needed equipment, and planning for managing increased labor needs. This includes hiring personnel or by entering into longer-term contracts with more favorable financial terms. Moreover, there is some evidence that indicates a reduction in the leak rates, which also indicates a level of effectiveness of GSEP.

[25] The Global Solutions Warming Act set economy-wide greenhouse gas (GHG) emission reduction goals for Massachusetts that will achieve reductions of between 10 percent and 25 percent below statewide 1990 GHG emission levels by 2020 and 80 percent below 1990 statewide emission by 2050.

[26] Rather than waiting for the filing of a full rate case, the GSEP rate recovery mechanism requires a company to engage in a regulatory proceeding about GSEP replacement plans and expenditures with the DPU, in which the AG's Office Ratepayer Advocate participates, twice a year. In the first proceeding the Gas Company sets forth the work it intends to performed; in the second proceeding, the parties reconcile the actual work performed against the planned work and scrutinize the reasonableness of the costs incurred before the DPU grants a gas company recovery of the costs incurred. The recovery generally is capped at 1.5% of the gas company's revenues for the prior year. The DPU has the authority to grant waivers to allow recovery in excess of the cap if it deems it appropriate.

7.4.2 GSEP provides many ancillary safety benefits.

In addition to reducing risks by reducing the amount of leak prone pipe in the system, a number of ancillary safety benefits have occurred as a result of GSEP. These include:

- Installing excess flow valves as a flow shut off device[27];
- Moving inside meters outdoors, thereby reducing the risk associated with indoor meters;
- Updating records of the system with new information;
- Installing pressure reducing regulators at every service;
- Using plastic pipe, which generally reduces the number of gas leaks;
- Enhancing the ability to accurately locate and mark assets has increased, and effectively reduces the number of dig-ins[28]; and,
- Reducing the number of low-pressure systems in the natural gas distribution system, which have their own inherent risks.

All of these additional benefits reduce risk to the public and increase public and pipeline safety.

7.4.3 GSEP work also increases risk because of the live gas work required.

Despite all of these safety benefits, the Panel also observes that any time a gas company undertakes any type of live gas work, it adds risk into the system. A gas company can manage this risk provided they have the appropriate personnel, processes and procedures in place, follow the procedures, and control for distractions. However, it is infeasible to reduce the risk to zero.

7.4.4 The intense focus on GSEP may distract from focusing on other priorities.

The Panel also observes that the intense focus on GSEP and the replacement of leak prone pipe can distract from managing other priorities (e.g. threats to pipeline integrity.) As described in Section 6.2, these threats could include (for example):

- Excavation damage caused by a dig in; and,
- Cracking caused by natural forces such as frost heave in a winter.

[27] Excess flow valves (EFVs) (residential) and curb valves (businesses) are usually installed between the gas main and the gas meter. As part of the GSEP program, these generally are being installed on every service. An EFV responds to an excessive flow of gas automatically by closing and restricting the gas flow. EFVs provide another layer of protection from the accumulation of gas in homes and businesses as the result of a gas leak or a gas over pressurization event. The National Safety Transportation Board (NTSB) began recommending the installation of EFVs in the early 1980's for schools and other places where people gather, expanded that recommendation in the 1990's to all customers, and in 2001, renewed the call for EFV's for all gas customers. (See NOPV Preliminary recommendation related to Louden County, VA incident, dated June 22 2001). Since then, many utilities have been installing EFVs. In 2017, PHMSA issued a new rule expanding the use of EFVs.

[28] A dig-in is the shorthand term for damage that can occur to pipelines during excavation. The excavation may be performed by the gas company (1st party), its own contractors (2nd party), or someone totally unaffiliated with the gas company (3rd party). Third party excavators include entities, such as the water and cable companies, as well as individuals such as your neighbor planting a new tree. (3rd party). Excavation damage is the leading cause of pipeline damages across the country. Ways to lower the risk of dig-ins include encouraging calling 811 for a free locate before you dig, having up to date records of the type and location of assets, conducting accurate locating and marking the location of the buried pipelines, having gas company personnel present during the excavation, and requiring hand-digging within a specified distance from the asset.

7.4.5 Increasing the pace of replacement under GSEP is constrained by a number of factors.

Increasing the pace of replacing leak prone pipe would result in an overall reduction of those risks arising from leak prone pipe yet doing so appears to be currently constrained by several factors. Prior to increasing the pace of leak prone pipe replacement, certain constraints would need to be resolved such as:

- Ensuring that increasing the pace can be done safely;
- Ensuring availability of resources to acquire materials and complete design work in a timely manner. This may especially be an issue if the new requirement that a Professional Engineer stamp certain projects is interpreted to require a PE involvement in each GSEP project;
- Developing the availability of qualified construction workforce;
- Resolving state and local requirements that limit the amount of construction within their jurisdictions. These include:
    - The Ch. 90 paving requirement;
    - Construction moratorium between November and April;
    - Societal impacts of increased construction on citizens; and,
    - Availability of police for after-hours traffic control duty.
- Addressing the GSEP revenue cap, which limits Gas Company recovery for costs.

7.4.6 GSEP Rate Recovery process generally seems to work although there are areas for improvement.

The GSEP rate recovery process generally seems to work. The Panel observes that waivers of recovery cap encourage gas companies to accelerate pace when circumstances permit them to do so safely. The Panel notes, however, that the regulatory process for GSEP rate recovery consumes significant resource time at Gas Companies, DPU and AG offices.

7.5 Initial Observations about the DPU

While each Gas Company is accountable for safely operating gas distribution systems to reliably deliver natural gas to customers, the DPU has an important inspection, enforcement, and ratemaking role in supporting and encouraging pipeline safety. Based on the Phase 1 work to date, and with the caveat that additional work will be done in Phase 2, the following represent the Panel's initial observations about the DPU (see sections 7.5.1 to 7.5.4).

7.5.1 The DPU meets PHMSA requirements.

As permitted under federal law[29], PHMSA has delegated its oversight and enforcement obligations related to intrastate pipeline safety to the DPU. Each year PHMSA undertakes an evaluation of the

[29] PHMSA certifies State Agencies to act on PHMSA's behalf Under 49 U.S. Code § 60105

DPU's Division of Pipeline Safety Program. Between 2009 and 2017, PHMSA found the DPU met its requirements[30].

7.5.2 The DPU faces challenges in recruiting and training staff in a timely manner.

The inability to offer competitive compensation makes it difficult for the DPU generally, and the Division of Pipeline Safety more specifically, to recruit and retain sufficient personnel with comprehensive pipeline safety knowledge. This puts an additional burden on the current experienced technical staff. Adding additional qualified people could help shift the focus of inspection and enforcement efforts by the DPU from compliance to pipeline safety. Also, additional qualified staff should enable additional DPU inspectors to be in the field to review Gas Company work practices.

7.5.3 The DPU's organizational structure would benefit from more emphasis on pipeline safety.

The DPU would benefit from an organizational structure that puts more emphasis on pipeline safety. Currently, the Division of Gas Pipeline Safety is just one of many divisions within the DPU[31]. In addition, the division of Pipeline Safety and the general topic of pipeline safety do not appear to be well- integrated across actions performed and decisions made by the other divisions. For example:

- It appears DPU staff working on rate cases rotate between different types of rate cases and as such, may not have developed sufficient expertise to properly evaluate the investor-owned Gas Companies' claims regarding the need or method to enhance pipeline safety;
- Notable resources appear to be focused on the pricing of gas supply; and,
- Rate case decisions appear to be more focused on keeping rates low than on ensuring operators are taking actions necessary to enhance pipeline safety.

7.5.4 Having DPU provide better data and metrics would improve transparency.

The Interested Parties and the general public would benefit if DPU developed better systems to provide more readily available data and metrics on its inspection and enforcement efforts.

7.6 Initial Observations about the Role of the AG's Ratepayer Advocate

The Attorney General's (AG's) Office participates as a ratepayer advocate in matters at the DPU on behalf of consumers in the Commonwealth. These initial observations cover the impact of the focus of the ratepayer advocate on costs and the potential outsized influence of that focus because the role is positioned within the AG's office. While not the only factor, the fact that a division of the AG's office has criminal enforcement powers among its many other roles may result in the DPU and

[30] PHMSA evaluates the state programs using a number of points available each year and the number of points scored by a given state to arrive at a state rating. Annual reports can be found at https://www.phmsa.dot.gov/working-phmsa/state-programs/evaluation. In the time period between 2009 and 2017 (the last year for which data is currently available), the Massachusetts DPU State Rating averaged 93.2, with a high of 97.4 in 2017 and a low of 87.4 in 2011.

[31] See Footnote 8.

Interested Parties giving more weight and deference to the positions and opinions of the ratepayer's advocate than otherwise warranted[32].

7.6.1 The ratepayer advocate's role is to focus on keeping rates affordable and consistent.

The ratepayer advocate is focused on keeping rates affordable and consistent for the consumer in the Commonwealth. This is not surprising since the law establishing that role specifically directs the ratepayer advocate to participate in matters involving rates, charges, prices and tariffs[33]. Notably the law does not require the ratepayer advocate to balance increased costs with the benefits of reducing risk or improving pipeline safety. This may create more focus on keeping rates low rather than encouraging the ratepayer advocate to support reasonable expenditures to improve pipeline safety that may raise rates.

7.6.2 Placing the ratepayer advocate role within the Office of the AG may provide added weight to its positions.

It is common to have an entity or office managing and advocating for the rights and interests of consumers in rate cases and other matters before state utilities. It appears to be uncommon, however, for the role of the ratepayer advocate to be placed in the AG's office. Doing so inadvertently may result in the DPU and other parties giving the ratepayer advocate's position in any given matter additional weight and deference.[34] This may be creating more emphasis on keeping costs down and rates low rather than supporting reasonable expenditures to improve pipeline safety.

Taking steps to ensure there is an appropriate weight and balance between keeping rates low and making prudent expenditures to improve pipeline safety would improve pipeline safety in the Commonwealth.

7.7 Other Topics Related to Gas Pipeline Safety

To enhance the necessary public discussion on natural gas pipeline safety going forward, the Panel provides a brief discussion on several other topic areas regarding pipeline safety:

1. Topic Area 1. The Role of Compliance

   Compliance with the federal and state regulatory requirements related to gas pipeline safety is insufficient to make operations of gas pipelines safe because:

   a. Regulations provide the minimum safety requirements. As such, while compliance is the basic foundation for safety, merely being compliant is insufficient to achieve the level of

[32] The Attorney General (AG) is the chief lawyer and law enforcement officer of the Commonwealth of Massachusetts. https://www.mass.gov/orgs/office-of-attorney-general-maura-healey . As such, the AG likely would be involved in any criminal prosecution of an entity within the Commonwealth charged with knowingly and willingly violating state or federal pipeline safety laws, although current research indicates there is no specific general law requiring the AG to undertake such a role. Press reports indicate federal prosecutors have assembled a Grand Jury to hear evidence on the possibility of such criminal activity related to the tragedy in the Merrimack Valley region.

[33] See MA General Laws, Part 1, Title 2, Chapter 12, Section 11E).

[34] The Massachusetts Attorney General is an executive branch officer who is independently elected under the Massachusetts Constitution. It is "an advocate and resource for the people of Massachusetts in many ways, including protecting consumers, combating fraud and corruption, investigating and prosecuting crime, and protecting the environment, workers, and civil rights." See: https://www.mass.gov/orgs/office-of-attorney-general-maura-healey

safety the public expects and deserves. Gas Companies must go beyond compliance to focus on safety and embrace continuous improvement in all they do;

b. An intense focus on meeting compliance requirements can mask or distract from other issues; and,

c. When compliance is attained, further effort on that issue generally stops. Safety, on the other hand, is never *attained*. That is, safety is a journey rather than a destination, so efforts to continue improving safety should never stop.

2. Topic Area 2. Financial Incentives

The Panel found no evidence to date indicating the MA Gas Companies have made decisions to choose profit over safety. In fact:

a. A gas company puts its profits and even its existence at risk if it does not develop and maintain an appropriate focus on safety. Historically, companies that have major incidents with their assets experience significant financial penalties, business disruption, and reputation damage. For example, Pacific Gas and Electric (PG&E) experienced a tremendous tragedy with a failure on its transmission pipelines in San Bruno CA in 2010. Costs and penalties following that tragedy were over $2.8 billion. Costs related to the tragic incident in the Merrimack Valley region in September 2018 are still being incurred and the most recent data from PHMSA indicates those costs have already exceeded $700 million, with press reports indicating costs have already topped $1 billion.

b. The allowable rate of return for each of the investor owned Gas Companies is determined by the DPU after an intense regulatory process, which is called a rate case[35]. This regulatory process has several features that control the amount a Gas Company can earn:

i. In this process, the Gas Company and the AG's Ratepayer Advocate office and other intervenors debate appropriate rates consumers will be charged, and based on the record that is developed, the DPU staff and Commission establish:

1. The amount of operating and maintenance expenses that can be recovered in rates. For costs other than gas supply costs[36], the investor-owned Gas Companies have a cost recovery mechanism based on the operating and maintenance costs incurred during a specified period known as a test year;

2. Those capital investments and assets on which the Gas Company can earn a rate of return. Collectively, these assets are often called the "rate base"; and,

3. An allowable rate of return on the capital investments, or rate base. The allowable rate of return for most MA Gas Companies is between 9% and 10%, and the actual rate of return is often lower.

ii. If the DPU believes a company is over-earning in the period between rate cases, the Commonwealth can initiate a rate case to correct that over-earning; and,

iii. Because of the ability of Gas Companies to earn on capital expenditures, they are incentivized to invest more in infrastructure, not less. That is, from a purely financial

[35] Municipal owned gas utility companies within Massachusetts are not set by the DPU. Their rates are governed by other locally managed mechanisms.

[36] Massachusetts allows investor-owned Gas Companies to pass through the cost of acquiring gas supply with no profit component. The cost of gas supply typically amounts to about 60% of an average customer's bill.

perspective, a company would prefer to replace the leak prone pipe and earn a return on that investment rather than simply repeatedly repair the same leak (which would cost more in terms of operating dollars).

3. Topic Area 3. The role of the reliability of gas supply in gas safety

   The pipeline safety concerns that arise when a Gas Company receives its gas supply from just one source may not have been fully considered. If a Gas Company, which obtains its gas from a single source, loses that supply – for any reason[37] -- it would become necessary for the gas company to take emergency actions to operate and manage their systems and the resulting outages. The necessity of taking such actions adds risk. Too, customers would lose natural gas service for some period of time, which depending on the time of year, could be life-threatening, and the customers may not be adequately prepared to withstand the loss of gas service.

   The contracts that Gas Companies have entered into with interstate pipeline companies for the delivery of natural gas from for "firm" transportation of natural gas will not protect the reliability of supply in all instances. This is because of the difference between contractual protections and the physical nature of transporting and delivering gas. In fact:

   a. If an interstate pipeline loses its ability to deliver gas through an event of Force Majeure, peak demands or otherwise, there may be contractual remedies available, but gas will not be delivered; and,

   b. If demand for the amount of gas that can fill an interstate pipeline exceeds the supply available on the interstate pipeline, the pipeline company can reduce the amount delivered. Again, this may result in the Gas Company having contractual remedies but not having gas to deliver to customers.

   For these reasons, it will be important as part of its efforts to enhance pipeline safety for the Commonwealth to provide an appropriate focus on strengthening gas supply availability in those instances in which a Gas Company relies on a single source of gas supply and while maintaining gas supply availability during the transition planning discussed in Section 7.3.3[38].

4. Topic Area 4. Risk Tolerance

   Risks arising from operating natural gas pipelines can be, and should be, managed to lower the risk, and to protect against and reduce the likelihood of future incidents.

   a. Safety can be improved and enhanced. This effort will lower the risks associated with operating natural gas pipelines. But, as with all activities in life, it is not possible to completely eliminate all risk.

   b. Recognizing that risk management requires certain decisions and priorities, it is essential to understand that eliminating all risk would require an infinite cost and would not be possible.

[37] For example, a rupture in an interstate pipeline could curtail its ability to provide any gas supply for some extended period of time while the ruptured pipe is repaired and the cause of the incident is investigated by regulatory agencies. Alternatively, gas demands on any given peak day could exceed the amount of physical gas available to be delivered to supply points. Massachusetts sits at the end of several interstate pipelines and this location makes the loss of supply due to high demand higher than if it were located elsewhere on the interstate pipeline system.

[38] There are a number of ways the Commonwealth can elect to address this concern. For example, supply issue could be addressed by increasing the reliance on and availability of LNG facilities within the Commonwealth.

8 Preliminary Recommendations

Preliminary recommendations arising from the Phase 1 work include the following:

1. Take steps to improve gas company emergency response plans, including:
    a. Develop and incorporate a common understanding of the Incident Command System (ICS), including communication protocols, common terminology, and accountabilities for each ICS function and role; and,
    b. Identify individuals and appropriate training protocols for each function and implement the training.
2. Conduct a tabletop and field emergency response preparedness drills, including:
    a. Consult a third party to organize and grade the drills;
    b. Exercise unified command structure and mutual aid with Gas Companies, fire departments and government;
    c. Consider communication protocols and technology needs; and,
    d. Follow up with a lessons-learned session for all participants to develop next steps for continued improvement.
3. Establish programs and training for process safety hazard identification in the field, specifically for live gas work to:
    a. Change the mindset of personnel in the field regarding potential impacts of work;
    b. Encourage personnel to actively look for and identify hazards to the gas system before starting field work; and,
    c. Promote a continued focus on personal and public safety rather than simply compliance.
4. Review the PE requirement and in the short term, enhance or supplement current guidance to obtain added value and to reduce disruption in upcoming construction seasons.
5. Consider whether resources expended in GSEP regulatory process provided good value for effort and cost and if the process can be made more efficient;
6. Develop a collaborative approach to consider further accelerating pipeline replacement. This includes:
    a. Involving all stakeholders;
    b. Collaborating to address the primary barrier of the qualified workforce; and,
    c. Assessing risks of all potential changes to the pace of replacement.
7. Consider providing additional financial resources to enhance recruitment and retention of individuals with pipeline safety experience and expertise in government agencies, divisions, and/or departments;
8. Ensure that pipeline safety is a significant consideration across all relevant government agencies, divisions, and/or departments, including in ratemaking process;

9. Further consider organizational goal conflicts and how best to resolve them. Identify accountability and responsibility within government agencies, divisions, and/or departments;
10. Consider extending the meter replacement program beyond seven years:
    a. Utilize moving meters outdoors in GSEP where feasible as an opportunity to re-evaluate costs and safety impacts;
    b. Recognize this is an opportunity to demonstrate the ability of Gas Companies and Interested Parties to collaborate and solve an issue;
    c. Raise awareness of jurisdictional boundaries of Gas Companies and responsibilities of customers; and,
    d. Address meter accuracy concerns and perceived indirect safety benefits separately. Consider the following:
        i. Meter accuracy for consumer protection, not safety; and,
        ii. Indirect safety benefits may include ad-hoc gas inspections inside residences and could be managed without removing meters.
11. Specifically consider gas pipelines and gas pipeline safety in the transition plan to achieve 80% reduction of greenhouse gases by 2050:
    a. Any transition plan should consider pipeline risk and societal impacts (public safety and pipeline safety);
    b. Varying priorities may adversely affect gas pipeline safety and gas supply reliability; and,
    c. Ensure that all policies and regulations fully consider gas pipeline safety and changes in risk.

9 Work to be Performed in Phase 2

While the DPU, EEA and Dynamic Risk are in discussions about the specifics of Phase 2, the Panel anticipates Phase 2 will include:

- Continuing the work of Phase 1, including reviewing and analyzing documents received from the Gas Companies and from DPU;
- Conducting field visits at gas company locations; and,
- Performing additional analysis to develop additional observations, final findings and recommendations, and develop the final report.

While additional specific topics will evolve as Phase 2 unfolds, some areas that will be explored more fully likely will involve:

- Within the Gas Companies:
  - Use of procedures in the field;
  - Front line culture – safety, following process/procedure, hazard identification;
  - Work planning – hazard identification, safety (employee and public);
  - Supervision – attitudes, amount of responsibility, time to be in the field, etc.;
  - Leadership – are the leaders committed and engaged? How do they manage risk/respond to risk?; and,
  - Use of excess flow valves (EFVs) in non-GSEP work.
- Within the Interested Parties:
  - Accountability for resolving organizational goal conflicts.
- Within the DPU:
  - Timeliness of DPU field inspections and enforcement actions;
  - Focus on pipeline safety interaction among DPU divisions; and,
  - Effectiveness of using a more collaborative approach.

Appendix A Terms and Abbreviations

Table A-1 lists terms and abbreviations used throughout the execution of this Assessment. In documents that pre-date this document, the definitions presented herein shall take precedence.

Table A-1: Terms and Abbreviations

Term or Abbreviation	Meaning or Definition
220 CMR	Code of Massachusetts Regulations Title 220 (220 CMR); Specifically applicable Sections 100.00 through 113.00
49 CFR Part 192	Code of Federal Regulations (CFR) for the Transportation Of Natural And Other Gas By Pipeline
Affected Stakeholder Group	*See Elected Officials Group.*
AG	Attorney Generally, more specifically the AG Office
API	American Petroleum Institute
API RP 1173	API Recommended Practice for Pipeline Safety Management System
API 1173	*See API RP 1173*
Approx	Approximately
ASME	American Society of Mechanical Engineers
ASME B31.8S	Managing System Integrity of Gas Pipelines
Assessment	Statewide Assessment of Gas Pipeline Safety conducted for the Commonwealth of Massachusetts. *See also* "Project"
BER	Berkshire Gas Company
BER	Berkshire Gas Company
BLA	Blackstone Gas Company
BOS	Boston Gas Co (National Grid)
CAP	Cape Cod Gas Co (Div Of Colonial Gas Co) (National Grid)
CFR	Code of Federal Regulations
CGM	Columbia Gas of Massachusetts (Bay State Gas Company)
Chatham House Rules	Procedure where information that is received can be used subject to guideline restrictions. However, neither the identity nor the affiliation of the speaker(s) may be revealed
CMR	Code of Massachusetts Regulations
COL	Colonial Gas Co - Lowell Div (National Grid)
Commonwealth	Commonwealth of Massachusetts
Commonwealth of Massachusetts	Commonwealth, or State, of Massachusetts.

Term or Abbreviation	Meaning or Definition
Community Representatives Group	Stakeholder group of 7-9 individuals comprised of union representatives, interested members from the general public, and selected State officials and/or other individuals with subject matter experts, chosen by the Panel with input and advice from the Commonwealth. (Note this was formerly referred to as the External Stakeholder Group.
Community Representatives Group	Stakeholder Group comprised primarily of certain parties that have expressed direct interest in this Assessment (Note: this was formerly referred to as the External Stakeholder Group)
Country	Reference to the United States of America
Customer	A *customer* is an individual or corporation who pays a regular fee to use a public utility (e.g., gas or electricity). Fees are usually based on the quantity of utility consumed by the customer. This term is synonymous with *ratepayer*.
CV	Curriculum Vitae, or Resume
Designated Participants	Individuals that have been invited and accepted to serve as a member of a Stakeholder Group
Dig-ins	External force that impacts a buried pipeline, most commonly via exaction equipment
DIMP	Distribution Integrity Management Plan
DPU	Commonwealth of Massachusetts Department of Public Utilities
DPU Leadership Team	Designated Individuals from the DPU and other agencies that provide support and direction in the execution of this Assessment.
DRA	*See Dynamic Risk*
Dynamic Risk	Dynamic Risk Assessment Systems, Inc.
EEA	Executive Office of Energy and Environmental Affairs for the Commonwealth of Massachusetts
Elected Officials Group	Stakeholder Group of 10-15 individuals comprised of elected or appointed government officials (Note: this was formerly referred to as the Affected Stakeholder Group)
ER	Emergency Response
ESS	Essex County Gas Co (National Grid)
Evaluator	*See Panel*
EVE	Eversource Energy (NSTAR Gas Company)
External Stakeholder Group	*See Community Representatives Group*
FAQ	Document setting forth Frequently Asked Questions to be periodically updated
Gas	Natural gas
Gas Companies	Seven (7) Investor-Owned Local Distribution Companies and four (4) Municipal Gas Companies (4) designated by the DPU to participate in this Assessment

Term or Abbreviation	Meaning or Definition
Gas Company Representatives	Generally, two (2) individuals that shall serve as the lead and co-lead points of contact plus, one individual designated by the DPU as the Gas Company representative, if different from the lead or co-lead.
GHG	Green House Gas
GIS	Geographical Information System
Guidelines for Engagement	Guidelines for participation this Assessment, one each for the Gas Companies, DPU, and the Stakeholder Groups
HOL	Holyoke Gas & Electric
ICS	Incident Command Structure
Independent Evaluator	*See Panel*
Independent Panel Members	Five (5) designated individuals that comprise the Panel
Independent Review Panel	*See Panel*
Industry Advisory Group	*See Industry Representatives Group*
Industry Representatives Group	Stakeholder Group comprised of approximately 5 individuals including select Executives from natural gas pipeline operators, key pipeline industry associations and/or experts working in complex operations in other industries such as nuclear power and commercial aviation. Note: this was formerly referred to as the Industry Advisory Group)
Integrity	In the context of pipelines, *integrity* refers to programs, practices and actions used to effectively manage and mitigate hazards and risks related to pipeline integrity management
Interested Parties	Individuals and organizations that can affect gas pipeline safety include State Legislators, U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA), Attorney General's (AG) Ratepayer Advocacy Office, Utility Unions, Environmentalists, Customers, and Municipal Governments (local rule state). This also includes the EEA, DPU, and Gas Companies
IR	Information Request
LDC	Local Distribution Company (natural gas)
Leak-prone pipe	Certain pipes that are more susceptible to failures that result in a release of gas; most commonly comprised of cast iron pipe and steel that is not cathodically protected.
LIB	Liberty Utilities (New England Natural Gas Company)
Listening Session	Session for sharing information about the process and soliciting input; not a Q & A Session
MA	Commonwealth of Massachusetts
MID	Middleborough Gas & Electric
NGA	Northeast Gas Association

Term or Abbreviation	Meaning or Definition
NGC	National Grid Companies comprised of Boston Gas Co, Essex County Gas Co, Colonial Gas Co – Lowell Div, and Cape Cod Gas Co
O&M	Operations and Maintenance
Operator(s)	*See Gas Companies*
Panel	Collectively, the five (5) Independent Panel Members; Also referred to as the Independent Review Panel, Evaluator, and Independent Evaluator
PDCA	Plan-Do-Check-Act
PDF	Portable document file (Adobe filename extension)
Phase 1	The first approved portion of this Assessment
Phase 2	The expected second phase of this Assessment
PHMSA	Pipeline and Hazardous Materials Safety Administration, and is part of the U.S. Department of Transportation
Project	*See Assessment*.
Project Leadership Team	Designated representatives from the project team and designated project leadership representatives from the DPU and/or other supporting agencies. For clarity, this currently includes Patrick Vieth, Elizabeth Herdes, Bill Ho, Shane Early George Yiankos, and Jamie Tosches.
Project Team	Dynamic Risk team that is executing this Assessment and includes the Panel.
Q&A	Question and Answer Session
Ratepayer	A *ratepayer* is an individual or corporation who pays a regular fee to use a public utility (e.g., gas or electricity). Fees are usually based on the quantity of utility consumed by the customer. This term is synonymous with *customer*.
Rev	Revision number, typically “A”, “B” etc., to reflect substantive modifications from the previously marked revision.
Review Panel	*See Panel*
Sharefile	ShareFile, operated by Citrix, is a privately-owned company that allows users to send and receive documents securely that uses a trusted method of encrypted document transfer.
Stakeholder Groups	Comprised of Elected Officials Group, Community Representatives Group, and Industry Representatives Group
State Assessment	*See Assessment*
UNI	Unitil (Fitchburg Gas and Electric Light Company)
Unp	Reference to steel pipe that is not cathodically protected; unprotected
WAK	Wakefield Municipal Gas & Light
WES	Westfield Gas & Electric Light
YYYYMMDD	Year-Month-Day (e.g., 20181210 corresponds to December 10, 2018); used for date stamp of documents

Appendix B Personnel and Organizations that Supported the Assessment

This appendix lists personnel and organizations that supported the assessment.

B.1 Independent Review Panel

These individuals comprise the Independent Review Panel:

- Patrick H. Vieth, Executive Vice President, Dynamic Risk (Project Lead);
- Elizabeth Herdes, Contractor to Dynamic Risk (Project Co-Lead);
- Chery Campbell, Contractor to Dynamic Risk (Technical Lead); and,
- Chris Hart, Advisor, Contractor to Dynamic Risk.

Todd Conklin, Advisor, Contractor to Dynamic Risk serves as an Advisor to the Independent Review Panel.

B.2 Project Technical Support Team

These individuals comprise the Project Technical Support Team:

- Terri Larson, Contractor to Dynamic Risk;
- Michael Courtien, Contractor to Dynamic Risk;
- Curtis Parker, Technical Director, Dynamic Risk;
- Bill Ho, Project Manager, Dynamic Risk;
- Karen Bowes, Project Administrator, Dynamic Risk; and,
- Trevor MacFarlane, President and CEO, Dynamic Risk.

B.3 DPU and EEA Representatives

DPU and EEA representatives are:

- Shane Early, General Counsel – Department of Public Utilities;
- George Yiankos, Director of Natural Gas Division, Department of Public Utilities; and,
- Jamie Tosches, Deputy General Counsel – Energy, Executive Office of Energy and Environmental Affairs.

B.4 Gas Companies

Table B-1 lists Gas Companies.

Table B-1: Gas Companies

Gas Company	Gas Company Address	Primary Contact	Abbreviation	PHMSA Identification Code
Investor-Owned Local Distribution Companies				
Columbia Gas of Massachusetts (Bay State Gas Company)	Bay State Gas Company d/b/a Columbia Gas of Massachusetts 4 Technology Drive, Suite 250 Westborough, MA 01581	Stephen Bryant, President	CGM	1209
Berkshire Gas Company	Berkshire Gas Company 115 Sheshire Road Pittsfield, MA 01202	Franklyn Reynolds	BER	1344
Blackstone Gas Company	Blackstone Gas Company 61 Main Street Blackstone, MA 01504	James Wojcik	BLA	1504
Eversource Energy (NSTAR Gas Company)	NSTAR Gas Company d/b/a Eversource Energy 247 Station Drive Westwood, MA 02090	William Akley, President	EVE	2652
Liberty Utilities (New England Natural Gas Company)	Liberty Utilities 36 5th Street Fall River, MA 02722-0911	Mark Smith, President	LIB	31770
Boston Gas Co (National Grid)	Boston Gas Company and Colonial Gas Company (each d/b/a National Grid) 40 Sylvan Road Waltham, MA 02451	Marcy Reed, President	NGC	1640
Essex County Gas Co (National Grid)	NA	NA	-	4547
Colonial Gas Co - Lowell Div (National Grid)	NA	NA	-	11856
Cape Cod Gas Co (Div Of Colonial Gas Co) (National Grid)	NA	NA	-	2066
Unitil (Fitchburg Gas and Electric Light Company)	Unitil 6 Liberty Lane WestHampton, NH 03842	Thomas Meissner	UNI	5200

Gas Company	Gas Company Address	Primary Contact	Abbreviation	PHMSA Identification Code
Municipal Gas Companies (4)				
Holyoke Gas & Electric	Holyoke Gas & Electric Department 99 Suffolk Street Holyoke, MA 01040	Brian Roy, Acting Gas Superintendent	HOL	7330
Middleborough Gas & Electric	Middleborough Gas & Electric Dept 2 Vine Street Middleborough, MA 02346	Richard Labossiere	MID	12444
Wakefield Municipal Gas & Light	Wakefield Municipal Gas and Light Department 480 North Avenue Wakefield, MA 01880	Peter Dion, General Manager	WAK	22035
Westfield Gas & Electric Light	Westfield Gas & Electric Light Dept. 100 Elm Street P.O. Box 990 Westfield, MA 01086-0990	Anthony Contrino, General Manager	WES	22511

B.5 Stakeholder Groups

This appendix contains the list of Stakeholders that contributed to Phase 1 of this Assessment.

B.5.1 Elected Officials Group

This group comprises elected and appointed officials, including Massachusetts legislative leadership, Merrimac Valley officials, and town mayors. Members include:

- Honorable Robert A. DeLeo, House Speaker;
- Honorable Mike Barrett, State Senator;
- Honorable Thomas Golden, State Representative, Chairman;
- Honorable Bruce Tarr, Senate Minority Leader;
- Honorable Frank Moran, State Representative - 17th Essex District;
- Honorable Diana DiZoglio, Senator - 1st Essex District;
- Honorable Tram Nguyen, State Representative 18th Essex District;
- Honorable Barry Finegold, State Senator -2nd Essex & Middlesex District; and,
- Mayor Dan Rivera, Mayor & CEO, City of Lawrence (MA).

B.5.2 Community Representatives Group

This group comprises union representatives, interested members from the general public, and selected State officials and/or other individuals with subject matter expertise. Members include:

- John Buonopane, USW Local 12012;
- Joe Kirylo, USW Local 12003;
- James (Red) Simpson, IBEW Local 326;
- Craig Pinkham, UWUA Local 369;
- Rebecca Tepper, Energy Chief, Mass. AG's Office;
- Peter Ostroskey, State Fire Marshall;
- Carl Weimer, Pipeline Safety Trust; and,
- Zeyneb Magavi, Mothers Out Front.

B.5.3 Industry Representatives Group

This group comprises select executives from natural gas pipeline operators, key pipeline industry associations and/or experts working in complex operations in other industries such as nuclear power and commercial aviation. Members include:

- Jay Sutton, Southern Company Gas;
- Eric DeBonis, P.E., Southwest Gas;
- Christina Sames, AGA;
- Jose Costa, Northeast Gas Association;
- Clifford Johnson, PRCI;
- CJ Osman, INGAA;
- Professor Najmedin Meshkati, USC Viterbi School of Engineering; and,
- Earl Carnes, Retired, Dept. of Energy.