2019

nationalgrid

Gas Distribution Integrity Management Plan

NATIONAL GRID CORPORATION

Preface

The development of this Distribution Integrity Management program was initiated in 2009 as a project involving the Northeast Gas Association, the Southern Gas Association, forty seven utilities (including National Grid), and Structural Integrity Associates. These parties collaborated to develop a best-in-class framework. Subsequent to the initial development, National Grid retained Structural Integrity to assist in the customization of the National Grid specific DIM Plan. Departments within National Grid that were directly involved in the Plan development included Operations, Regulatory Compliance, and Distribution Engineering. A team with representatives from these three groups was assigned the task of creating the National Grid DIM Plan by August 2011 for U.S. Gas Operations.

REVISION CONTROL SHEET

Title: National Grid Corporation Distribution Integrity Management Plan

SECTION	PAGES	REVISION	DATE	COMMENTS
1-12	All	0	8/2/2011	INITIAL RELEASE
1-12	All	1	2/17/2012	REVISION 1
1-12 & All Appendices	All	2	8/29/2013	REVISION 2
1-12 & All Appendices	All	3	9/12/2014	REVISION 3
1-12 & All Appendices	All	4	9/1/2015	REVISION 4
1-12 & All Appendices	All	5	9/1/2016	REVISION 5 (Complete Re-evaluation)
1-13 & All Appendices	All	6	8/2/2017	REVISION 6
1-13 & All Appendices	All	7	8/2/2018	REVISION 7
1-13 & All Appendices	All	8	8/2/2019	REVISION 8
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2, 3, 9, 11, D Appendix	2, 3, 9, 11, 14, 15 &16	9	12/14/2020	REVISION 9.1

Table of Contents

1.0 COMPANY OVERVIEW **1-1**

2.0 COMPANY SAFETY **2-1**

  2.1 COVID-19 Impact on National Grid **2-1**

3.0 SCOPE **3-1**

  3.1 DIM Plan Review **3-3**

4.0 PURPOSE AND OBJECTIVES **4-1**

  4.1 Roles and Responsibilities **4-2**

    4.1.1 Vice President, Gas Asset Management ***4-2***

    4.1.2 Director, Gas Distribution Engineering ***4-2***

    4.1.3 Manager, DIMP ***4-2***

  4.2 DIM Program Administration **4-2**

    4.2.1 Org. Chart ***4-5***

  4.3 How to Use this Plan **4-5**

5.0 DEFINITIONS AND ACRONYMS **5-1**

6.0 KNOWLEDGE OF FACILITIES **6-1**

  6.1 Policy & Procedures **6-1**

  6.2 Overview of Past Design, Operating, Maintenance, and Environmental Factors **6-6**

    6.2.1 Bare and Coated Steel Mains & Services ***6-6***

    6.2.2 Cast Iron Mains ***6-11***

      6.2.2.1 Cast Iron Graphitization **6-12**

      6.2.2.2 Cast iron Pipe Support **6-14**

      6.2.2.3 Cast Iron Pipe Size – Diameter and Flexural Resistance **6-14**

      6.2.2.4 Cast Iron Bell Joints **6-15**

      6.2.2.5 Cast iron Loading and Impact **6-17**

    6.2.3 Plastic Pipe ***6-17***

6.2.4 Copper Piping 6-21
6.2.5 Instrumentation & Regulating Facilities 6-21
6.2.6 Construction Methods 6-23
6.2.7 Excess Flow Valves 6-23
6.2.8 Mechanical Fittings 6-24
6.3 Characteristics of Design, Operations and Environmental Factors 6-24
6.3.1 Operating Pressures and Gas Quality 6-25
6.3.2 Reportable/Significant Gas Incidents 6-25
6.3.3 Gas Distribution Inventory and Repair Data 6-25
6.3.4 Environmental Factors 6-26
6.3.5 Gas Distribution Mains and Services Assets Analysis 6-26
6.3.6 Gas Distribution Instrumentation & Regulation (I&R) Facilities Asset Analysis 6-28
6.4 Additional Data Needed 6-29
6.5 Data Capture for New Construction 6-33
6.6 Knowledge Capture – Subject Matter Experts 6-33
6.6.1 Bi-Annual Meeting 6-34
7.0 THREAT IDENTIFICATION 7-1
7.1 Means of Threat Identification 7-5
7.2 Monitoring Potential Threats 7-5
8.0 EVALUATION AND RANKING OF RISK 8-1
8.1 Objective 8-1
8.2 Mains & Services 8-1
8.3 Pressure Regulation 8-4
9.0 IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS 9-1
9.1 Corporate Culture Philosophy and Programs 9-1
9.2 Primary Threat Mitigation 9-8

9.2.1 Mitigation Program Tracker ... 9-8

10.0 MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATING EFFECTIVENESS ... 10-1

10.1 Number of Hazardous Leaks Either Eliminated or Repaired, per §192.703(c), Categorized by Cause ... 10-1

10.2 Number of Excavation Damages ... 10-1

10.3 Number of Excavation Tickets (Received from the Notification Center) ... 10-1

10.4 Total Number of Leaks Either Eliminated or Repaired, Categorized by Cause ... 10-2

10.5 Number of Hazardous Leaks Either Eliminated or Repaired, per §192.703(c), Categorized by Material ... 10-2

10.6 Additional Performance Measures ... 10-2

11.0 PERIODIC EVALUATION AND IMPROVEMENT ... 11-1

11.1 Plan Updating and Documentation ... 11-1

11.2 Effectiveness Review ... 11-2

12.0 REPORTING RESULTS ... 12-1

12.1 State & Federal Annual Reporting Requirements ... 12-1

13.0 DOCUMENT AND RECORD RETENTION ... 13-1

14.0 APPENDICES FOR MASSACHUSETTS ... 14-1

APPENDIX A KNOWLEDGE OF FACILITIES ... 14-2

APPENDIX B THREAT IDENTIFICATION ... 14-11

APPENDIX C EVALUATION AND RANKING OF RISK ... 14-24

APPENDIX D IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS ... 14-38

APPENDIX E MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS ... 14-49

APPENDIX F PERIODIC EVALUATION AND IMPROVEMENT ... 14-72

APPENDIX G CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE DIM PLAN ... 14-77

15.0 APPENDICES FOR NEW YORK 15-1

APPENDIX A KNOWLEDGE OF FACILITIES 15-2

APPENDIX B THREAT IDENTIFICATION 15-17

APPENDIX C EVALUATION AND RANKING OF RISK 15-30

APPENDIX D IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS 15-47

APPENDIX E MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS 15-61

APPENDIX F PERIODIC EVALUATION AND IMPROVEMENT 15-87

APPENDIX G CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE DIM PLAN 15-92

16.0 APPENDICES FOR RHODE ISLAND 16-1

APPENDIX A KNOWLEDGE OF FACILITIES 16-2

APPENDIX B THREAT IDENTIFICATION 16-6

APPENDIX C EVALUATION AND RANKING OF RISK 16-18

APPENDIX D IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS 16-25

APPENDIX E MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS 16-35

APPENDIX F PERIODIC EVALUATION AND IMPROVEMENT 16-46

APPENDIX G CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE DIM PLAN 16-49

Table of Figures

Figure 1-1: National Grid Operating Region 1-1
Figure 4-1: DIM Plan Elements 4-1
Figure 4-2: Organization Chart 4-5
Figure 4-3: DIM Program Process Flow 4-6
Figure 6-1: Chart Indicating Exponential Leak Rates for Bare Steel Gas Service (1938) 6-8
Figure 6-2: Chart Indicating Exponential Leak Rates for Bare Steel Gas Service (2001) 6-9
Figure 6-3: Bare Steel Pipe Corrosion 6-10

Table of Tables

Table 3-1: Program Coverage 3-2

Table 4-1: Roles and Responsibilities (RACI Chart)....................4-3

Table 4-2: DIM Program Administration 4-4

Table 6-1: Policy Documents Related to Integrity Management for Distribution[2] 6-2

Table 6-2: Plastic Pipe Material Summary....................6-18

Table 6-3: Currently Approved Plastic Pipe Material Summary....................6-19

Table 6-4: Summary of Plastic Pipe by Region 6-19

Table 6-5: Construction Practices Summary....................6-23

Table 6-6: Mechanical Fittings 6-24

Table 6-7: Additional Information 6-30

Table 6-8: Data Capture Requirements....................6-33

Table 13-1: Data Matrix for Collection Method and Storage Location....................13-0

Table 14-1: Summary of Applicable Threats....................14-12

Table 14-2: Summary of SME Interview Responses for Threat Identification....................14-15

Table 14-3: Threat Mitigation 14-39

Table 15-1: Summary of Applicable Threats....................15-18

Table 15-2: Summary of SME Interview Responses for Threat Identification....................15-21

Table 15-3: Threat Mitigation 15-48

Table 16-1: Summary of Applicable Threats....................16-7

Table 16-2: Summary of SME Interview Responses for Threat Identification....................16-9

Table 16-3: Threat Mitigation 16-26

1.0 COMPANY OVERVIEW

National Grid Corporation is one of the largest investor-owned utilities in the world and is the largest distributor of natural gas in the Northeastern US, serving approximately 3.5 million customers in Massachusetts, New York and Rhode Island (See Figure 1-1).

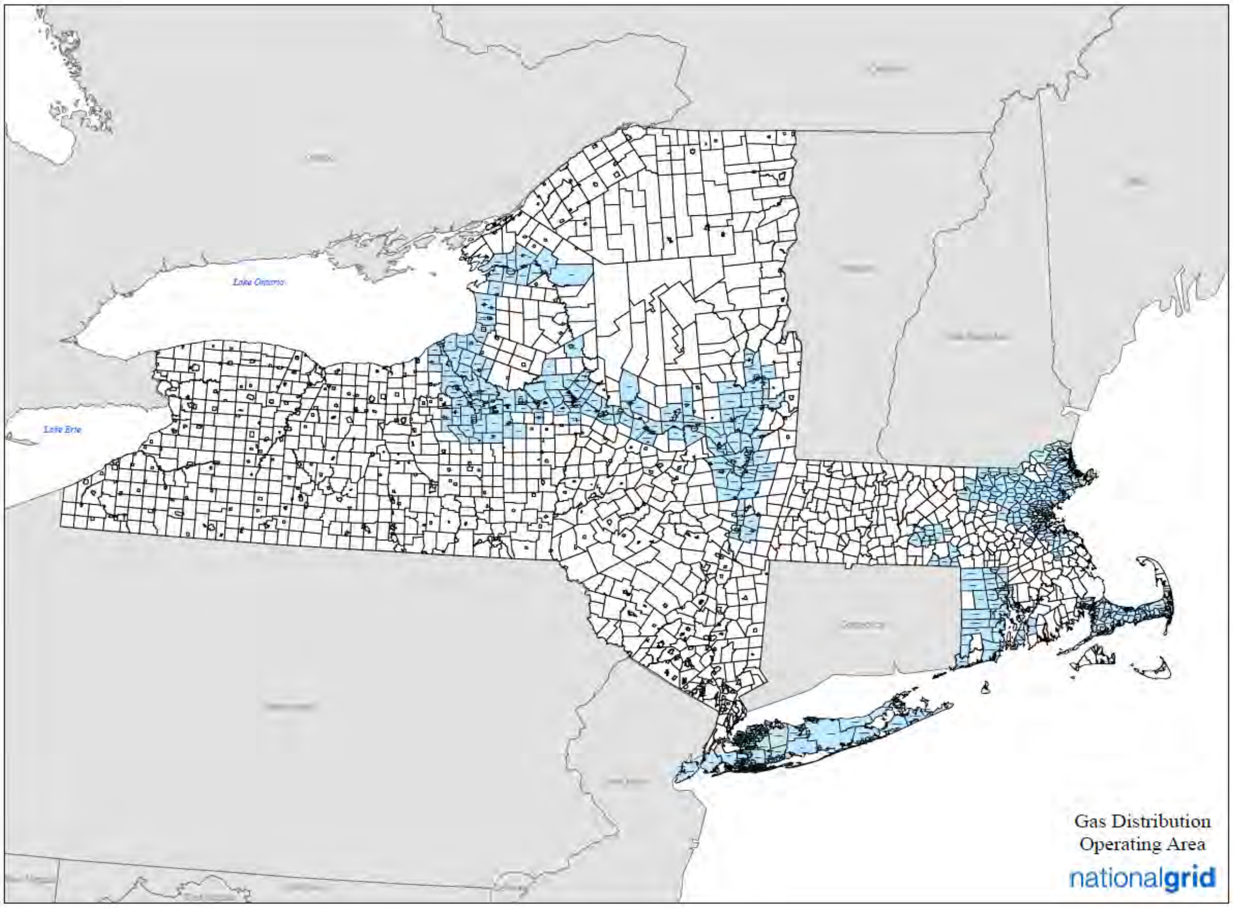

Figure 1-1: National Grid Operating Region

At this time, National Grid provides annual reports to The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) under the following Operator IDs:

Operator ID 4547 – Massachusetts (MA), Essex
Operator ID 11856 – Massachusetts (MA), Colonial Lowell
Operator ID 2066 – Massachusetts (MA), Colonial Cape
Operator ID 1640 – Massachusetts (MA), Boston
Operator ID 13480 – New York, Upstate (UNY)
Operator ID 1800 – New York City (NYC)

Operator ID 11713 – New York, Long Island (LI)

Operator ID 13480 – Rhode Island (RI)

2.0 COMPANY SAFETY

National Grid recognizes that its operations potentially give rise to risk and believes that it can eliminate or minimize those risks to achieve zero injuries safeguarding members of the public. The communities that are served include all those who have a stake in or are affected by the company. By using the best designs, processes, tools, and training, National Grid aims to develop a process-focused approach to mitigating risk, therefore increasing the overall safety of our system and customers. The Distribution Integrity Management Program (DIMP) aims to ensure pipeline integrity by identifying, evaluating, and mitigating the risks within National Grid's system. The following are key elements within the program in order to achieve this goal as per the requirement of 49 CFR §192.1007:

(a) Knowledge
(b) Threat Identification
(c) Risk Evaluation and Prioritization
(d) Threat Mitigation and Implementation
(e) Measure Performance, Monitor Results, and Evaluate Effectiveness
(f) Periodic Evaluation and Improvement
(g) Report results

2.1 COVID-19 Impact on National Grid

In March 2020, National Grid activated the Incident Command Structure (ICS) within all Business Units of the Company's US Operations to respond to the Coronavirus Pandemic (COVID-19). The Role of the ICS was to ensure the safety of all employees and to ensure COVID-19 pandemic measures were in place. Members of the ICS reviewed and approved all operational decisions, with the Incident Commander ultimately responsible for these decisions. The Incident Commander relied upon subject matter experts within the ICS, including the Operations Officer, the Safety and Health Officer, to help set standards and guidance for protective measures to be used to limit the spread of the COVID-19 virus. These Officers, in turn, utilized the expertise of other members of the organization within Operations, Safety, and Health, to assess risks associated with the work being performed and provide guidance on the most effective measures to be used by employees to protect themselves, their coworkers, our customers, and members of the public.

In May 2020, the ICS oversight responsibilities were transitioned to the Plan Forward team and the responsibilities for recommendation of standards and guidance was transferred to the Safety and Health teams in conjunction with input from Operations and Support Services teams.

The Programs within the DIM Plan as well as the Company's jurisdictional portfolio are evaluated on a monthly basis.

3.0 SCOPE

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) amended the Federal Pipeline Safety Regulations on December 4, 2009 to require operators of gas distribution pipelines to develop and implement a Distribution Integrity Management Program (DIMP). National Grid's written integrity management plan also comply with Code of Massachusetts Regulations 220 CMR 99 (Dig Safe Rules), 220 CMR 100.00 through 115.00 (Gas Distribution Code), New York Code, Rules and Regulations 16 NYCRR§ 255 (Transmission and Distribution of Gas), and Rhode Island Division of Public Utilities Rules and Regulations Prescribing Standards for Gas Utilities, Master Meter Systems and Jurisdictional Propane Systems.

The purpose of the DIMP is to enhance safety by identifying and reducing gas distribution pipeline integrity risks. Operators must integrate reasonably available information about their pipelines to inform their risk decisions. The DIMP approach was designed to promote improvement in pipeline safety by identifying and implementing risk control measures beyond those previously established in PHMSA regulatory requirements, when warranted.

This written DIM Plan addresses the DIM Rule which requires operators to develop and implement a DIM program that addresses the following elements as per §192.1007:

(a) Knowledge
(b) Threat Identification
(c) Risk Evaluation and Prioritization
(d) Threat Mitigation and Implementation
(e) Measure Performance, Monitor Results, and Evaluate Effectiveness
(f) Periodic Evaluation and Improvement
(g) Report results

Because of the significant diversity among distribution pipeline operators and pipelines, the requirements in the DIM Rule are high-level and performance-based. The DIM Rule specifies the required program elements but does not prescribe specific methods of implementation.

This written Integrity Management Plan applies to gas distribution pipelines operated by National Grid Corporation. Gas distribution pipelines include the mains, services, service regulators, customer meters, valves, regulator stations, and other gas carrying appurtenance attached to the pipe. This Integrity Management Plan also applies to transmission pipelines that are not covered by the National Grid Transmission Integrity Management Program (IMP). Table 3-1 below summarizes which National Grid piping systems (mains) are covered by the Transmission Integrity Management Program and which are covered by the DIM program.

Table 3-1: Program Coverage

Pipeline System	Approximate Miles of Mains as of 2019 PHMSA Report[1]	Asset Family	Integrity Program	Pipeline Attributes	National Grid Management Plans
Covered+ DOT Transmission	306 miles	Transmission	TIMP	= or >20% SMYS and in HCA	Assessment, Preventive & Mitigative Measures
Non-Covered DOT Transmission[2] in Piggable MCA[3]	95 miles	Transmission	TIMP	= or >20% SMYS and in piggable MCA	Preventive, Mitigative & *Performance Measures*
Other DOT Transmission[4] (Not in HCA or Piggable MCA)	96 miles	Transmission	DIMP	= or >20% SMYS and not in a HCA or piggable MCA	Preventive, Mitigative & *Performance Measures*
Local Transmission (Distribution per §192.3)	510 miles	Transmission	DIMP	<20% SMYS >124 psi NYS > 200 psi NE	Preventive, Mitigative & *Performance Measures*
Distribution	About 35,682 miles	Distribution	DIMP	< or = 124 psi NYS < or = 200 psi NE	Preventive, Mitigative & *Performance Measures*

+ Covered under Subpart O

1- Provided for illustrative purposes, see Annual PHMSA Report for current mileage.

2- As of 2020, Non-Covered DOT Transmission is not managed as Local Transmission under DIMP.

3- Moderate Consequence Area (MCA) – a new definition for all non-HCA DOT mileages effective 7/1/2020.

4- Managed as Local Transmission under DIMP.

This Plan also acknowledges National Grid's responsibilities relative to Oxbow Farm's master meter system in Middletown, RI in accordance with its Agreement with RI on Oxbow Farms Apartments (Docket# D-06-54). National Grid recognizes its ownership, operation and maintenance of the natural gas pipelines downstream of the Oxbow Farms master meter system. This includes performing walking leak surveys on a 3-year cycle and the cathodic protection of steel facilities

All piping was included in its respective asset category for threat identification, risk ranking, risk mitigation, and all other requirements as identified in 49CFR, Part 192.1015.

This plan does not cover:

Customer owned lines – piping downstream of the service line (as defined in Section 5.0).

Gathering lines –National Grid does not currently own or operate gas gathering lines.

Regulator stations are covered under the National Grid's Station Integrity Management Program (SIMP)

Transmission lines covered under the National Grid's Transmission Integrity Management Program (TIMP), refer to Table 3-1.

Liquefied Natural Gas (LNG) and Compressed Natural Gas (CNG) are covered under the Asset Management Program (AMP)

3.1 DIM Plan Review

On February 11th, 2019, Gas Distribution Engineering awarded the contract to safety management consultant, Exponent, to assist in adopting API RP 1173 core elements (DIMP focused) into the DIMP Plan, to identify gaps within the DIMP Plan, and to ensure program compliance with PHMSA Inspection Form-22 and 24. Exponent was also tasked to review the Massachusetts -Senators' letter, and AGA's recommendations as the result of 2018 Columbia gas Incident, against the information contained within National Grid's DIM Plan.

4.0 PURPOSE AND OBJECTIVES

The purpose of the DIM program is to enhance safety by identifying and reducing gas distribution pipeline integrity risks. Managing the integrity and reliability of the gas distribution pipeline has always been a primary goal for National Grid; with design, construction, operations and maintenance activities performed in compliance with or exceeding the requirements of the Code of Federal Regulations (CFR) and as well as the following where applicable: Code of Massachusetts Regulations 220 CMR 99 and 100.00 through 115.00, New York Code, Rules and Regulations 16 NYCRR§ 255 (Transmission and Distribution of Gas), and Rhode Island Division of Public Utilities Rules and Regulations Prescribing Standards for Gas Utilities, Master Meter Systems and Jurisdictional Propane Systems.

The objective of this DIM Plan is to establish the requirements to comply with 49 CFR § 192.1005, 192.1007, 192.1009, 192.1011, 192.1013 and (192.1015 for the master meter system in Middletown, RI) pertaining to integrity management for gas distribution pipelines. National Grid does not currently propose to reduce the frequency of periodic inspections and tests allowed by 192.1013 but may submit such proposals for consideration and concurrence by regulators in the future.

The DIM Plan is comprised of seven elements as depicted in Figure 4-1 (DIM Plan Section reference also provided).

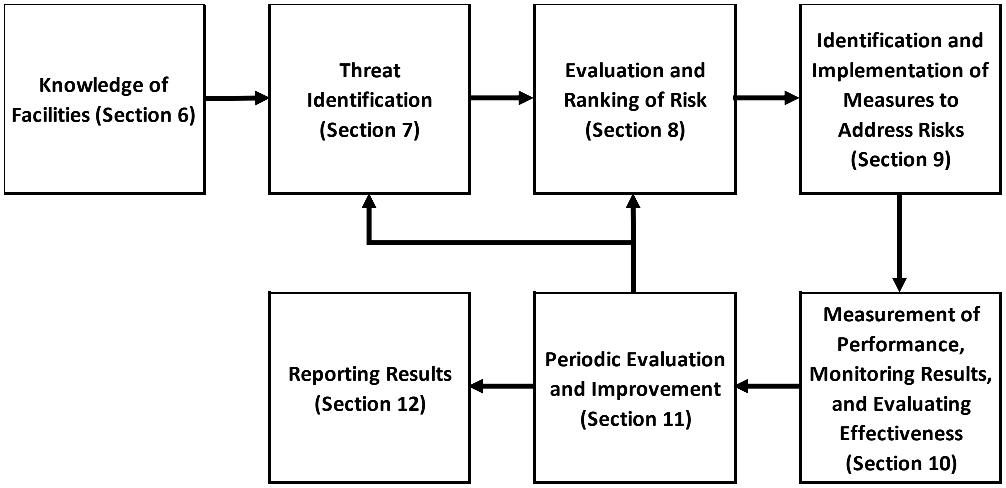

Figure 4-1: DIM Plan Elements

In addition to the key elements shown in Figure 4-1, the DIM Plan also establishes requirements for reporting of mechanical fitting failures (Section 12.1) and maintaining records (Section 0).

All elements of this DIM Plan were implemented on August 2, 2011.

4.1 Roles and Responsibilities

The purpose of this section is to describe key roles within the organization.

4.1.1 Vice President, Gas Asset Management

The Vice President of Gas Asset Management is responsible for oversight of the DIM Plan and assures that the program processes are implemented by the organization in accordance with this DIM Plan and associated regulatory requirements. The Vice President of Gas Asset Management may delegate, in writing, some or all of these responsibilities to the Director of Gas Distribution Engineering.

4.1.2 Director, Gas Distribution Engineering

The Director of Gas Distribution Engineering has overall responsibility to assure that the DIM Plan processes are implemented by the organization in accordance with this DIM Plan and associated regulatory requirements. The Director conducts a month to month review of the program with the Manager to make sure the DIM Plan aligns with the Company's operating procedures. The Director of Gas Distribution Engineering of DIMP may delegate some or all of these responsibilities.

4.1.3 Manager, DIMP

The Manager of DIMP has the responsibility for day-to-day program oversight, policy integrity, facility replacement priorities, and responsibility to assure that the plan is implemented effectively and is integrated with the Company's operating procedures. This Plan assigns authority to the Manager for approval of the DIM Plans.

4.2 DIM Program Administration

Gas Asset Management is responsible for the overall Integrity Management Program. Table 4-1 Provides a RACI Chart outlining the Departments that are either responsible, accountable, consulted or informed on the seven elements of the DIMP.

Table 4-1: Roles and Responsibilities (RACI Chart)

Stakeholder Group	Facilities Knowledge	Threat Identification	Risk Evaluation & Prioritization	Threat Mitigation & Implementation	Performance & Monitoring	Performance Evaluation & Improvement	Reporting Results
Gas Asset Management	**A**	**A**	**A**	**A**	**A**	**A**	**A**
Gas Field Ops	**R**	**R**	**C**	**R**	**R**	**R**	**I**
Gas Construction	**I**	**I**	**I**	**R**	**I**	**I**	**I**
Corrosion Control	**R**	**R**	**I**	**R**	**R**	**R**	**R**
Project Management	**I**	**I**	**I**	**R**	**I**	**I**	**I**
Resource Planning	**I**	**I**	**I**	**R**	**I**	**I**	**I**
Project Engineering & Design	**I**	**I**	**I**	**R**	**I**	**I**	**I**
Damage Prevention	**I**	**I**	**I**	**R**	**I**	**I**	**I**
Pipeline Safety & Compliance	**I**	**C**	**C**	**I**	**I**	**C**	**I**

Notes:

R = responsible for performing the task
A = accountable for overall result of task
C = consulted to provide input or participate in the task
I = informed about the progress or results of task

Table 4-2: DIM Program Administration

Plan Section	Role / Responsibility	Responsible Position *
4.1	Overall Program Oversight	Vice President, Gas Asset Management
4.1	Overall Program Implementation	Director, Gas Distribution Engineering
6.1, 6.2, 6.3 Appendix A	Updates to Appendix A	Manager, DIMP
6.4	Update Action Plans for Gaining Additional Knowledge	Manager, DIMP
6.6, Appendix A Appendix B	Conduct and Record SME Interviews as necessary for input into Appendix A (Knowledge) and Appendix B (Threat Identification)	Manager, DIMP
7.0, 7.1, Appendix B	Update Threat Identification (Appendix B) as new or modified threats are known or recognized	Manager, DIMP
8.1	Update the Risk Assessment and Ranking process and/or algorithms	Manager, DIMP
Appendix C	Perform and document updates to the Risk Assessment & Ranking Results.	Manager, DIMP
9.1, 9.2, Appendix D	Ongoing updates to Mitigation Measures to Address Risks	Manager, DIMP
10.1 thru 10.6, Appendix E	Maintain Performance Measures (updates to actual performance as well as the associated baselines)	Manager, DIMP
11.1, Appendix F	Periodic Updates to the Plan	Manager, DIMP
11.2, Appendix F	Conduct and document the Annual Effectiveness Review	Manager, DIMP
11.1, Appendix F	Conduct the Program Re-evaluation	Manager, DIMP
12.1	Prepare and submit the annual report to PHMSA and the State Pipeline Safety Authority	Manager, DIMP
13.0	Maintain DIM Program Records and Files as required by Retention Policy	Manager, DIMP

* or designee

4.2.1 Org. Chart

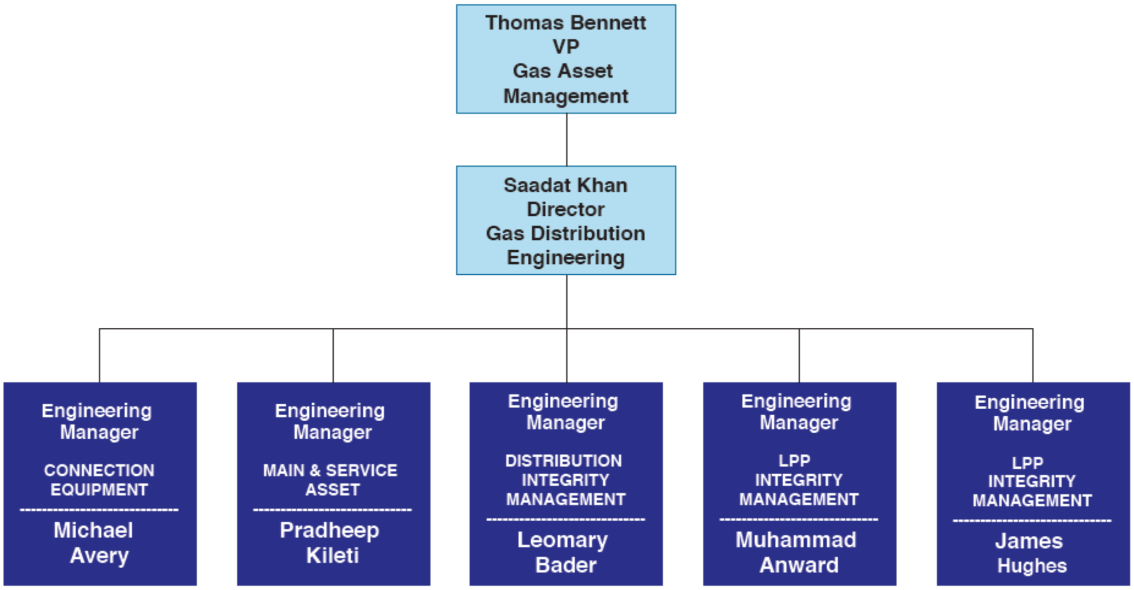

Figure 4-2: Organization Chart

4.3 How to Use this Plan

This DIM Plan is intended to be a resource and decision-making guide for implementing the DIM Program at National Grid. The 12-section general Plan applies to all National Grid jurisdictions. There is also a state-specific Appendix for each of the three states in which National Grid operates. The general IMP and DIM Program workflow is outlined in Figure 4-3.

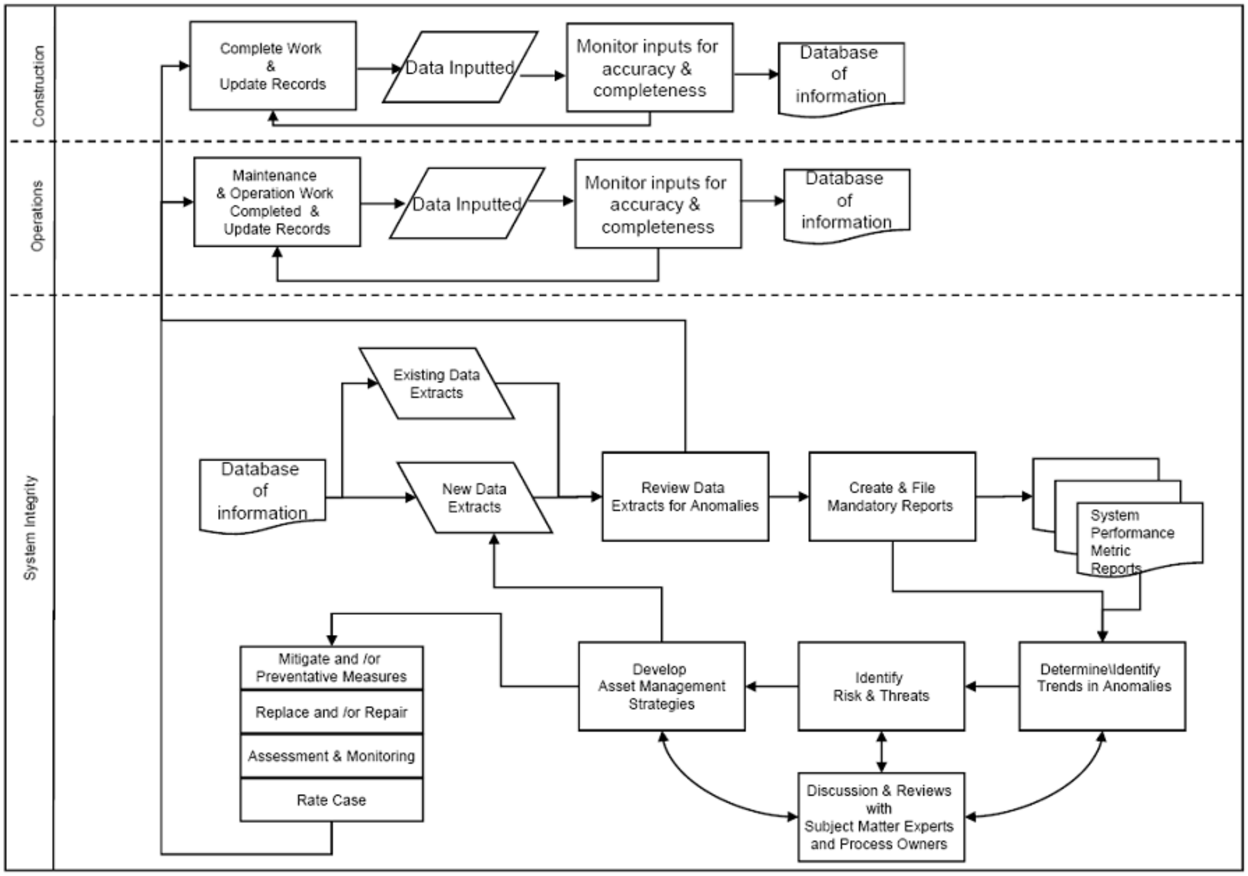

Figure 4-3: DIM Program Process Flow

5.0 DEFINITIONS AND ACRONYMS

The definitions provided in 49 CFR, §192.3 and §192.1001 shall apply to this DIM Plan. The following definitions and acronyms shall apply to this DIM Plan.

American Petroleum Institute Recommended Practice 1173 (API RP 1173): API RP 1173 is Safety Management System that was developed by the American Petroleum Institute. **Baseline**: A value established for the purposes of evaluating the ongoing results of a performance measure. Baselines are established as a matter of judgment and can change and evolve over time.

Business Management System (BMS): The Company has adopted the BMS standards that brings together best practice from across all regions.

COF: Consequence of Failure

D.I.R.T.: Damage Information Reporting Tool – A secure, national web application for the collection, analysis and reporting of underground facility damage information for all stakeholders. More information on D.I.R.T. may be found at the Common Ground Alliance's (CGA's) website at www.cga-dirt.com.

Distribution Integrity Management Plan (DIM Plan): A written explanation of the mechanisms or procedures the operator will use to implement its integrity management program and to ensure compliance with subpart P of 49 CFR Part 192 (reference §192.1001)

Distribution Integrity Management Program (DIM Program): An overall approach used by an operator to ensure the integrity of its gas distribution system (reference §192.1001)

Distribution Integrity Management Program Files: Operator records, databases, and/or files that contain either material incorporated by reference in the Appendices of the DIM Plan or outdated material that was once contained in the DIM Plan Appendices but is being retained in order to comply with record keeping requirements.

DIM Rule: 49 CFR, Part 192, Subpart P

Distribution Line: A pipeline other than a gathering or transmission line (reference §192.3)

EFV: Excess Flow Valve. An Excess Flow Valve is a safety device that is designed to shut off flow of natural gas automatically if the service line breaks

Excavation damage: A physical impact that results in the need to repair or replace an underground facility due to a weakening, or the partial or complete destruction of the facility including, but not limited to, the protective coating, lateral support, cathodic protection, or the housing for the line device or facility (reference §192.1001)

Hazardous Leak: A leak that represents an existing or probable hazard to persons or property, and requires immediate repair or continuous action until the conditions are no longer hazardous (reference §192.1001)

HDPE: High Density Polyethylene

FOF: Frequency of Failure; synonymous with Likelihood of Failure

Transmission Integrity Management Program (TIMP): A program used to manage gas transmission pipeline integrity in compliance with Subpart O of 49CFR, Part 192.

Main: A distribution line that serves as a common source of supply for more than one service line (reference §192.3)

MDPE: Medium Density Polyethylene

Mechanical fitting – As defined in the instructions for completing Form PHMSA F7100.1-1; includes Stab Type Mechanical Fittings, Nut Follower Type Mechanical Fittings, Bolted Type Mechanical Fittings and other types as may be specified by PHMSA.

NTSB: The National Transportation Safety Board

PHMSA: The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration

Pipeline: All parts of those physical facilities through which gas moves in transportation, including pipe, valves, and other appurtenances attached to pipe, compressor units, metering stations, regulator stations, delivery stations, holders, and fabricated assemblies (reference §192.3)

Region: **A**reas within a distribution system consisting of mains, services, and other appurtenances with similar characteristics and reasonably consistent risk. The term Region may also apply to a geographic area within the operator’s system.

Risk: A relative measure of the likelihood of a failure associated with a threat and the potential consequences of such a failure

Risk Model: The integration of facility data, operational data, SME input, and established algorithms to estimate the relative risk associated with a gas distribution system threat

Service Line: A distribution line that transports gas, or is designed to transport gas, from a common source of supply to an individual customer, to two adjacent or adjoining residential or small commercial customers, or to multiple residential or small commercial customers served through a meter header or manifold. A service line ends at the outlet of the customer meter or at the connection to a customer's piping, whichever is furthest downstream, or at the connection to customer piping if there is no meter. In New York State, under 16 NYCRR § 255.3, a service line ends at the first accessible fitting inside a wall of the customer's building where a meter is located within the building, or at the building wall if the meter is located outside the building.

Service Line Shut-off Valve: a curb valve or other manually operated valve located near the service line that is safely accessible to operator personnel or other personnel authorized by the operator to manually shut off gas flow to the service line, if needed (reference §192.385).

SME: Subject Matter Expert. An SME is an individual who is judged by the operator to have specialized knowledge based on their expertise or training.

Sub-Threat: A threat type within one of the primary threat categories specified in §192.1007(b)

Ticket: A notification from the one-call notification center to the operator providing information of pending excavation activity for which the operator is to locate and mark its facilities

6.0 KNOWLEDGE OF FACILITIES

The objective of this section is to assemble and demonstrate as complete of an understanding of the company's infrastructure as possible using reasonably available information from past and ongoing design, operations and maintenance activities. In addition, this plan identifies what additional information is being sought for the program and provides a plan for gaining that information over time through normal activities.

National Grid has a long history of systematically managing its distribution systems. The Company actively participates in committees of the American Gas Association (AGA), the Northeast Gas Association (NGA), the American Society of Mechanical Engineers (ASME), and the National Association of Corrosion Engineers (NACE).

The National Grid Distribution Engineering Department is responsible for the development and implementation of Integrity Management Programs for Gas Distribution facilities and pipelines. The department compiles and analyzes system and operating data, files annual reports to the Department of Transportation (DOT) and State regulators, generates periodic bulletins, and prepares various Integrity Reports and Analyses. Data analysis is an important component of Integrity Management. System performance, analysis, risk, threats, asset management, replacement strategies and rate case support are all performed. These engineering and operational activities require knowledge of the system inventory, age, and annual performance, as well as performance trends over time.

6.1 Policy & Procedures

National Grid has a number of policies and procedures that are related to integrity management and asset management of its gas distribution system. Table 6-1 below has been prepared to summarize which procedures exist to cover the elements as outlined in §192.1007.

For example: National Grid follows the nine (9) elements contained within the published PHMSA Damage Prevention Assistance Program (DPAP). The Company has been actively involved in mark outs and damage prevention for over 25 years and these processes are covered under numerous legacy operating procedures and test instructions. Mark out and damage prevention statistics are tracked, and the company expects to develop a single enterprise wide policy document to include all the data elements required under the rule.

Section 11.0, Periodic Evaluation and Improvement, will identify any areas, policy or procedures that will require changes to comply with the rule or to improve the process over time.

Table 6-1: Policy Documents Related to Integrity Management for Distribution[2]

Category	Covered Elements per 192.1007	Element Description	Procedure	Procedure Title	Regions
Annual SI Gas Distribution Report	(a) (1), (2), (4), (b), (c), & (f)	Demonstrating Knowledge, Identified Threats & Periodic Evaluation	N/A	Gas Distribution Facilities 10 Year Trend Analysis	All Regions
Improving Knowledge, Asset Information	(a) (1), (a) (3) & (a) (5)	Identify Additional information	CNST01005	Preparation of Gas Facility Historical Records	All Regions
Asset Information	(a) (1) & (5)	Demonstrating Knowledge	GEN03002	Preparation and Processing Gas Main and New Services Work Packages	All Regions
Asset Information	(a) (1) & (a) (5)	Demonstrating Knowledge	CNST06020	Completion and Processing of Gas Service Record Cards	All Regions
Risk Scoring Policy	(c)	Ranking Risk	GEN01002	Risk Scoring Policy	All Regions
Annual DOT Reports	(b) & (g)	Identify Threats & Reporting Results	GEN01020	Preparation and Filing of DOT Annual Report for the Gas Transmission and Distribution System	All Regions
Problematic Materials	(a) & (b)	Demonstrating Knowledge & Identifying Threats	GEN01009	Reporting Nonconforming Material	All Regions
Damage Prevention Policy	(d)	Mitigate Risk	DAM01000	Damage Prevention Policy	All Regions

Category	Covered Elements per 192.1007	Element Description	Procedure	Procedure Title	Regions
System Operation Procedures	(d)	Mitigate Risk	GCON02001	System Operating Procedure (SOP)	All Regions
Welding Policy	(d)	Mitigate Risk	CNCSTO5002	Welding Policy	All Regions
Operator Qualification Plan	(d)	Mitigate Risk	GEN01100	Operator Qualification Plan	All Regions
Asset Information	(a) (1), (a) (2), (a) (3), (a) (5) & (d)	Demonstrating Knowledge, Mitigate Risk	ENG01002	Design of Gas Regulator Stations	All Regions
Corrosion Design Criteria	(d)	Mitigate Risk	COR01100	Corrosion Design Criteria	All Regions
Leakage Survey	(d)	Mitigate Risk	CNST02001	Leakage Survey Policy	All Regions
Leakage Survey	(d)	Mitigate Risk	CNST02002	Leakage Surveys	NYC, LI
Leakage Survey	(d)	Mitigate Risk	CNST02003	Building of Public Assembly Inspections	NYC, LI
Leakage Survey	(d)	Mitigate Risk	LSUR-5030	Building of Public Assembly	MA
Leakage Survey	(d)	Mitigate Risk	CNST02022	Special Survey (Schools & Hospitals) for Rhode Island	RI
Leakage Survey	(d)	Mitigate Risk	CNST02001-RI	Leakage Survey Policy	RI
Leakage Survey	(d)	Mitigate Risk	LSUR-5020	Walking Survey	MA
Special Winter Operations	(d)	Mitigate Risk	CNST02004	Winter Leak Operations	All Regions

Category	Covered Elements per 192.1007	Element Description	Procedure	Procedure Title	Regions
Corrosion Control	(d)	Mitigate Risk	COR02100	Requirements for Corrosion Inspection, Testing and Repair	All Regions
Atmospheric Corrosion Inspections	(d)	Mitigate Risk	COR02010	Atmospheric Corrosion Inspection of Services	NYC, LI RI, UNY
Corrosion Control	(d)	Mitigate Risk	COR03002	Measuring Pipe-To-Soil Potential	All Regions
Valve Inspection Policy	(d)	Mitigate Risk	CNST04009	Valve Inspection Policy	All Regions
Classifying Gas Leaks	(d)	Evaluating Risk	CNST02009	Classifying Gas Leaks	NYC, LI, UNY
Eliminating Gas Leaks	(d)	Mitigate Risk	CNST02010	Leak Response and Repair	NYC, LI, UNY
Surveillance of Gas Leaks	(d)	Mitigate Risk	CNST02011	Surveillance of Classified Leaks	NYC, LI, UNY
First Responder	(d)	Evaluating Risk	CNST02013 -MA	First Responder – Massachusetts	MA
First Responder	(d)	Evaluating Risk	CNST02013 -NY	First Responder – New York	NYC, LI, UNY
First Responder	(d)	Evaluating Risk	CNST02013 -RI	First Responder – Rhode Island	RI
Odor Monitoring	(d)	Mitigate Risk	INR06001	Odor Monitoring	All Regions
Regulator Station Inspection	(d)	Mitigate Risk	INR03001	Regulator Station Monthly Inspection Policy	All Regions
Regulator Station Inspection	(d)	Mitigate Risk	INR03003	Regulator Station Annual Inspection Policy: New England	MA, RI

Category	Covered Elements per 192.1007	Element Description	Procedure	Procedure Title	Regions
Asset Management Strategy	(d)	Mitigate Risk	ENG04030	Identification, Evaluation and Prioritization of Distribution Main Segments for Replacement	All Regions
Survey & Inspection	(d)	Mitigate Risk	CNST02005	Patrolling Transmission Pipelines	All Regions
Asset Management Strategy	(d)	Mitigate Risk	CNST06001	National Grid's Policy for Inactive Services	All Regions
Asset Management Strategy	(d)	Mitigate Risk	CNST06005	Inspection and Abandonment of Inactive Services	All Regions
Regulators	(d)	Mitigate Risk	ENG02001	Design of Gas Services	All Regions
Purging Operations	(d)	Mitigate Risk	CNST03006	Purging Operations - Direct Displacement	All Regions
Purging Operations	(d)	Mitigate Risk	CNST03007	Purging Operations - Complete Inert Gas Fill	All Regions
Purging Operations	(d)	Mitigate Risk	CNST03008	Purging Operations - Slug Method	All Regions
Cast Iron Management	(d)	Mitigate Risk	DAM01007/ DAM01009	Cast Iron Encroachment Policy for New York State	LI, UNY, NYC
Cast Iron Management	(d)	Mitigate Risk	DAM01008	Cast Iron Encroachment Policy for Massachusetts and Rhode Island	MA, RI

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[2] Note: Table 6-1 may not include all the policies and procedures related to the DIM Plan. Refer to the Codes and Standards website http://dc-gasweb1/codesnstds/SP3IndexB.asp for the Company's policies and procedures.

These documents are subject to revision or replacement at any time. It is not practical to issue DIM Plan revisions for every policy/procedure change or update. Table 6-1 is updated when a full Plan revision occurs. Refer to the Company's intranet site for the most current Gas Standards, and Policies. Some procedures may not have been in effect in all National Grid regions at the time of this publication. In those cases, the enterprise-wide procedure(s) should list any currently active state-specific policies and the date(s) that the enterprise-wide procedure(s) are expected to take effect. Also, during the transition to enterprise-wide procedures, some aspects of the Rhode Island Operations and Maintenance Manual including specifications and procedures for Construction and Maintenance (CM documents) and Customer Field Services (CFS documents) will continue to be in effect.

6.2 Overview of Past Design, Operating, Maintenance, and Environmental Factors

National Grid owns and operates approximately 35,682 miles of cast iron, steel (non-IMP Transmission) and plastic distribution mains at various pressures from low to high throughout its service territory, as well as the associated services, connection equipment, instrumentation and regulation, and other appurtenances. The Company has sought and obtained regulatory approval to upgrade, replace and maintain the distribution systems needed to reduce risk and to address threats to its system and the customers it serves. Since annual system performance statistics can easily vary due to external conditions (e.g. weather), programs and plans must be based on the performance of the system over time. Identifying trends and evaluating data requires an understanding of the science of past designs, operating and maintenance histories. National Grid's knowledge of its gas distribution system is supported by the Company's gas industry experience and data.

National Grid separates its gas distribution system into two primary asset classes; Mains & Services which includes associated connection equipment, and Instrumentation & Regulation. National Grid also divides assets into sub-classes (regions) which include distinctions by factors such as material, size, vintage, pressure, construction method, and location.

6.2.1 Bare and Coated Steel Mains & Services

The modes and mechanisms of failure associated with bare-steel corrosion are well understood by corrosion experts and documented in a number of texts on the topic. It is a known fact that non-cathodically protected bare steel pipe, buried in the earth where there is moisture in the soil and without cathodic protection, will corrode over time. This corrosion may occur over the entire surface of the pipe and it may take many years before the first corrosion leak occurs. However, once the first leak on a pipeline segment occurs, there are other points on the pipe where the pipe is losing metal and where corrosion pits are becoming deeper. As corrosion pitting continues and the pipes continue to lose metal, these pipes will increasingly experience additional leaks. Eventually many additional points of corrosion may result in an unmanageable leak rate.

The deterioration mentioned above is a function of time in the ground and is also influenced by the particular environment. This fact is evidenced by the fact that the USDOT has not allowed the installation of unprotected or bare steel for gas service since 1971. Furthermore, an early scientific reference regarding the failure rate of buried steel pipe was given in the book “Soil Corrosion and Pipe Line Protection” by Scott Ewing Ph.D., published in 1938. In the text, the performance of the service pipes in the Philadelphia Gas Works System was plotted and showed that corrosion leak occurrences over time on bare steel pipe increased at an exponential rate. This graph is shown below in Figure 6-1. When this text was written the natural gas industry was still in its infancy and high performance materials such as plastic and well-coated and cathodically protected steel were not available or well understood.

Corrosion in Distribution Systems Chapter IV

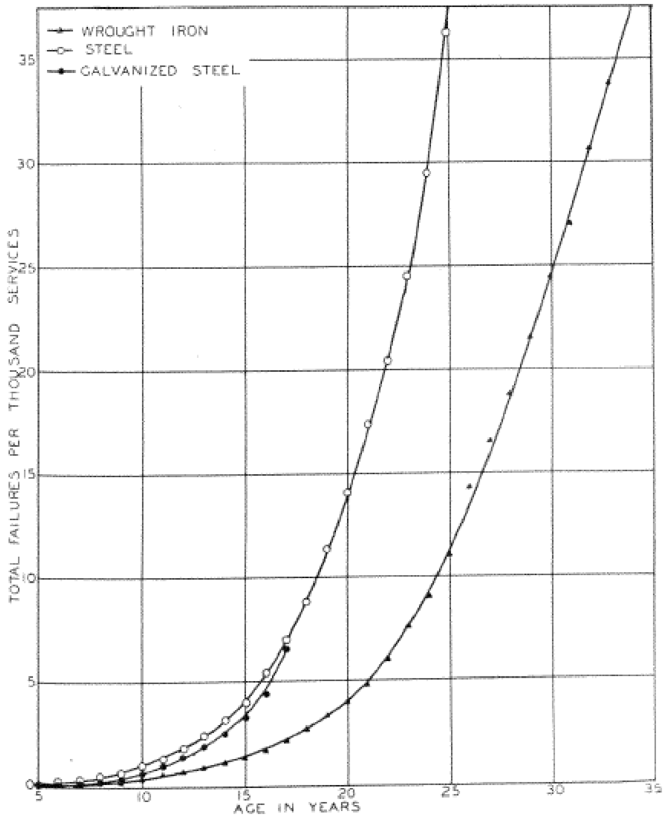


Fig. 7. Failure curves of house services in the Philadelphia Gas Works System.

Figure 6-1: Chart Indicating Exponential Leak Rates for Bare Steel Gas Service (1938)

This very same finding is corroborated today in more modern texts. One such text that is considered by many to be a foundational book for the study of corrosion is: “Peabody’s Control of Pipeline Corrosion” by A.W. Peabody, published by the National Association of Corrosion Engineers International, the Corrosion Society (Second Edition 2001). This text, published more than 60 years after the Ewing text, reaffirms the fact that leak incidents on unprotected bare pipe will occur at an exponentially increasing rate. In the Peabody text, this is shown on semi log paper. A copy of the graph used to describe this in the Peabody text (Figure 15.1 in Peabody) is shown in Figure 6-2 below.

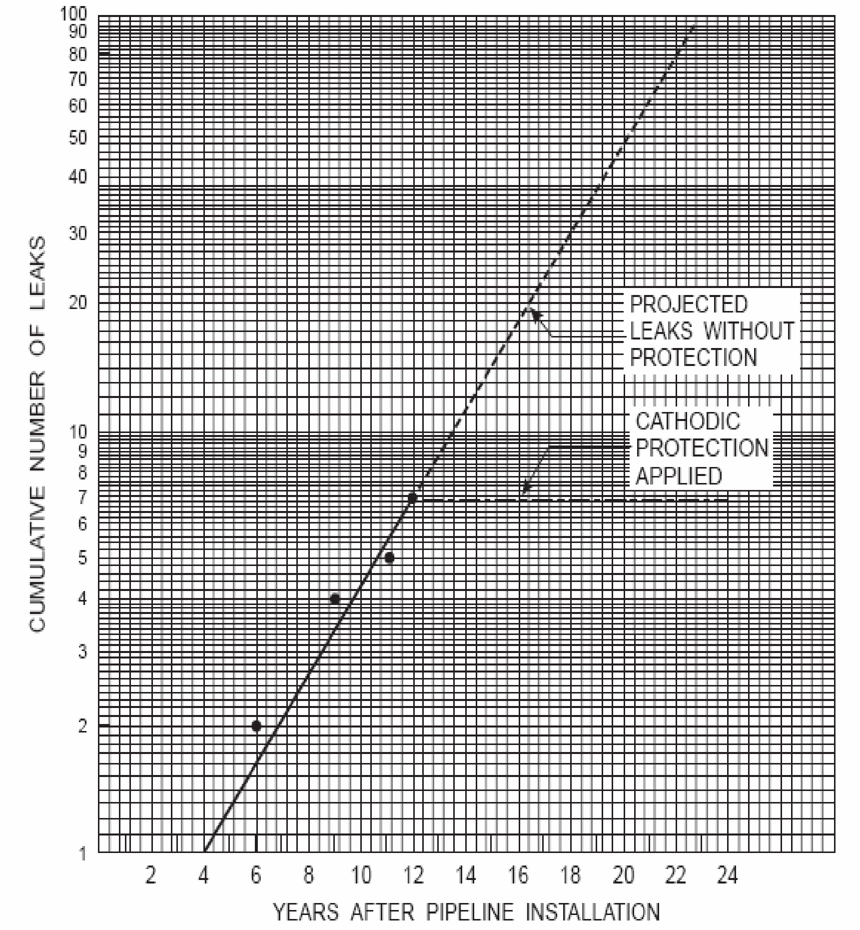


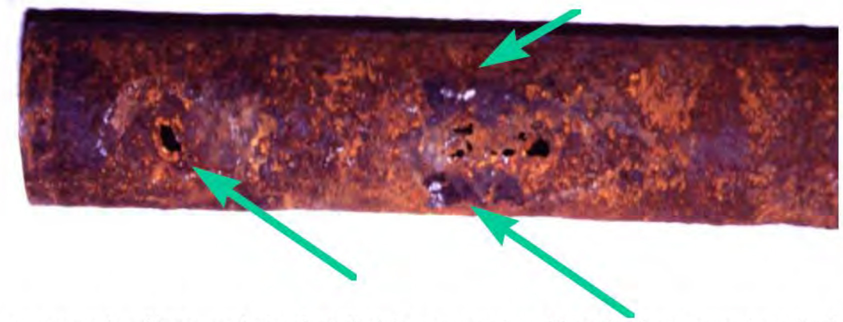
Figure 15.1 Cumulative number of leaks without CP.

Figure 6-2: Chart Indicating Exponential Leak Rates for Bare Steel Gas Service (2001)

As shown on this graph, no leakage occurs during the initial life of the pipe (first leak occurred 4 years after placing the piping in service). Then, in the next 4 years, 1.5 new leaks occurred. Then, in the next 4 years, 4.5 new leaks occurred. Then, in the next 4 years, 11 new leaks occurred. This increasing frequency of leaks continues at a rate that places the cumulative leak count off the scale, past the 23rd year, with more than 100 cumulative leaks occurring. What is important to note is not that the leaks are occurring, but that they are occurring at an ever increasing frequency as a function of time (once the corrosion process has reached the point of producing the initial leak). Although National Grid's inventory of main and services contains many pipes that have exceeded the 23 years noted, not all of these pipes have experienced leaks at the same initial time.

This exponential growth of leak occurrences on bare-steel pipe is scientifically documented as indicated in the text above. This exponential growth of leak occurrences on bare steel pipe is also well known by experienced gas system operators who perform bare-steel repairs and find themselves installing multiple leak repair sleeves on sections of corroding pipe.

This ever increasing frequency of leak incidents is evidence of the corrosion mechanisms. Bare steel pipe is undergoing continuous deterioration by corrosion. In some locations, the deterioration is more aggressive than in other locations. In many cases, although the wall thickness is penetrated at only a single point, it can be seen that the entire pipe may have been degraded to the point where future leaks will occur at an ever increasing rate. This is visually obvious by viewing the piece of corroded pipe shown from the USDOT website in Figure 6-3. In this picture, there may be only a few points of actual leakage, but the pipe shows apparent signs of distress along the entire wall thickness.



An example of bare steel pipe installed for gas service. Note the deep corrosion pits that have formed. Operators should never install bare steel pipe underground. Operators should use either polyethylene pipe manufactured according to ASTM D2513 or coated steel pipe as new or replacement pipe. If steel pipe is installed, that pipe must be coated and cathodically protected.

Figure 6-3: Bare Steel Pipe Corrosion

Wrought iron pipes, while less brittle than cast-iron mains and service lines, are also subject to corrosion. The corrosion of wrought iron is similar to bare steel in its exponential leak rate growth.

Coated steel mains and services, when cathodically protected against corrosion, are an excellent and well-performing gas distribution material. They resist corrosion and have significantly higher strength than plastic. All underground steel pipe installed after July 31, 1971 is required by federal code (per 49 CFR 192, Subpart I) to be coated and cathodically protected and is regularly tested to ensure an adequate level of protection and compliance. In many cases, steel pipe installed before 1971 is also coated, cathodically protected, and regularly tested. However, coated steel mains and services that are unprotected can undergo accelerated corrosion if the coating is breached – either by damage or disbonding. Such mains are currently viewed by National Grid as not protectable and are considered to be ineffectively coated and subject to the same risks as bare unprotected steel.

6.2.2 Cast Iron Mains

The natural gas industry considers cast-iron mains, non-cathodically protected steel mains, and services to be higher risk materials. Cast Iron mains are among the oldest materials remaining in gas distribution systems, often pre-dating the 1900's. Gas facilities in most large older cities (particularly in the Northeast) account for the largest amounts of cast iron dating back before the turn of the 20th century. The cast iron system in National Grid's Boston Gas region is the second oldest in the United States (after Philadelphia Gas Works). The changeover from the use of cast iron to steel started slowly in the 1920s. During the 1940s, following the discovery of electric arc welding which provided a tight joint, steel pipe gradually replaced cast iron entirely. The industry has since replaced steel pipe with plastic pipe and cathodically protected coated steel pipe as the primary materials for distribution systems. Similar to unprotected or bare steel mains, the USDOT no longer permits installations of cast iron mains or service lines.

There are 21,272 miles of buried cast iron pipe still in service in the United States distributing natural gas as of 2019. Much of this pipe has provided excellent service over its life. However, aging cast-iron mains have experienced gradual deterioration and are susceptible[1] to breaks, cracks, and other failures such as joint leaks.

As the owner and operator of nearly 20 percent of all the cast iron distribution main in the United States, National Grid has unparalleled experience in dealing with cast iron mains in a safe and reliable manner. Extensive research has been done throughout the years by National Grid's legacy companies and National Grid's cast iron replacement programs have been carefully designed to continue cost-effective operation in the safest and most reliable way possible.

In 2013, National Grid also participated in the development of an AGA white paper to Congress entitled "Managing the Reduction of the Nation's Cast Iron Inventory", which is incorporated here by reference.

Experience from companies[2] that operate greater mileage of cast iron has identified certain parameters associated with higher leak and failure rates. Many of these parameters are useful to evaluate in identifying pipe segments more prone to failure. The predominant among these are:

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[1] Other environmental effects, including methods used to support the pipe, frost, and vehicle loads that impose additional stress on the pipe, thus further reducing its useful life, exacerbate the deterioration caused by graphitization.

[2] A number of studies of cast-iron and factors affecting their service life have been made. A number of these studies and evaluations were made by ZEI, Inc. (formerly Zinder Eng Inc) Ann Arbor Michigan, including articles written; see Gas

- Pipe graphitization history
- Manufacture and original wall thicknesses, sometimes associated with vintage pipe diameter size and flexural resistance
- Loading and stresses associated with:
    - Operating pressures
    - Weather induced loads such as depth of winter frost penetration and frost action
    - Traffic loads
    - Construction impacts
    - Block supports
    - Settlement
    - Undermining
    - Washouts
    - Direct impact

Under research contracts with Cornell University that started in the early 1980's, the former Brooklyn Union (now part of National Grid) and other NY Gas Group companies sponsored research that has developed a library of technical papers on CI main condition, performance and evaluation. National Grid's Cast Iron related policies are informed by those studies, the most recent of which was prepared in 2008. National Grid's New York City Cast Iron system (the former Brooklyn Union Gas - which accounts for nearly 30% of all the Cast Iron in National Grid) dates from before 1895 through approximately 1950. After approximately 1930, centrifugally cast pipe predominates over pit-cast cast iron. Pit cast pipe was less uniform than later pipe, though out-of-spec wall thickness is rare. French cast iron piping of approximately WWI vintage has been reported to be overly brittle. Centrifugally cast pipe is theoretically more prone to stress crack corrosion according to UK studies, but that has not been recognized on the New York City system.

6.2.2.1 Cast Iron Graphitization

NACE[3], in its Introduction to Corrosion Basics, 1984, pg. 216, states that the corrosion rate of cast iron is comparable to that of steel in a soil. The iron is removed from the metal, leaving a network of carbon particles by the de-alloying phenomenon termed graphitization. The residual carbon retains the form of

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Industries, February 1986. The Department referred to this report in its February 28, 1991 Order concerning its investigation into proposed rules for cast iron.

[3] National Association of Corrosion Engineers.

the pipe, and unless the weakened pipe is fractured, the graphitized pipe will continue to transport gas. Once the cast-iron is graphitized, the exterior becomes an extremely noble electrode in any galvanic couple. Thus, uncoated or unprotected cast-iron or steel will act as the anode in contact with this “noble” pipe.

It should be noted that graphitization is still relatively infrequent within National Grid and only included here to demonstrate the Company’s knowledge base. Experience shows that the soils in New York City and Long Island are the most benign with respect to graphitization. Upstate and New England soils appear to be somewhat more aggressive, though there does not appear to be much of a difference in the resulting frequency of graphitization.

Graphitization occurs when cast iron is exposed to certain types of corrosive environments over time. The resultant graphitization causes the beam strength to weaken and the pipe to become brittle and contributes to rates of broken mains. In its 1971-72 study of cast iron, the New York Gas Operations Advisory Committee report stated that its experience indicated graphitization was limited to certain specific localized environments. These were areas where there were localized salt water exposures or extreme stray current discharges (such as at substations and electrified rail transit systems).

Cast iron contains carbon, in the form of graphite, in its molecular structure. It is composed of a crystalline structure as are all metals (i.e., it is a heterogeneous mass of crystals of its major elements iron, manganese, carbon, sulfur and silicon). In the presence of acid rain and/or seawater, the stable graphite crystals remain in place, but the less stable iron becomes converted to insoluble iron oxide (rust). The result is that the cast iron piece retains its shape and appearance but becomes weaker mechanically because of the loss of iron.

Graphitization is not a common problem. It generally will occur only after bare metal is left exposed for extended periods, or where joints allow the penetration of acidic rainwater to internal surfaces. Therefore, there is a time dependency for graphitization to occur, and excluding other factors, the expectation would be that older pipes will have experienced deeper graphitic penetration and disintegration. Soil moisture is normally enough to provide a conducting solution. This corrosion process is galvanic, with the carbon present acting as the noblest (least corrosive) element and the iron acting as the least noble (most corrosive) element. The composition or microstructure of the iron affects the durability of the object because the rate of corrosion is dependent upon the amount and structure of the graphite present in the iron.

Graphitic corrosion or graphitization[4] is a form of de-alloying or parting caused by selective dissolution of iron from cast iron (usually gray cast iron). It precedes uniformly inward from the surface, leaving a porous matrix of the remaining alloying element, carbon. Graphitization occurs in salt water, acidic mine water, dilute acids, and soils, especially those containing sulfates and sulfate reducing bacteria. There is no outward appearance of damage, but the affected metal loses weight, and becomes porous and brittle. The porous residue may retain appreciable tensile strength and have moderate resistance to erosion. For example, a completely buried cast-iron pipe may hold gas under pressure until jarred by a worker's shovel. Sulfates and sulfate-reducing bacteria in soil stimulate this form of attack.

6.2.2.2 Cast iron Pipe Support

A number of methods were used to install cast iron pipe sections. The most common method involved support of individual lengths of pipe with wooden or concrete blocks near each end. The blocks served to both support the main during construction and slope the pipe for proper drainage of manufactured gas liquids. Some installations included support near the center, placing pipe on mounds of earth instead of blocks, and still others directly on the trench bottom. Placing pipe on the trench bottom actually provides the greatest life expectancy as it minimized unsupported lengths of pipe, increased ability to withstand superimposed loads, and reduced beam action. Installation on wooden blocks has been seen to cause increased instances of graphitization at the point of contact between the cast iron and wood. There are no records indicating the method of installation; though at times, it can be inferred from the condition of the pipe. Block supports may also be detrimental when they cause pipe sections to behave as beams. All of these factors result in regionally higher break rates, which are used for identifying system replacement.

6.2.2.3 Cast Iron Pipe Size – Diameter and Flexural Resistance

Cast iron is more brittle and relatively weak as compared to steel. Sections of cast iron pipe supported at their ends on blocks experience loading and act as a beam. Flexural stress is created by the weight of the soil overburden, by the weight of the pipe itself, and by forces such as frost heave and other loads. Results of one study[5] to identify those main sizes that experience the highest failure rates revealed that 4", 6" and 8" diameter pipe accounted for 90% of the incidences of breaking and cracking. Said another way, the beam strength is much less for smaller diameters of cast iron pipe than for larger diameter

[4] NACE defines graphitic corrosion in its Introduction to Corrosion Basics 1984, at page 107.

[5] 2007 Final Report on Peoples Gas Light and Coke Cast Iron Main Replacement – Kiefner and Associates, Inc.

pipe. There is an increase in relative beam strength for cast iron pipe with diameters equal to or greater than 10", providing some higher relative safety. In its system integrity analyses, National Grid regularly tracks the cast iron breakage "rates" on all of its systems and has found similar results.

While National Grid has not experienced extensive cast iron graphitization, it should be noted that cast iron pipe was installed bare and cannot be adequately protected by cathodic protection. Graphitization reduces wall thickness and thus reduces flexural resistance. An evaluation of flexural resistance (which is directly related to the "section modulus"[6]) demonstrates that a wall loss of 0.2 inch will result in a change in the relative section modulus of 4" through 8" diameter cast iron of between 45% and 52%. This reduced flexural resistance demonstrates that the smaller size pipes are far more susceptible to breakage than the larger size pipes.

Research performed by Cornell University identified 2000 micro strain as a critical level for cast iron pipe. For the purposes of replacement decisions related to parallel trench construction, 600-800 micro strain (0.06-0.08%) was selected as the replacement criteria. The condition of the cast iron pipe tested supported those levels as a proper margin of safety, which has been proven out by field experience under New York State PSC waiver and Massachusetts regulation.

When cast-iron main was originally installed as low pressure piping, its bell and spigot joints were filled with compacted jute backing and sealed with molten lead and lead caulking or cement. After years of service and switching from wet manufactured gas to natural gas, the jute has dried out and reduced in volume, weakening the seal within the joint. Additionally, exterior loads impact and flex the pipe and disturb the seal. Loads adversely impacting cast iron mains result from traffic, seasonal weather, vibration, and soil movements due to nearby construction activities; causing these joints to leak. Cornell observed that depending upon the diameter of the pipe, the joint contributed more or less to the flexibility of the pipe. Lead and jute joints were found to flex more than cement jointed pipe, which is common on Staten Island in New York City. Lead joints were also seen to leak when flexed, and later creep and seal again in low pressure applications.

6.2.2.4 Cast Iron Bell Joints

Cast Iron and Ductile Iron gas mains are constructed with bell and spigot joints. These joints were most often sealed with jute and lead, cement, or encased in concrete in order to make the joint leak free and rigid. In many cases, bell joints have been retrofitted with mechanical bell joint clamps or bell joint

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[6] Section Modulus is a function of outside diameter, inside diameter, and wall thickness.

encapsulation as a means of addressing bell joint leaks. In the New York City operating area (formerly Brooklyn Union), all joints on cast iron pipe operating at a 15 psig MAOP have been sealed with mechanical clamps or elastomers. A majority of the low pressure joints are sealed as well.

National Grid has used a number of methods to seal cast iron joints in past years. These methods fall into five broad categories and are listed below:

- Metallic Joint Clamps – A two-part clamp secured by bolts and designed to force a steel ring over the bell and spigot joint. Pressure from a rubber gasket presses on the circumferential lead face of the bell joint. One problem caused by this method of repair is that the steel clamp can become anodic to the cast iron, resulting in corrosion.
- Shrink Sleeves – Rubber/plastic materials used have varied as have the shrinking methods (electrical or thermal). A sleeve is fitted over a cleaned bell and spigot joint as well as a short section of pipe beyond the joint. The material is then essentially shrink fit to seal the joint. Extensive cleaning of the joint area is required and if performed incorrectly it can cause these to fail over time.
- Anaerobic Seals - These have had the advantage of exposing only the top part of the joint. A hole is drilled into the bell and an anaerobic sealant injected into the jute backing. The sealant material wicks into the jute and joint surfaces sealing the joint.
- Encapsulants - Also commonly called boots or muffs, encapsulate the face of the joint. This method is more effective than shrink sleeves and not subject to corrosion or gasket failure as is common with metallic clamps, nor are they as susceptible to improper installation.
- Internal sealing methods - There have been a few approaches used over the years, including internal clamping of the joint, fogging of the main, spraying the inside of the joint with an atomized sealer, mechanically applying a sealant of the joint and the internal pipe surface from within the pipe as well as pipe lining with a type of “innertube”.

Metallic Joint Clamps and Shrink Sleeves are no longer used, though metallic clamps that were properly coated are often found to be in good condition. Anaerobic seals are often selected when a large excavation is undesirable, exposing the entire joint is difficult or impossible, or in high water tables where it is difficult or disruptive to effectively encapsulate the joint. The current internal sealing method used is known as "CISBOT" and it has diameter, length and other limitations. Internal Lining is an expensive process, but adds other benefits. The best application for internal liners is on stretches of main without tie-ins or large numbers of services. Encapsulating bell joints is generally the most effective of the methods and the most commonly used. Many thousands of cast-iron joints are sealed every year in response to leaks. While this creates a high cost of operating and maintaining this class of asset material, leaking joints have rarely led to incidents.

6.2.2.5 Cast iron Loading and Impact

Cast iron is much more brittle than steel and is susceptible to cracks or breaks due to loading and impact. Main breaks are a major concern due to the large amount of gas that may be released in such instances. This is made worse when the driving force behind the cast-iron main leak is the operating pressure. Medium or high pressure cast iron aggravates the safety threat posed by cast-iron mains.

Cast iron breaks are often more severe than the typical corrosion leak. A cracked main may leak at a high rate, quickly saturating the area around the break with natural gas, migrating and entering conduits and following the path of other utilities to homes or other confined spaces such as utility vaults and sewers. Cast iron main breaks are of particular concern during periods of cold temperatures when frost actions may cause additional stresses on these mains and when frost caps create an impermeable barrier of the earth’s surface, preventing leaking gas from safely venting to the atmosphere. Such leaks may be difficult to pinpoint as they can cause high gas readings at appreciable distances from the actual leak site. The difficulty of leak investigation is aggravated under frost conditions and with depth of frost penetration. The inability of the gas to safely escape increases the risk to nearby residents, as gas follows the path of least resistance, often to nearby habitable structures.

The inventory of small diameter cast iron in National Grid’s service territory varies. Small diameter cast iron (8” and less) is most susceptible to bending stress and impact. National Grid policies define the replacement criteria for sound cast iron adjacent to parallel trenches or exposed due to crossing excavations. Additional consideration is given to conditions such as system performance and removal of pavement over shallow cast iron mains during road reconstruction.

6.2.3 Plastic Pipe

Plastic pipe has a more recent but yet almost 50 year history. Various plastic piping materials were developed and introduced into the gas industry in the late 1960’s and early 1970’s. The industry became more focused on the corrosion and performance concerns with unprotected piping following the 1968 “National Gas Pipeline Safety Act”. This required Federal regulations on Gas Transmission & Distribution systems in the U.S. and placed them under the jurisdiction of the Department of Transportation. Table

6-2 below is a summary of the plastic pipe materials that have been manufactured and marketed to the gas industry with a notation as to whether or not they are known to exist on the National Grid system.

The Company has included Aldyl-A as part of the leak prone pipe inventory and is scheduling for replacement. This includes plastic pipe installed pre-1985.

Table 6-2: Plastic Pipe Material Summary

Plastic Material Type	Known to Exist in the National Grid Gas System?
PVC – Polyvinyl Chloride	No
ABS – Acrylonitrile Butadiene Styrene	No
CAB – Cellulose Acetate Butyrate*	No
PB – Polybutylene**	Yes
PP – Polypropylene	No
PA – Polyamide	No
Century MDPE 2306	No
Aldyl-A (1972 and Prior) PE 2306	Yes
Aldyl-A (Post 1972) PE 2306	Yes
Aldyl-A (1973 and After) PE 2406	Yes
Aldyl 4A (green) PE 2306	Yes
MDPE 2406	Yes
MDPE 2708	Yes
HDPE 3306	Yes
HDPE 3406	Yes
HDPE 3308	No
HDPE 3408	Yes
HDPE 4710	Yes

* A limited number of 1-inch clear CAB services were installed in Upstate New York but have been reported to have been removed.

** Rhode Island only

NOTE: Fiberglass main was once used in MA, but has been completely removed to the best of our knowledge.

Table 6-3 below provides a summary of the currently approved plastic material types.

Table 6-3: Currently Approved Plastic Pipe Material Summary

Current Approved Plastic Material Type	Region(s)
PE 2708/PE 2406	NYC/LI
PE 4710	NYC/LI
PE 4710	UNY
PE 4710	RI
PE 2708	MA
PE 4710	MA

Details for plastic pipe by Company, Material designation, description, and Region are provided below in Table 6-4.

Table 6-4: Summary of Plastic Pipe by Region

Common Name	Company	Material Designation	Physical Description	Region(s)
Aldyl A*	Dupont Pipe	PE 2306 (pre-1973)	Pink, but can turn grey	LI, MA, NYC*, RI, UNY
Aldyl A*	Dupont Pipe	PE 2306 (1973 & later)	Pink, but can turn grey	LI, MA
Aldyl A*	Dupont Pipe	PE 2406 (1973 & later)	Pink, but can turn grey	LI, MA, NYC*, RI
Aldyl 4A	Dupont Pipe	PE 2306	Green	LI
CAB (Cellulose Acetate Butyrate)	Unknown	Unknown	Clear tubing	UNY***
Polybutylene	Clow Corp.	(1976 – 1979)	Tan	RI
Red Thread	Inner-tite	Epoxy-Fiberglass	Orange/red	NYC****, UNY
Inner-tite	Inner-tite	PE3306	Glossy Black	NYC,LI
Barrett	Barrett	PE3306	Glossy Black	NYC,LI
Orangeburgh	Orangeburgh	PE3306	Glossy Black	NYC,LI
Allied	Allied	PE3306	Glossy Black	NYC
Celanese Ultrablue	Celanese	PE 3306	Glossy Black	NYC
Crestline HD	Crestline	PE 3306	Glossy Black	UNY
Dupont HD	Dupont	PE 3406	Dull Solid Black	NYC**
Drisco 6500	Phillips Driscopipe	PE 2406	Orange	LI,MA,UNY
Drisco 6500	Phillips Driscopipe	PE 2406	Yellow	LI,MA,UNY
Driscoplex 6500	Performance Pipe	PE 2406/PE 2708	Yellow	LI,MA, RI
Drisco 7000	Driscopipe / Phillips	PE 3406	Solid Black	NYC, RI, UNY

Common Name	Company	Material Designation	Physical Description	Region(s)
Drisco 8000	Driscopipe / Phillips	PE3406/PE3408	Solid Black	NYC, MA,RI, UNY
Plexco	Plexco Pipe	PE2306	Orange	RI
Plexco	Plexco Pipe	PE2406	Orange	LI,MA
Plexco	Plexco Pipe	PE 2406	Yellow	LI,MA,RI
Plexco Yellowstripe	Plexco Pipe	PE 3406/3408	Black pipe with 4 yellow stripes	LI, MA, NYC,RI, UNY
Plexco Plexstripe II	Plexco Pipe	PE 3408	Black pipe with 2 yellow stripes	UNY
CSR Polypipe 4810	CSR Poly	PE 3408	Black pipe with 6 yellow stripes	UNY
Extron TR 418	Extron	PE 2306	Orange	UNY
Drisco/Performance Pipe 6800	Driscopipe / Phillips	PE 3408	Black with 3 yellow stripes	LI, NYC, UNY, RI
Drisco/Performance Pipe 8100	Driscopipe / Phillips	PE 3408/4710	Yellow exterior black pipe	NYC, RI, UNY
Performance Pipe 8300	Performance Pipe	PE 3408/4710	Black with 4 yellow stripes	LI, RI, UNY
US Poly UAC 3600 (formerly DuPont)	US Poly	PE 3408/ PE 3710	Black with 3 yellow stripes	LI, MA, NYC, RI, UNY,
US Poly UAC 3700 (formerly DuPont)	US Poly	PE 3408/4710	Black with 3 yellow stripes	LI, MA, NYC, RI, UNY,
JM Eagle UAC 3700 (formerly US Poly)	JM Eagle	PE3408/PE4710	Black with yellow stripes	LI, MA, NYC**, RI, UNY
UPONOR UAC 2000	DuPont	PE 2406	Yellow	LI, MA, NYC**, UNY
US Poly UAC 2000 - Formerly UPONOR	US Poly	PE 2406/PE 2708	Yellow	LI, MA, NYC, UNY
JM Eagle UAC 2000 (formerly US Poly)	JM Eagle	PE 2406/PE 2708	Yellow	LI, MA, NYC, UNY
Charter Plastics Inc	Charter Plastics Inc	PE 2406/PE 2708	Yellow	LI, MA, NYC
Charter Plastics Inc	Charter Plastics Inc	PE 3408/ PE 3608/ PE 4710	Black with 3 Yellow stripes	LI, MA, NYC, RI, UNY
Endot Bi-modal MDPE	Endot	PE 2406/PE 2708	Yellow	LI, MA, NYC,
Endot	Endot	PE 3408/ PE 4710	Black with 3 Yellow stripes	LI, MA, NYC, RI, UNY

* A very limited amount of Aldyl A exists due to a trial installation in New York City.

** limited to Staten Island

*** A limited number of 1-inch clear CAB services were installed in Upstate New York but have been reported to have been removed

**** Limited to Greenpoint Area Only - RETIRED

6.2.4 Copper Piping

Copper pipe was used for gas service lines in many service territories throughout the United States. Within National Grid's service territory, copper was predominantly used for service renewal by inserting copper inside of deteriorated steel services. In a much more limited manner, copper services were occasionally direct buried.

Copper services may be subject to leakage caused by corrosion. In particular, direct buried copper services may be subject to advanced rates of corrosion in the presence of dissolved salts in the soil (e.g., deicing salts to melt ice and snow on road surfaces).

Copper tubing is far less of a corrosion risk than steel—National Grid's corrosion experience with 114,886 copper services, which indicates less percentage of corrosion leaks associated with copper compare to all eight PHMSA threats.

When inserted in older steel services, the steel provides corrosion protection since the steel is more anodic than the copper. The older steel also protects the copper pipe from excavation, natural forces, and other damage. Corrosion on National Grid's copper services has been limited to locations where it was connected to dissimilar metal without insulating joints to provide isolation between the two dissimilar metals. The dissimilar metal is anodic to the copper and corrodes. The most common situation for this exists where copper is joined to an iron or bronze service tee (the iron tees are the most susceptible). Records of where and when these dissimilar metals were installed do not exist.

6.2.5 Instrumentation & Regulating Facilities

The Instrumentation & regulating assets family includes regulating stations, transfer stations, heaters, control lines and all ancillary equipment. National Grid has over 1,800 instrumentation & regulating facilities within its service territory. Over the years there have been various designs, manufacturers and styles of stations. These include single stage with relief, double stage with either a working or open monitor. In addition, they may be above grade, below grade, in the same vault, or in separate vaults. Stations may have one single run or multiple runs. Each station is specifically designed for the upstream and downstream pressures and the intended capacity.

The regulating facilities have been designed for continuity of supply and peak performance during normal and critical gas demand periods. They have been designed for specific load and pressure requirements. The following design philosophy has been utilized:

- Stations are designed using corporate engineering guidelines for flow capacity and pressure control with consideration given to other factors such as the required footprint, security, noise, operation, maintenance, community impact and the potential for third-party damage.
- Stations are designed in accordance with applicable state and federal codes to help ensure safe and continuous supply of natural gas to our customers and the community we serve.

During the annual performance test, any minor maintenance issues are corrected. Any major repairs requiring parts replacement and calibrations are rescheduled. By the time all work is completed and the station is ready for the next season, the operating condition of that particular regulating station will be back to 100%.

A good asset management program consists of systematic and coordinated activities and practices through which National Grid optimally manages its assets, performance, risks and expenditure. The evaluation process will identify two key questions, what we expect the asset to do and what are we actually doing to maintain it.

National Grid is committed to managing and investing in our system to protect the future of our business. This is done through proactively managing existing and future risks as well as contributing to the economic growth of the region in which we operate through the provision of safe, high quality and dependable services.

National Grid Asset Management and Engineering has committed to reach compliance with the Business Management System (BMS) standards by October 2020. The BMS standards have been written to ensure clear guidance on what is expected from our leaders and focus efforts towards addressing the most important asset management issues and opportunities. They establish performance requirements and promote continual improvement to drive value and mitigate risk.

6.2.6 Construction Methods

The existing National Grid distribution system is one of the oldest in the country and various methods of construction may have been utilized from time to time. Table 6-5 summarizes the types of construction Practices that have been used or practiced within the company's service territory.

Table 6-5: Construction Practices Summary

Construction Practice	Comment
Open trench installation	Yes
Support and Blocking	Yes
Service Replacement via insertion of Copper	Yes
Replacement of mains and services via Insertion of Plastic	Yes
Main Replacement via insertion and pipe splitting via PIM (Pipe Insertion Method)	Yes
Main Replacement via insertion and pipe splitting (static pipe bursting)	Yes
Internal lining / swage-lining / roll-down	Yes
Joint Trench with other utilities	Yes
Unguided Bore (e.g. Hole Hog)	Yes
Guided Directional Bore / Drill	Yes
Blasting	Yes
Plow-in	Yes

6.2.7 Excess Flow Valves

National Grid has implemented the recent Pipeline and Hazardous Materials Safety Administration (PHMSA) requirement of 49 CFR 192.381 Service Lines: Excess Flow Valve Performance Standards, and 192.383 Excess Flow Valve Installations. National Grid has been installing excess flow valves for new and replacement high pressure residential service lines in all areas since the early 1990's and since the late 1970's in NYC.

Ball type EFVs installed in the 1970's has been found to be unreliable, but there have not been issues with the spring & plunger type. National Grid uses EFVs of various capacities, including branch service lines serving single family residence, multifamily residence, small businesses where they are compatible with load patterns and volumes. Refer to Table 6-7 for additional information.

Notifications to customers of their right to request installation of an EFV on service lines that are not being newly installed or replaced have been made through the Company's website[7].

National Grid is in the process of developing a tracking and maintenance program for new or replaced service valves as required by 49 CFR 192.385 Manual Service Line Shut-off Valve Installation requirements.

6.2.8 Mechanical Fittings

A summary of the known mechanical fittings currently in service is detailed below in Table 6-6.

Table 6-6: Mechanical Fittings

Mechanical Fitting Manufacturer	Type	Region
Perfection	Stab Fitting	All
Lyco	Stab Fitting	LI, RI
AMP Fittings	Stab Fitting	All
Reynolds	Nut-Follower	RI
ContinentalFittings	Stab Fitting	MA
Chicago Fittings	Nut-Follower	MA
ContinentalFittings	Nut-Follower	MA
Mueller w/ Dresser End	Nut-Follower	All
Normac	Nut-Follower	All
Dresser	Nut-Follower	All
Dresser	Bolted	All
Eastern	Bolted	All
Plidco	Bolted	LI, NYC, MA
Mueller	Bolted	All
Smith Blair	Bolted	All
CSI	Bolted	All
Dresser Posi-Hold	Hydraulic	All

6.3 Characteristics of Design, Operations and Environmental Factors

The characteristics of the pipeline's design, operations and environmental factors that are necessary to assess the applicable threats and risks are summarized in the following sections as well as Appendix A.

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[7] **Natural Gas Safety Links:**
https://www.nationalgridus.com/MA-Gas-Business/Natural-Gas-Safety/Pipeline-Safety
https://www.nationalgridus.com/NY-Home/Natural-Gas-Safety/
https://www.nationalgridus.com/RI-Home/Natural-Gas-Safety/

6.3.1 Operating Pressures and Gas Quality

The National Grid gas distribution pipeline system operates at various pressures from low to high throughout its service territory. Sources of gas include LNG and gas produced from natural underground reservoirs. Gas Quality is monitored and managed via National Grid's Transmission Integrity Management Program.

6.3.2 Reportable/Significant Gas Incidents

Detailed summaries of recent DOT reportable gas incidents are provided in Appendix A, and were given the highest influence in the risk evaluation and prioritization. Table A-1 summarizes incidents by year for the past 30 years – with consequences. Table A-2 summarizes incidents by year for the past 30 years – by cause. Additionally, details of last 10 years reportable incidents are provided in Table A-3 and the asset-threat combinations of all integrity-related incidents in that table were given a superseding influence in the risk ranking and prioritizations for that region. PHMSA reportable gas incidents are reviewed on a quarterly basis to determine the likelihood of such incident occurring in the National Grid's system and to create mitigation programs when necessary.

6.3.3 Gas Distribution Inventory and Repair Data

National Grid's Distribution Engineering Department is responsible for the development and implementation of Integrity Management Programs for Gas Distribution facilities. The department compiles and analyzes system and operating data, files annual reports to the Department of Transportation (DOT) and State regulators, generates periodic bulletins, and prepares various Integrity Reports and Analyses. System performance, analysis, risk, threats, asset management, replacement strategies and rate case support are all performed. The former Brooklyn Union committed to continuing to perform these sorts of analyses in an MOU issued to the New York State PSC in 1989 (although they were already a well-established routine by that time). These engineering and operational activities require knowledge of the system inventory, age, annual performance as well as performance trends over time.

A complete system inventory by material and size as well as leak repair data by cause is updated annually and submitted on the Annual DOT reports. Copies of the reports are available on the Distribution Engineering web page along with comparisons reports for each region over time. Annual DOT reports are publicly available on PHMSA's website. National Grid Operator IDs are provided in Section 1.0.

6.3.4 Environmental Factors

National Grid operates gas distribution piping in some of the most populated regions of the country and where extremes of all four seasons are experienced. As such, all these factors are considered in the design, operation and maintenance of the gas system. As previously noted in this section (Knowledge of Facilities) there are many different policies, piping materials and construction methods utilized. National Grid utilizes, where appropriate, the characteristics of the distribution system, design, operating, environmental, performance and physical testing and inspections to assess the applicable threats and risk to its gas distribution assets. The actual performance, testing and observed condition of the asset is directly related to the environmental conditions encountered. Other attributes that are considered in the risk can include asset class (main, service or I&R facility), material, size, pressure, construction method, or meter location (sub-classes). Environmental factors that have been considered in threat identification (see Appendix B) include seismic activity, earth movement, frost heave, heat sources, and flooding. Population density and other location-specific conditions are considered in National Grid's secondary, more detailed, risk ranking efforts at the segment level via the estimate of potential human exposure (in the building types and usage), following the preliminary assessment by asset class and subclass (region). National Grid’s leak survey and surveillance practices take into account environmental factors such as susceptibility to leak migration (wall-to-wall paving or seasonal frost cap) and proximity to buildings of public assembly. Valves are located in a variety of environments, including areas of paved streets. Valves are operated and maintained in accordance with Policy CNST04009.

6.3.5 Gas Distribution Mains and Services Assets Analysis

National Grid gas distribution system was constructed with the materials and methods described above over more than a century. The company reduces risk and threats by replacing the riskiest leak prone piping where appropriate and through prudent operating and maintenance that includes a number of Preventative and Mitigative policies as noted in Table 6-1.

The National Grid Annual System Integrity Report is incorporated by reference into the DIM Plan and typically provides the following:

- Overall Regional Distribution Integrity Assessment Summary
- Total Leak Receipts – Current Year and Previous 9 Years
- Leak Receipts as a Function of Total System Pipe Mileage – Current Year
- Leak Receipts by Discovery Source (Excluding Damages) - Current Year and Previous 9 Years

- Leak Receipts by Original Classification (Excluding Damages) - Current Year and Previous 9 Years
- Year-End Workable (excludes Type 3) Leak Backlogs - Current Year and Previous 9 Years
- Year-End Open Type 3 Leak Inventories - Current Year and Previous 9 Years
- Performance Measure (Workable Backlog / Miles of System Pipe) - Current Year and Previous 9 Years
- Performance Measure (Type 3 Inventory / Mile of System Pipe) - Current Year and Previous 9 Years
- Main Inventory by regional Company- Current Year and Previous 9 Years
- Main age analysis by region - Current Year and Previous 9 Years
- Leak-prone pipe and Main replacement program - Current Year and Previous 9 Years
- Percentage of Leak-Prone Pipe - Current Year and Previous 9 Years
- Rate Case Supported Leak-Prone Main Replacement Levels
- Total Main Leak Repairs (Including Damages) - Current Year and Previous 9 Years
- Total Main Inventory by Material vs. Total Main Leak Repairs (incl. damages) by Material – Current Year
- All Main Leak Repairs by Material (Excluding Damages) - Current Year and Previous 9 Years
- All Main Leak Repairs (Including Damages) by Cause – Current Year
- Total Main Leak Rates (repairs per total mile of main) Including Damages - Current Year and Previous 9 Years
- Total Main Leak Rates (repairs per mile of total main) Including Damages - Current Year
- Main Leak Rates (Excluding Damages) by Material - Current Year and Previous 9 Years
- Current Year Main Leak Rates (Excluding Damages) – All Region Comparison by Material
- Main Leak Repairs – Material-Cause Matrix – Current Year
- 10-Year Cast Iron Main Inventory and Attrition Rate – All Region Comparison
- Total Cast Iron Main Breaks - Current Year and Previous 9 Years
- Cast Iron Main Break Rates – All Region Comparison by Diameter – Current Year
- 10-Year Bare/Unprotected Steel Main Inventory and Attrition Rate– All Region Comparison
- Main Corrosion Leak Rates - Current Year and Previous 9 Years
- Service Inventory by regional Company- Current Year and Previous 9 Years
- Total Service Leak Repairs (Including Damages) - Current Year and Previous 9 Years
- Total Service Inventory by Material vs. Total Service Leak Repairs by Material – Current Year

- All Service Leak Repairs (Excluding Damages) by Material - Current Year and Previous 9 Years
- All Service Leak Repairs (Including Damages) by Cause – Current Year
- Total Service Leak Rates (Including Damages) - Current Year and Previous 9 Years
- Total Service Leak Rates (Excluding Damages) by Material - Current Year and Previous 9 Years
- All Region Service Leak Rates (Excluding Damages) Comparison by Material – Current Year
- Service Leak Repairs Material-Cause Matrix – Current Year
- Distribution DOT Report data Comparisons – Current Year & Previous Year.
- System Integrity Report Analysis (Findings and Explanations)

The company has developed a procedure for selecting main segments for replacement. ENG04030: Identification, Evaluation, and Prioritization of Distribution Main Segments for Replacement. This procedure details the attributes that are considered and utilized, and they include but are not limited to Design, Operations and Environmental factors.

National Grid Damage Prevention metrics are also incorporated by reference into the DIM Plan and provide the following:

- Total Damages per 1000 Tickets
- Excavator Error Damages per 1000 Tickets
- Damages due to No-Calls per 1000 Tickets
- Damages due to Mismarks per 1000 Tickets
- Damages due to Company & Company Contractors per 1000 Tickets

(Note that “tickets” refers to all “one-call” requests, and not actual mark outs performed)

6.3.6 Gas Distribution Instrumentation & Regulation (I&R) Facilities Asset Analysis

As previously noted above, I&R facilities are inspected annually, and immediate or scheduled repairs are made to ensure continued operation. Observed conditions are noted and used to assess and risk rank the facilities. The risk ranking methodology is viewed as a high-level assessment that goes beyond the annual PT to capture overall residual risks. The assessment process guides and validates the organization’s activities.

The I&R risk ranking method consists of four primary factors: impact to the Company, effectiveness of technical controls, effectiveness of location specific controls, and the likelihood of an asset failure. These factors are weighted, averaged, and multiplied to make up the risk score. This risk score is utilized to risk rank and capture the overall condition of the station and compare it to the other stations.

The company has several programs related to integrity of I&R facilities:

- Reactive program – for operations to handle immediate parts & equipment changes
- Proactive Station Program - for planned station upgrades / replacements based on assessment, risk and threats
- Proactive Heater Program - for planned heater upgrades / replacements based on assessment, risk and threats
- Proactive Control Line Program - for planned control line upgrades / replacements based on assessment, risk and threats

Inspection data is collected and stored locally within operations and some regions have migrated to electronic data collection and storage. The risk ranking data is stored electronically and maintained by Pressure Regulating Engineering.

6.4 Additional Data Needed

Additional information needed that will be obtained over time through normal activities conducted on the pipeline is described in Table 6-7.

Table 6-7: Additional Information

Area of incomplete records or Knowledge	Can it be acquired over time through normal activities?	Does Action Plan Exist? Y / N	Scope	Schedule	Responsible Departments
Estimate number of EFVs • In system at CY end • Installed during the year on residential services only	Yes	Yes	• Interim - Estimate annual based on usage and totals calculations based on other available / reasonable data • Long term - through Electronic Reporting and GIS	• Interim for annual 2010 – 2019 DOT reporting estimates • Long term 3-5 years	• Distribution Engineering
Above grade hazardous leak repair data on services	Yes	Yes	Not previously included in DOT reporting. These leaks now need to be reported per latest OPS ruling	• Completed (2019 Annual DOT reporting)	• Distribution Engineering
Above grade leak repair data on I&R facilities	Yes	Yes	Not previously included in DOT reporting unless leak tickets and leak numbers are generated. These leaks now need to be reported per latest OPS ruling	• Completed (2019 Annual DOT reporting)	• Distribution Engineering
Leak repair data on Mechanical fittings	Yes	Yes	• Interim - Issued procedure, forms and bulletins • Long Term- Electronic Reporting	• Interim – Regulatory & Technical Bulletins issued 12/12/2010. Procedure GEN01009 Reporting Non-conforming Materials - issued 7/31/2009	• Distribution Engineering

Area of incomplete records or Knowledge	Can it be acquired over time through normal activities?	Does Action Plan Exist? Y / N	Scope	Schedule	Responsible Departments
				• Long Term Electronic reporting – Fall of 2020	
Incorrect or Incomplete Facilities Records – Maps and Scanned Records – MA	Yes	Yes	• Employees may submit corrections to the AMMS system via Field Data Capture unit or the Maps & Records Data Correction Form. • Appropriate changes are made in ArcFM & SPIPE. Sketches are added to the Scanned Records system.	• Continuous	• Maps and Records
Incorrect or Incomplete Facilities Records – Maps and Scanned Records – LI and NYC	Yes	Yes	• Employees may submit change requests through the Feedback tool in NRG. • Appropriate changes are made in NRG and Fortis. Sketches are added to the Fortis system.	• Continuous	• Maps and Records
Incorrect or Incomplete Facilities Records – Maps and Scanned Records – UPSTATE NY	Yes	Yes	• Employees may submit a corrected service card or GFDR. • Appropriate changes are made in Smallworld. Sketches are added to the GasCar system.	• Continuous	• Work Support • Asset Replacement

Area of incomplete records or Knowledge	Can it be acquired over time through normal activities?	Does Action Plan Exist? Y / N	Scope	Schedule	Responsible Departments
Incorrect or Incomplete Facilities Records – Maps and Scanned Records – RI	Yes	Yes	• Employees may submit corrections when inconsistencies are found. • Appropriate changes are made in ArcGIS. Sketches are added to the Scanned Records system.	• Continuous	• Damage Prevention • Maps and Records

6.5 Data Capture for New Construction

The requirement for data capture for the location where any new pipeline is installed and the material of which it is constructed is contained in various standards as summarized in Table 6-8 below

Table 6-8: Data Capture Requirements

STANDARD	NYC	UNY	LI	MA	RI
GEN03002 Processing Gas Main and New Service Work Packages	x	x	x	x	x
CNST06020 Completion and Processing of Gas Service Record Cards	x	x	x	x	x
CNST01005 Preparation of Gas Facility Historical Records	x	x	x	x	x
Construction Documentation Specifications					x

6.6 Knowledge Capture – Subject Matter Experts

In addition to existing enterprise wide data, information, and reporting, National Grid has conducted additional interviews and discussions with process owners and regional groups of Subject Matter Experts (SME's) to determine if there are undocumented risks that could impact system performance. SME's are individuals who have specialized knowledge based on their experience or training. SME's were used to supplement existing, incomplete, or missing records and may be the only or best source of information in subjects such as historical operations, maintenance, and construction practices. SME interviews were also utilized to ensure that all threats have been identified. All SME interviews have been documented and stored in the Distribution Integrity Management Program files.

It should be noted that, due to the extent of National Grid's gas delivery systems over eight (8) legacy companies, SME interviews needed to be limited in order to accomplish implementation of the Plan within the necessary time frame. SMEs were selected based on experience and knowledge of general regions. It was not possible to include operations personnel from all geographic locations in each legacy company. To ensure that all reasonable threats were identified and evaluated, the summary SME data was carefully reviewed after the first issuance of the Plan. If anything was believed to be incorrect by the engineering SME panel or any regulator, that information was corrected in the current revision.

Furthermore, after the Plan is audited by regulators in all states, a more detailed rollout will be conducted with Operations and feedback will be solicited and incorporated into a future revision, as appropriate.

6.6.1 Bi-Annual Meeting

Threats, or Abnormal Operation Conditions (AOC), are continually being identified by Corrosion, Construction, Field Operations, Lab, and Process Standards & Procedures. Gas Distribution Engineering (GDE) has established a formal bi-annual meeting with SME's from the various service territories to provide updates on the Engineering Organization, Distribution Engineering Management Program, review of 10 year Trends and Distibution system performace, DIMP Threat Remediation Programs, Procedure Updates, AOC methodology to determine emerging threats and to gain Subject Matter Expert Feedback. The summary of the bi-annual meeting is referenced in the GDE share drive.

7.0 THREAT IDENTIFICATION

The objective of this section of the plan is to identify existing and potential threats to the gas distribution pipeline. The following categories of threats shall be considered for each gas distribution pipeline:

- Corrosion Failure
- Natural Forces Damage
- Excavation Damage
- Other Outside Force Damage
- Pipe, Weld or Joint Failure
- Equipment Failure
- Incorrect Operation
- Other Cause concerns that could threaten the integrity of the pipeline.

In addition to the above categories established by §192.1007(b), National Grid may collect and assess threats by other additional categories to evaluate the system, trends, and risk. The Leak Cause categories and definitions per PHMSA OMB No. 2137-0629 are summarized below.

Corrosion Failure

A leak caused by galvanic, atmospheric, stray current, microbiological, or other corrosive action. A corrosion release or failure is not limited to a hole in the pipe or other piece of equipment. If the bonnet or packing gland on a valve or flange on piping deteriorates or becomes loose and leaks due to corrosion and failure of bolts, it is classified as Corrosion. (Note: If the bonnet, packing, or other gasket has deteriorated to failure, whether before or after the end of its expected life, but not due to corrosive action, report it under a different cause category, such as Incorrect Operation for improper installation or Equipment Failure if the gasket failed)

Excavation Damage

A leak resulting directly from excavation damage by operator's personnel (oftentimes referred to as “first party” excavation damage) or by the operator’s contractor (oftentimes referred to as “second party” excavation damage) or by people or contractors not associated with the operator (oftentimes referred to as “third party” excavation damage). Also, this section includes a release or failure determined to have resulted from previous damage due to excavation activity. For damage from outside forces OTHER than excavation which results in a release, use Natural Force Damage or Other Outside Force, as appropriate.

Equipment Failure

A leak caused by malfunction of control/relief equipment including valves, regulators valves, meters, compressors, or other instrumentation or functional equipment, Failures may be from threaded components, Flanges, collars, couplings and broken or cracked components, or from O- Ring failures, Gasket failures, seal failures, and failures in packing or similar leaks. Leaks caused by overpressurization resulting from malfunction of control or alarm device; relief valve malfunction: and valves failing to open or close on command; or valves which opened or closed when not commanded to do so. If overpressurization or some other aspect of this incident was caused by incorrect operation, the incident should be reported under “Incorrect Operation.”

Pipe, Weld or Joint Failure (All Materials, Including Plastic)

A leak resulting from a material defect within the pipe, component or joint due to faulty manufacturing procedures, desing defects, or in-service stresses such as vibration, fatigue and environmental cracking. Material defect means an inherent flaw in the material or weld that occurred in the manufacture or at a point prior to construction, fabrication or installation. Design defect means an aspect inherent in a component to which a subsequent failure has been attributed that is not associated with errors in installation, i.e., is not a construction defect. This could include, for example, errors in engineering design. Fitting means a device, usually metal, for joining lengths of pipe into various piping systems. It includes couplings, ells, tees, crosses, reducers, unions, caps and plugs. Any leak that is associated with a component or process that joins pipe such as threaded connections, flanges, mechanical couplings, welds, and pipe fusions that leak as a result from poor construction should be classified as “Incorrect Operation”. Leaks resulting from failure of original sound material from applied during construction that caused a dent, gouge, excessive stress, or other defect, including leaks due to faulty wrinkle bends, faulty field welds, and damage sustained in transportation to the construction or fabrication site that eventually resulted in a leak, should be reported as “Pipe, Weld or Joint Failure”. force

Natural Forces Damage

A leak caused by outside forces attributable to causes NOT involving humans, such as earth movement, earthquakes, landslides, subsidence, heavy rains/floods, lightning, temperature, thermal stress, frozen components, high winds (Including damage caused by impact from objects blown by wind), or other similar natural causes. Lightning includes both damage and/or fire caused by a direct lighting strike and damage and/or fire as a secondary effect from a lightning strike in the area. An example of such a secondary effect would be a forest fire started by lightning that results in damage to a gas distribution system asset which results in an incident.

Other Outside Force Damage

A leak resulting from outside force damage, other than excavation damage or natural forces such as:

• Nearby Industrial, Man-made or Other Fire/Explosion as Primary Cause of Incident (unless the fire was caused by natural forces, in which case the leak should be classified Natural Forces. Forest fires that are caused by human activity and result in a release should be reported as Other Outside Force),

• Damage by Car, Truck, or Other Motorized Vehicle/Equipment NOT Engaged in Excavation. Other motorized vehicles/equipment includes tractors, mowers, backhoes, bulldozers and other tracked vehicles, and heavy equipment that can move. Leaks resulting from vehicular traffic loading or other contact (except report as “Excavation Damage” if the activity involved digging, drilling, boring, grading, cultivation or similar activities.

• Damage by Boats, Barges, Drilling Rigs, or Other Maritime Equipment or Vessels so long as those activities are not excavation activities. If those activities are excavation activities such as dredging or bank stabilization or renewal, the leak repair should be reported as “Excavation Damage”.

• Previous Mechanical Damage NOT Related to Excavation. A leak caused by damage that occurred at some time prior to the release that was apparently NOT related to excavation activities, and would include prior outside force damage of an unknown nature, prior natural force damage, prior damage from other outside forces, and any other previous mechanical damage other than that which was apparently related to prior excavation. Leaks resulting from previous damage sustained during construction, installation, or fabrication of the pipe, weld, or joint from which the release eventually occurred are to be reported under “Pipe, Weld, or Joint Failure”. Leaks resulting from previous damage sustained as a result of excavation activities should be reported under “Excavation Damage” unless due to corrosion in which case it should be reported as a corrosion leak.

- Intentional Damage/. Vandalism means willful or malicious destruction of the operator’s pipeline facility or equipment. This category would include pranks, systematic damage inflicted to harass the operator, motor vehicle damage that was inflicted intentionally, and a variety of other intentional acts.

- Terrorism, per 28 C.F.R. § 0.85 General functions, includes the unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives.

- Theft. Theft means damage by any individual or entity, by any mechanism, specifically to steal, or attempt to steal, the transported gas or pipeline equipment.

Incorrect Operations

A leak resulting from inadequate procedures or safety practices, or failure to follow correct procedures, or other operator error. It includes leaks due to improper valve selection or operation, inadvertent over pressurization, or improper selection or installation of equipment. It includes a leak resulting from the unintentional ignition of the transported gas during a welding or maintenance activity.

Other Cause

Leak resulting from any other cause not attributable to the above causes. A best effort should be made to assign a specific leak cause before choosing the Other cause category. An operator replacing a bare steel pipeline with a history of external corrosion leaks without visual observation of the actual leak, may form a hypothesis based on available information that the leak was caused by external corrosion and assign the Corrosion cause category to the leak.

USE THIS CAUSE FOR ALL CAST IRON JOINT LEAKS – Including those which re-occurred because a failed joint clamp or seal.

7.1 Means of Threat Identification

National Grid's records and employees provide the basis of information regarding the system assets and material. The cause categories noted above are the threats for gas distribution pipelines. The 5 year summary of the annual DOT reports by operator identification is incorporated by reference into this DIM Plan.

In an effort to gain additional information about the gas system and to identify potential unknown threats, Subject Matter Expert (SME) interviews were conducted and are summarized in Appendix B. Subsequent threats shall be identified as they are discovered or identified and reviewed by Integrity Engineering for inclusion in the program.

A review of information gathered for Section 6.0 shall be conducted periodically to identify existing and potential threats. Threats (including material performance concerns) shall subsequently be identified by personnel who are knowledgeable of the National Grid system, operations and the Distribution Integrity Management Program. This is accomplished through the annual system integrity report that is prepared and issued by Distribution Engineering and is incorporated by reference into the DIM Plan. An annual review of the system performance combined with knowledge of the facilities, design, materials science, engineering, operation and maintenance histories, construction methods, environmental factors and an understanding of reportable/significant gas incidents provides National Grid with a sound indication of the threats to its system.

7.2 Monitoring Potential Threats

Potential Threats include those that are not currently evident based on National Grid gas distribution system failures, leak, or incident data. National Grid routinely monitors information from sources that may include:

- National Transportation and Safety Board (NTSB) Reports and Recommendations applicable to Pipeline Accidents.
    - Reports may be found at: http://www.ntsb.gov/investigations/reports_pipeline.html
    - Recommendation Letters may be found at: http://www.ntsb.gov/recsletters/
- Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) Advisory Bulletins: http://www.phmsa.dot.gov/pipeline/regs/advisory-bulletin

- Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) Reportable Incidents:
  https://www.phmsa.dot.gov/data-and-statistics/pipeline/distribution-transmission-gathering-lng-and-liquid-accident-and-incident-data
  Reported failures attributed to the gas distribution system are analyzed on a quarterly basis.
- Membership in a local, regional, or national gas association (e.g. American Gas Association, Northeast Gas Association, NACE, ASME, etc.) and involvement in Association workshops and forums that share knowledge regarding distribution pipeline threats
- Review of trade journals and magazines that publish material regarding gas distribution
- Incident Analysis (IA's) or Near Miss Reviews
- Leak Repair Data
- Mechanical Coupling / Fitting failure reports
- Process Safety Reporting
- All Failure Analysis Reports from the Materials, Standards and Testing Group (MS&T - which includes the Materials Testing Lab) are reviewed by Distribution Engineering and key failure data is entered into a Failure Analysis Database, which is used to identify any potential systemic integrity issues. Whenever an issue is discovered, even if it is not attributable to any asset subclass in the risk ranking (e.g. – common substandard conditions, fittings, etc.), appropriate mitigative measures are developed and implemented regionally or organizationally (depending on the nature of the issue). To further enhance the accuracy of the Failure Analysis Database, details of plastic leak data from all regions are scanned quarterly to identify any failures that may not have been sent in for analysis.

For Mechanical Fitting Failures resulting in hazardous leaks, the following requirements have been incorporated into the gas operating procedure GEN01009, Reporting Nonconforming Material:

- Operations and Construction will complete the "Mechanical Fitting Field Failure – US DOT Report" and send it, with the fitting (if removed from service), to MS&T for evaluation.
- Operations and Construction will notify Distribution Engineering immediately if the failure is potentially systemic in nature, requiring immediate follow-up.
- MS&T will review the form, examine the material, perform any necessary testing, notify manufacturers and/or vendors when applicable, issue any necessary technical bulletins, product

advisories or reports containing their findings, recommendations and required follow-up actions.

- MS&T will make all necessary filings with the AGA, PPDC and Public Service Commission.
- MS&T will forward the form and report to Distribution Engineering for appropriate filing with PHMSA and advise Distribution Engineering if the investigation deems that immediate or scheduled removal of in-service material is warranted.
- Also, under "Reporting Nonconforming Material GEN01009 ", other potential threats (beyond mechanical fitting failures) are reported to and investigated by MS&T and the follow-up is similar.

8.0 EVALUATION AND RANKING OF RISK

8.1 Objective

Risk analysis is an ongoing process of understanding what factors affect the risk posed by threats to the gas distribution system and where they are relatively more important than others. The primary objectives of the evaluation and ranking of gas distribution risk are:

- Consider each applicable current and potential threat
- Consider the likelihood of failure associated with each threat
- Consider the potential consequences of such a failure
- Estimate and rank the risks (i.e. determine the relative importance) posed to the system
- Consider the differences in the relevance of threats in areas among the various regions

For the purposes of risk assessment, National Grid has separated its gas distribution system into two broad (and very different) asset categories; Mains & Services and Instrumentation & Regulation Facilities. Separate models have been developed to estimate and relatively rank the risks for each of the assets (by sub-category). The models are different and completely independent of one another. The models and the results of these models are maintained by Distribution Engineering and Pressure Regulation Engineering and are used to develop National Grid's Asset Management Strategies by State and by Operator ID.

8.2 Mains & Services

For mains and services (with service lines including all equipment upstream of customer-owned piping, with "service line" as defined in Section 5.0), because of their sheer volume and non-homogenous nature, National Grid has elected to divide these assets into "regions" (segments of the system with similar characteristics and reasonably consistent risk for which similar actions would be effective in reducing risk). For purposes of the mains and services model, the "regions" will be the asset subclasses. The asset is first broken into two general facilities – mains or services. Each facility is further broken down by such factors as material (including active/inactive status, pipe coating, and cathodic protection status), inside vs. outside meter set (for services), pressure and diameter (for mains).

Diameters for pipe are classified by the following diameter ranges: up to 4-inch (small fractional wall thickness), over 4-inch and up to 8-inch (nominally ¼-inch wall), and over 8-inch (0.375-inch wall). For iron pipe (cast and wrought), diameters are classified by the following diameter ranges: less than 4-inch (with a higher break rate), 4-inch to 8-inch, and greater than 8-inch (with a lower break rate).

All plastic pipe evaluated in the model is assumed to be Polyethylene. As covered in Section 6.2.3, there may be small quantities of CAB in Upstate NY and PB in RI. To address any potential risk associated with these materials, company policy requires that all integrity-related plastic pipe failures be reported to the MS&T lab for evaluation and monitoring for possible systemic issues.

A relative risk score is calculated for each asset subclass (with the main and service facilities ranked independently) for each of the eight defined threat categories. The risk ranking method for each asset subclass and threat consists of 4 parts: likelihood of failure and release of gas, likelihood of the release resulting in ignition, reduction controls and the potential consequences of such an event.

A separate score is calculated for each asset subclass and threat category. The highest scores (separately for mains and services) are identified for each region and then reviewed by an engineering SME panel in order to validate/adjust the model results. Some asset subclass/threat category scores were removed if the panel concluded that the high scores were the result of known data anomalies. Additionally, some asset subclass/threat categories with lower scores were added if the SME panel felt that the potential risk or exposure was not adequately represented by the calculations. Further, any asset subclass/threat category that experienced a reportable integrity-related incident within the prior ten (10) calendar years had its score changed in its respective region to “Known Incident”. (If the asset subclass/threat was not among the top risks listed, it was added to the list with a score of “Known Incident”.) All scores labeled “Known Incident” were then accelerated to the top of the risk rankings. The resulting final main and service lists of the highest risks for each region appear in Appendix C. The model and these lists will be updated annually based on the inventory and performance data for the previous calendar year.

It is not possible for National Grid to utilize operating environment factors such as known soil conditions, frost heave susceptibility, depth of cover, potential "other outside force damage" sources, potential "natural force damage" sources, geological conditions, paving, population density, building types, substandard conditions, etc. in its primary risk rankings (beyond the overall asset subclass general susceptibilities to "natural force" and "other outside force" damages); as these are very specific to geographic areas and can vary widely within even a small geographic region. As a result, National Grid's DIM Plan ranks risk by dividing its mains and services into "regions" with similar characteristics (as previously described). These types of factors, when known, are all considered when evaluating and prioritizing assets for proactive replacement as a mitigative measure. National Grid utilizes a secondary methodology for replacement qualification and prioritization (ENG04030) (see Section 6.3.4) that is risk-based and applied on a segment-by-segment level. Wherever possible, this methodology allows for accounting of environmental and other location-specific factors in the qualification and prioritization algorithms. These algorithms also include a "DIMP Factor" (which is based on the highest risk scores for that region in the DIM Plan) to increase the scoring for those asset subclasses and subsequently accelerate their attrition.

The parts (or "factors") used for risk ranking have been carefully designed to take advantage of known differences in the asset subclasses, extensive experience in failure modes and subsequent events, actual current performance data for the asset subclasses and threat categories, subject matter expert opinion on assets and failures experienced throughout the history of the company, existing system operational procedures, and populations affected by each threat. Some of these factors are variable (and will be updated on an annual basis), while others are relatively fixed. The factors and their components are detailed as follows:

- Likelihood of Failure and Release of Gas – There are two components to this. The first is the actual failure frequency (or leak repair rate) for the most recent calendar year. This is a variable factor that will be updated annually. The second is a rating applied from the results of subject matter expert interviews. This strengthens the likelihood calculation because it accounts for infrequent failures that may not occur on a consistent basis. It also was derived from extensive questioning on not only each threat category, but of all the known sub-threats for each category. This is a comparatively fixed factor.
- Likelihood of the Release Resulting in an Ignition – There are 2 components to this factor as well. The first involves the hazardous nature of all failures. This will be determined by the percentage of all leak discoveries that are Type 1 (hazardous). This varies widely within National Grid's companies. This will be a variable factor and will be updated on an annual basis. The second component will be a failure mode factor, which will be a fixed score assigned based on the most common mode of asset failure.
- Separate failure mode factor scores were identified by an engineering SME panel and will be assigned based on the asset and threat category.

    - Additionally, reduction factors were included to this category for "controls" that are in place to reduce the likelihood of a release resulting in ignition. Extreme care was utilized not to include any controls that would have already been accounted for by the actual failure frequencies (leak rates). There was one control reduction factor applied to select services and one to select mains:
        - SERVICES – A reduction factor was applied to all non-LP operating greater than 10 psi services to account for the likelihood reduction due to the presence of excess flow valves (EFVs). The factor was different for each region, based on the percentage of those services which had been equipped with an EFV.
        - MAINS – A set of reduction factors was also applied to all Local Transmission mains. These factors are the same for each region, but vary by threat category. They were applied to account for the fact that these mains were designed and constructed as Transmission mains and are operated, maintained and monitored as Transmission mains as well; thereby reducing the likelihood.
- Potential Consequences – The Health & Safety consequence is given a weight of 60% of the total consequence score, while Customer Interruption is given a weight of 20% and Regulatory & Reputational Impact and Asset Impact consequences are weighted at 10% each.

The data used in the mains & services risk assessment is consistent with the data reported to PHMSA in National Grid's Annual Gas Distribution Reports.

8.3 Pressure Regulation

National Grid utilizes a risk model to evaluate and risk rank the 1,892 Take and Regulating Stations across the service territory. Using data from the annual Performance Test, Cathodic Protection testing, and on-site inspections technical assessments are conducted for each station taking into account pipe and equipment condition, regulator performance, corrosion data, heater, and scrubber performance. This information, combined with the potential customer impact resulting from a station outage, is used to prioritize mitigation. Data to support the risk assessment and ranking was gathered throughout 2018 during routine testing and analysis of that data was used to prioritize the work for the 2019/2020 work plan.

Initial data analysis for each station asset has been completed and will be updated as necessary. An updated listing of the highest risk-ranked facilities is maintained by Pressure Regulation Engineering and is available at all times. This listing is not being physically incorporated into Appendix C of the Plan, as it is very dynamic – changing when retirements or replacements occur; but is incorporated by reference in its most updated form.

9.0 IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS

The objective of this section of the DIM Plan is to describe existing and proposed measures to address the risks that have been evaluated and prioritized in Section 7.0. National Grid has a number of Corporate and Gas Business programs and initiatives to minimize risk to the company, the customers and the public.

9.1 Corporate Culture Philosophy and Programs

National Grid recognizes that the energy it provides is essential to today's society, but that it has inherent risk which cannot be completely eliminated. The risk can however be managed and kept as low as reasonably possible. These programs and initiatives, in most cases, exceed existing gas safety regulations and position National Grid to be a premier energy company. These programs and initiatives include but are not limited to the following:

- *Asset Management* and Engineering

  National Grid has adopted the Business Management System (BMS). At National Grid, asset management and engineering are vital to delivering safe, efficient, reliable and environmentally sound performance in each of its lines of business.

  Safety Management System - National Grid has implemented a Safety Management System (SMS) based on the American Institute Recommended Practice 1173 (API RP 1173). The SMS provides a framework to house all relevant activity under ten prescribed elements**:**

  1. **Leadership and Management Commitment:** Puts the National Grid's commitment to improve pipeline safety into formal practice
  2. **Stake Holder Engagement:** Build relationships both internally and externally to support the safety of our system and operations
  3. **Risk Management:** Manages the Company's assets and operations using a risk-based approach

4. **Operational Controls:** Integrates all aspects of the Company's operations into a single, umbrella framework, providing a disciplined and formal method to communicate and manage standard ways of working.
5. **Incident Investigation, Evaluation, Lesson Learned:** Provides the basis for learning and continuously improve from the review and feedback from incidents
6. **Safety Assurance:** Measures and assess pipeline safety risk and compliance issues
7. **Management Review and Continuous Improvement:** Ensures that pipeline safety performance is reviewed, and continuous improvement actions are developed on an on-going basis
8. **Emergency Preparedness and Response:** Develops and practice readiness to response in the event of a pipeline incident
9. **Competence, Awareness and Training:** Design and deliver proper training and information to achieve a workforce that has the appropriate level of experience, knowledge and expertise
10. **Documentation and Record Keeping:** Manage documentation and record keeping to support pipeline safety decision-making and reporting

- *Damage Prevention* - National Grid follows the nine (9) elements contained within the published PHMSA Damage Prevention Assistance Program (DPAP). The Company has been actively involved in mark outs and damage prevention for over 25 years. National Grid also participates in the Common Ground Alliance DIRT program.
- *Gas Emergency Procedure Manual – A* Gas US manual that includes plans specifically developed to provide for a rapid emergency response. The program is designed to minimize the extent of an emergency.

- *Incident Investigation Program* –This program is intended to reduce the recurrence of injuries and incidents by identifying contributing factors and root causes, and then taking corrective actions that address the root causes. Using this program, personnel can help prevent repeat incidents, reducing risk of injury. this is the process necessary to ensure that injuries and serious incidents are analyzed thoroughly and promptly to avoid reoccurrence.

National Grid Safety Procedure J-1001 provides details on:

  - How we ensure that injuries and serious incidents are investigated, and corrective actions are taken promptly, to avoid any recurrence.
  - How the information derived from our investigations is communicated to the organization to ensure that the lessons learned through operating experiences can be utilized by others.

- *Leak Management Program* – National Grid's leak management program (see Table 6-1 for specific procedures) adheres to the following principles:
  - Locate the leaks (leak response and leak survey)
  - Evaluate the actual or potential hazards associated with these leaks
  - Act appropriately to mitigate these hazards (including leak surveillance)
  - Keep records; and
  - Self-assess to determine if additional actions are necessary to keep people and property safe
- *Material Standards & Testing (MS&T)* - National Grid maintains its own materials lab that tests gas materials for compliance with standards and for suitability for its gas system. The lab also performs root cause analysis of materials failures and investigates issues with materials and tools. Findings often generate changes in manufacturers' products and QA/QC procedures. MS&T's role in investigating mechanical fitting failures and other non-conforming materials is described in Section 7.2.
- *Operator Qualifications (OQ)* – Representatives of The New England Gas Association, the regional trade association for 26 distribution companies operating in the 6 New England states, and the New York Gas Group, a regional trade association for 10 distribution companies operating in the state of New York, formed a consortium in 1999 to develop an operator qualification written plan. Those trade associations merged, and are now the Northeast Gas Association. The National Grid OQ committee has met quarterly to ensure the effectiveness of the OQ program. National Grid participates in meetings with all State Commission Staffs through the Northeast Gas Association's OQ Working Group (offspring of the two organizations mentioned previously).

- *Personnel and Job Site Safety* – This includes a core belief and commitment to Believe in Zero accidents, Employee Safety Handbooks, Trusted to Work Responsibly Documents, the Golden Rules of Safety, Job Briefing and Compliance Assessments.
- *Plastic Pipe Data Collection (PPDC) Initiative* – National Grid participates in the national effort to track plastic material failures and use that information to assess risk on plastic systems.
- *Proactive Main and Service Replacement Programs* – National Grid recognizes that over 28% of the mains and 22% of the services are made up of leak prone materials. Significant replacement plans are in place to reduce the inventory and thus the risk associated with leaks and cast iron breaks.
    - Additionally, ENG04030 has been revised (Revision 4, effective 08/01/2020) to better address systemic issues on vintage plastic pipe, and the extent of replacement under such conditions.
- *Process Safety* – This program is based upon practices of the chemical industry and the Baker Panel investigation of the BP Texas City incident. It seeks to understand and manage the risk of low frequency high consequence events (i.e. fires and explosions). In addition to internal measures and the review of incidents and near misses, events external to the company are also reviewed (e.g., sewer cross-bore incidents, compression coupling failures, etc.). Over 100 Process Safety Key Performance Indicators (KPIs) are tracked and reported to the Board of Directors, covering the following twelve Elements of Process Safety.
    - Process Safety Leadership
    - Plant Design and Modifications
    - Operational Procedures
    - Workforce Competence
    - Human Factors
    - Emergency Arrangements
    - Protective Devices, Instrumentation and Alarms
    - Inspection and Maintenance
    - Permit to Work
    - Asset Records and Data Quality
    - Third Party Activities
    - Audit, Review and Closeout

- *Flooding* – National Grid has begun identifying its vulnerable facilities in flood-prone regions on both 100-year and 500-year flood surge maps, and will consider any appropriate safety and reliability improvements to those facilities.
- *Storm Hardening* – National Grid is currently evaluating various potential storm hardening measures.
- *Process Ownership* - National Grid has established process owners for various safety and management tasks to reduce risk by ensuring that best practices are reviewed and there is consistent reporting and tracking across all territories.
- *QA/QC* – National Grid has a Quality Assurance and Quality Control (QA/QC) group which monitors compliance with all gas regulatory requirements, as well as applicable National Grid construction, maintenance, service and safety policies. This effort involves:
  - Field inspection and assessment of National Grid personnel and contractors who routinely perform gas construction, maintenance and service activities;
  - Performing process audits involving Federal and State gas regulations;
  - Conducting additional audits for gas related activities on a regional basis, as well as those identified by the Business Management System (BMS) for having potential adverse risk to the Company's gas assets;
  - Utilize the Six Sigma process methodology to address companywide projects that require a detailed focus for inter related departmental issues;
  - Re-Dig program - this program targets post inspection results of completed gas facility installation and repair activities across National Grid's U.S. Gas Operations.
- *Gas Distribution Engineering Reporting* – Distribution Engineering tracks and produces regulatory reports for compliance with annual DOT and State reporting requirements. In addition, various in-depth reports on the system's performance are created to provide trending data. These reports are also used to measure and monitor the performance of existing programs.
- *Corrosion Control* – National Grid has established enterprise wide corrosion control standards, test instructions and policies covering the design, installation, surveys inspections, testing and monitoring of the cathodic protection on its gas system. These provide the preventative and mitigative actions necessary to address the threat of corrosion.
- *Special Patrols* – The local and non-IMP transmission lines are covered under this DIM plan. National Grid has established enterprise wide patrol policy CNST02005, Patrolling

Transmission Pipelines. The policy covers the DOT transmission system and local transmission lines.

- The Standards, Policies & Codes area of National Grid's Gas Asset Management organization has developed a Pipeline Public Awareness (PPA) program as a result of the Pipeline Safety Improvement Act of 2002. The program encompasses all of National Grid's gas transmission and distribution facilities across New York, Massachusetts and Rhode Island. The goal of the program is to educate the general public about pipeline safety, including topics such as:
    - How to recognize possible leaks in gas pipelines and what to do if a leak is suspected
    - How to contact the pipeline operator in an emergency
    - The presence of buried gas pipelines in the communities served
    - The necessity to call before excavation – Know What's Below; Call Before you Dig – Call 811
    - The significant role the public/excavators can take in helping to prevent third-party damage accidents as well as how they should respond.
    - The proper actions emergency response agencies and first responders should take in response to a pipeline emergency
    - The means to assess the effectiveness of the communications used by the PPA Program, in order to improve the Program's effectiveness over time.
- The PPA program is managed within the Operations, Codes & Policies area of Gas Asset Management. There is a Committee that provides oversight to the program made up of:
    - Customer Communications
    - Community & Customer Management
    - Damage Prevention
    - Emergency Planning
    - Gas Work Methods
    - Learning & Development
    - Safety
- The PPA program has four key stakeholders:
    - Affected Public: Residents along a transmission pipeline right-of-way, places of congregation, near gas storage & operational facilities, along gas distribution lines as well as all National Grid customers should be educated on the appropriate actions and

precautions to take while living in proximity of gas pipelines. This will in turn create a safer environment and allow for more reliable service.

- Emergency Officials: Fire departments, police departments, Local Emergency Planning Management Agencies (EMA) and 911 call centers must be aware and educated on the safety measures and company plans while dealing directly with a gas pipeline emergency.
- Local Public Officials: Mayors & administrators, zoning boards, public works officials, licensing & permitting departments, building code enforcement departments and public officials must be educated and work alongside National Grid to ensure the safety and cooperation of the public.
- Excavators: Employees from construction, blasting, directional drilling and landscaping companies as well as farmers, sprinkler system installers and demolition teams all need to be aware of and educated on pipeline safety. This increased awareness and education will likely reduce the number of pipeline damages and accidental leaks.

National Grid's PPA Program communicates to these key stakeholder groups in a number of ways:

- Pipeline Public Awareness brochures included in customer bills
- Public service announcements
- Paid advertising
- Direct mailings with letters and safety brochures
- National Grid websites
- Links to other pipeline safety information sites
- Facebook
- Twitter
- On-line training programs for first responders and contractors dealing with natural gas and electric
- Education materials for elementary school teachers and students regarding natural gas and electric.
- Liaison meetings with emergency and local public officials
- Attendance at community events

- National Grid also participates in collaborative outreach to key stakeholders through the Northeast Gas Association using radio and cable television spots.
- The PPA program also communicates natural gas and pipeline safety information by direct mail outreach to excavators and in conjunction with the local Call Before You Dig call centers like Dig Safely, New York 811 and Dig Safe to provide natural gas safety and damage prevention information and training sessions.

9.2 Primary Threat Mitigation

National Grid worked with the American Gas Association (AGA) and the American Gas Foundation (AGF) on the development of an AGF Study on Distribution Integrity. This study was based on an analysis of gas distribution incidents in the DOT / OPS Database for the years 1990-2002. The study concluded that the top five (5) processes having the greatest impact on distribution integrity were:

- One Call / Mark Outs Systems to reduce third party damage
- Operator Qualifications to reduce operator error
- Cathodic Protection to reduce potential corrosion leaks or wall loss
- Leak Management to reduce the potential for leaks to cause an incident
- Proactive Replacement to reduce the inventory of problematic materials or components

National Grid also included construction activities in Operator Qualifications program early in its development. Additional or accelerated actions that have been taken or are being planned in order to reduce the risks from failure of the gas distribution pipeline are documented in Appendix D. These mitigation efforts address each of the primary threat types: corrosion, natural forces, excavation damage, other outside force, material or weld failure, equipment failure, incorrect operation, and other causes. National Grid's Distribution Engineering Department continuously monitors system performance in order to evaluate threats and also monitors gas industry best practices. As necessary, the Distribution Engineering Department will work with the Standards & Policy Department to update or issue new policies and procedures to mitigate threats.

9.2.1 Mitigation Program Tracker

Appendix D in the DIM Plan includes a description of all the National Grid's mitigation programs. Gas Distribution Engineering has established a monthly HUB where updates on DIMP mitigation programs are provided and reviewed.

10.0 MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATING EFFECTIVENESS

The objective of this section of the plan is to establish performance measures that shall be monitored from an established baseline in order to evaluate the effectiveness of the DIM program. The performance measures detailed in Sections 10.1 through 10.6 have been established in order to monitor performance and assist in the ongoing evaluation of threats. Distribution Engineering shall aggregate data from various legacy data sources (and successor data systems) as necessary to track each performance measure.

10.1 Number of Hazardous Leaks Either Eliminated or Repaired, per §192.703(c), Categorized by Cause

National Grid has been tracking all leaks by material and cause since 2005, consistently monitoring trends. The baseline and ongoing performance of the number of hazardous leaks either eliminated or repaired, per §192.703(c), categorized by cause, shall be documented, or included by reference, in Appendix E, Section 1. The baseline for this performance measure shall be 5 years recorded performance. Recent improvements in data scrubbing and validation make 5 years performance the best baseline from which to monitor ongoing performance.

10.2 Number of Excavation Damages

Excavation Damage was defined in §192.1001 in December of 2009 with the publishing of the Final Distribution Integrity Management Rule. National Grid has been tracking and trending leaks associated with excavation damage since 2004; however the new definition of excavation damage goes beyond just leaks. Thus, the baseline for this performance measure will be 5 years performance. The baseline and ongoing performance of the number of excavation damages shall be documented, or included by reference, in Appendix E, Section 2.

10.3 Number of Excavation Tickets (Received from the Notification Center)

The baseline and ongoing performance of the number of excavation tickets received from the notification center(s) shall be documented, or included by reference, in Appendix E, Section 3. The baseline for this performance metric will be 5 years performance.

10.4 Total Number of Leaks Either Eliminated or Repaired, Categorized by Cause

National Grid has been tracking all leaks by material and cause since 2004, consistently monitoring trends. Recent improvements in data scrubbing and validation make 5 years performance the best baseline from which to monitor ongoing performance. The baseline and ongoing performance of the total number of leaks either eliminated or repaired, categorized by cause, shall be documented, or included by reference, in Appendix E, Section 4.

10.5 Number of Hazardous Leaks Either Eliminated or Repaired, per §192.703(c), Categorized by Material

National Grid has been tracking all leaks by material and cause since 2004, consistently monitoring trends. The baseline and ongoing performance of the number of hazardous leaks either eliminated or repaired, per §192.703(c), categorized by material, shall be documented, or included by reference, in Appendix E, Section 5. The baseline for this performance measure shall be 5 years recorded performance. Recent improvements in data scrubbing and validation make 5 years performance the best baseline from which to monitor ongoing performance.

10.6 Additional Performance Measures

As it is determined that additional performance measures are needed to evaluate the effectiveness of the DIM Program in controlling an identified threat, the performance measures shall be documented, or included by reference, in Appendix E, Section 6.

Additional performance measures initially established include:

- Workable Leak Backlog at the End of Year (known system leaks scheduled for repair)
- Total Excavation Damages per 1000 Tickets
- Main Leak Rates by Material Excluding Damages
- Service Repairs per 1000 Services by Material, Excluding Damages
- Total Leak Receipts
- Response Time Performance

National Grid monitors many other metrics in the course of conducting and monitoring operations and process safety. Extensive investigation/research, monitoring and improvement works are being performed on some special projects like Farm Tap investigation and design upgrades to new Process Safety Standards, Inner-Tite fitting Inspection, etc. All the reports are incorporated by reference in its most updated form. Additional performance measures may be added to Section 10.6 when warranted to control threats.

11.0 PERIODIC EVALUATION AND IMPROVEMENT

The objective of this section of the plan is to periodically re-evaluate threats and risks on the entire pipeline and periodically evaluate the effectiveness of its program.

11.1 Plan Updating and Documentation

This written integrity management plan shall be reviewed periodically and updated as required to reflect changes and improvements that have occurred in process, procedures and analysis for each element of the program. National Grid performs extensive trending and analysis annually and documents it in the System Integrity Report. Additionally, National Grid will update risk assessment and ranking by asset class on an annual basis. In addition to the annual efforts, a complete program re-evaluation shall be completed, at a minimum, every five years. All the DIM Plan changes and results are documented in a "Description of Change" report, which kept on the Gas Distribution Engineering Internal Share drive. The complete program re-evaluations shall address:

- Frequency of the next complete program re-evaluation based on the complexity of the system and changes in factors affecting the risk of failure
- Verification of general information
- Incorporation of new system information
- Re-evaluation of threats and risk
- Review the frequency of the measures to reduce risk
- Review the effectiveness of the measures to reduce risk
- Modification of the measures to reduce risk and refine/improve as needed
- Review performance measures, their effectiveness, and necessary improvements

Form F-1 in Appendix F must be used to document Periodic Review and Updating. All changes to the written plan, inclusive of material from the appendices, shall be recorded on the Revision Control Sheet on page ii. However, changes to material in the appendices that is included by reference need not be recorded on the Revision Control Sheet. This plan shall reside on the National Grid intranet with the accompanying change-management.

11.2 Effectiveness Review

An assessment of the performance measures described in Sections 10.1 through 10.5 shall be performed periodically. The National Grid System Integrity Report shall be prepared annually. The evaluation of threats and risks shall be performed annually. Other discretionary measures (mitigation beyond minimum code requirements) may be necessary and shall be assessed at the discretion of management. An emerging threat in one or more location shall be evaluated for relevance to other areas. If the reviews described above demonstrate significant changes to threats or system performance, a complete program re-evaluation may be completed in a shorter timeframe than five years. Form F-1 in Appendix F may be used to document Effectiveness Reviews.

12.0 REPORTING RESULTS

12.1 State & Federal Annual Reporting Requirements

The following shall be reported annually, by March 15, to PHMSA as part of the annual report required by 49 CFR, § 191.11:

- Number of hazardous leaks either eliminated or repaired (or total number of leaks if all leaks are repaired when found), per § 192.703(c), categorized by cause
- Number of excavation damages
- Number of excavation tickets (receipt of information by the underground facility operator from the notification center)
- Total number of leaks either eliminated or repaired, categorized by cause
- Information related to failure of mechanical fittings, excluding those that result only in non-hazardous leaks, shall be reported to PHMSA on the Gas Distribution Mechanical Fitting Failure Form (PHMSA F-7100.1-2).

These measures, as well as any others that may be required by the State, shall also be reported to the appropriate State Agency as per GEN01020 (incorporated by reference). A copy of the reports shall be maintained in the Distribution Integrity Management Program files.

13.0 DOCUMENT AND RECORD RETENTION

The following records shall be retained in the Distribution Integrity Management Program files.

- The most current as well as prior versions of this written DIM Plan and its Appendices
- Documents supporting Knowledge of Facilities (material supporting Appendix A of the DIM Plan as well as the annual System Integrity Report)
- Documents supporting threat identification (material supporting Appendix B of the DIM Plan)
- Documents supporting the identification and implementation of measures to address risks (material supporting Appendix D of the DIM Plan)
- Annual Reports to PHMSA (as required by §191.11) and State pipeline safety authorities
- Mechanical fitting Failure Reports

Documentation demonstrating compliance with the requirements of 49 CFR, Part 192, Subpart P shall be retained for at least 10 years. Table 13-1 summarizes a data matrix on records used, collection method, collection frequency, and storage location.

Table 13-1: Data Matrix for Collection Method and Storage Location

Source	Data Characteristics (192.1007(a)(1)) (Design, Operations, or Environment)	Asset Type	Collection Method/ Frequency	Storage Location	Region	Responsible Party	Description
As-Built Drawings	Design	Main	Paper and electronic/ completion of job	Gas System Engineering Sharedrive	NY LI Upstate MA RI	Construction / Field Operation	Material, installation method, Installed Date, material, pressure, Pressure Test, Pressure test duration, material, pressure, diameter, , segment length, construction method, foreman, spatial placement, fitting information, Depth of Cover, Easement, Pipe grade,
	Design	Service	Paper and electronic/ completion of job	Fortis for > 2" NPS MDSI for < or = 2" NPS MA & RI Iron Mountain	NY LI Upstate MA RI	Construction / Field Operation	Material, installation method, Installed Date, material, pressure, Pressure Test, Pressure test duration diameter, segment length, construction method, foreman, spatial placement, fitting information, Depth of Cover, Easement, Pipe grade, Meter Location, Service Valve Installed, Meter Protection, EFV Installed, Cathodic Protection, Pipe Abandoned, Meter Capacity, Tracer Wire
GIS	As- Built Drawings	Main	Electronic/ updated as new information becomes available	NRG NRG Smallworld ArcFM GIS-Esri	NY LI Upstate MA RI	Mapping	Distribution assets: Work Order, Date Installed, Vintage Date, Location, Diameter, Install Method, Material, Length, Cathodic Protection Status, Pressure Classification, Joining Method, Coating Type
	As- Built Drawings	Service	Electronic/ updated as new information becomes available	NRG NRG Smallworld SPIPE GIS-Esri	NY LI Upstate MA RI	Mapping	Distribution assets: Work Order, Date Installed, Vintage Date, Location, Diameter, Material, Length, Cathodic Protection Status, Pressure Classification, Joining Method, Coating Type
DIMP Bi-Annual Meeting	Design, Operations, Environment	Main/ Service	Electronic meeting minutes	DIMP Sharedrive	NY LI Upstate MA RI	DIMP	Bi-Annual Meeting with NGrid SMEs - Review Distribution10 years Trends for System Performance, overall review of PHMSA reportable incidents, Engineering Organization, Distribution Engineering Management Program Overview, Threat Remediation Program, Procedure Updates, Subject Matter Expert Feedback.

Source	Data Characteristics (192.1007(a)(1)) (Design, Operations, or Environment)	Asset Type	Collection Method/ Frequency	Storage Location	Region	Responsible Party	Description
PHMSA Bulletins	Design, Operations, Environment	Main/ Service	Electronic	https://www.phmsa.dot.gov/regulations-fr/notices	NY LI Upstate MA RI	Gas Process Safety / Compliance	The safety compliance distributes the bulletins to the appropriate departments
National Weather Service	Environment	Not Applicable	Electronic	DIMP Sharedrive	NY LI Upstate MA RI	DIMP/ Field Operations	Weather Forecast information is used to initiate winter leak operations.
PHMSA Reportable Incidents	Design, Operations, Environment	Main/ Service	Paper and electronic/ As needed	DIMP Sharedrive- Incidents as of 2010	NY LI Upstate MA RI	DIMP	The criterion to report incident to PHMSA, if as follow: 1 - Any fatalities or Injuries are involved 2- Estimated property damage of $50,000 or more 3- Unintentional estimated gas loss of three million cubic feet or more 4- An event that is significant in the judgment of the operator, even though it did not meet the criteria listed above (1,2,3)
Incident Management System (IMS)	Operations	Main/ Service	Electronic	DIMP Sharedrive	NY LI Upstate MA RI	DIMP	Incident Management System (IMS) - IMS Safety, Health and Environmental Services' online management tool. IMS which allows the reporting of safety and environmental-related incidents, perform incident analysis. GDE reviews all reported Incidents and take necessary actions as needed.
Quarterly Google News Alert (Incidents)	Knowledge	Main/ Service	Electronic	DIMP Sharedrive	NY LI Upstate MA RI	DIMP	Utilize Google Alerts to perform keyword search in news articles for potential gas incidents. GDE review all US incidents on quarterly bases for existing and new threats

Source	Data Characteristics (192.1007(a)(1)) (Design, Operations, or Environment)	Asset Type	Collection Method / Frequency	Storage Location	Region	Responsible Party	Description
Quarterly Google News Alert (Incidents)	Knowledge	Main/ Service	Electronic	DIMP Sharedrive	NY LI Upstate MA RI	DIMP	Utilize Google Alerts to perform keyword search in news articles for potential gas incidents. GDE review all US incidents on quarterly bases for existing and new threats
Leak Survey Plan	Operations	Main/ Service	Refer to NY,MA, RI procedures for collection method and Frequency	Fulcrum	NY LI Upstate MA RI	Field Operations	1- Distribution Survey-Walking: Main and service leakage surveys shall be conducted at least once every three calendar years. 2- Distribution Survey-Mobile (NYC ONLY): In New York City, a mobile leakage survey shall be conducted once per calendar year and at intervals not to exceed 15 months. 3- Business District Survey: Conducted in company designated business districts, at intervals not to exceed 15 months. 4- Winter Patrol Surveys: Conducted during company defined frost periods for company designated segments of the distribution system. Piping subject to the cast iron encroachment plan shall be surveyed for leakage daily until the main is replaced. As requested surveys - shall be performed based on demand. 6- Special Surveys: As requested surveys - shall be performed based on demand.
Leak Management System	Operations	Main/ Service	Electronic	Maximo, CWQ Maximo, LMS GAM LMS New Maximo, GIS (DIMP Sharedrive)	NY LI Upstate MA RI	DIMP	Class 1, 2, and 3 leaks information and repair status for Quarterly PSC Reports, Yearly DOT, System Integrity, DIMP
Pipeline Patrol	Operations, environment	Main	Weekly but not to exceed 10 days	Damage Prevention GFO I&R I&R I&R	NY LI Upstate MA RI	Field Operation	Pipeline operating at >124 psi Patrolling Transmission Pipelines CNST02005 Patrolling Mains in Hazardous Locations CNST02006
Nonconforming Material (Internal Procedure CNST01009)		Main/ Service	Electronic / Failure Based	Nonconforming Material Database (Material Testing Lab Sharepoint Site)	NY LI Upstate MA RI	Operations / Construction / Material Testing Lab / DIMP/ Codes and Standards	Nonconforming material removed should be reported to the Material Testing Lab.

14.0 APPENDICES FOR MASSACHUSETTS

MASSACHUSETTS
APPENDIX A
KNOWLEDGE OF FACILITIES

A summary of PHMSA Reportable Gas Incidents (reported on PHMSA F7100-1) as well as details of recent incidents are provided in Tables A-1, A-2 and A-3 below.

Table A-1: Reportable Gas Incidents by Year (**BOSTON** + **ESSEX**)

Year	Number of Incidents	Fatalities	Injuries	Property Damage
2019	0	0	0	$ -
2018	0	0	0	$ -
2017	1	0	0	$ 1,097,565.00
2016	2	0	0	$ 225,548.00
2015	0	0	0	$ -
2014	0	0	0	$ -
2013	1	0	0	$ 109,451.00
2012	1	1	0	$ 606,936.00
2011	0	0	0	$ -
2010	2	0	1	$ 750,000.00
2009	1	0	1	$ 400,000.00
2008	0	0	0	$ -
2007	2	0	0	$ 525,000.00
2006	0	0	0	$ -
2005	4	0	1	$ 200,000.00
2004	0	0	0	$ -
2003	1	0	0	$ 50,000.00
2002	0	0	0	$ -
2001	0	0	0	$ -
2000	3	0	0	$ 750,000.00
1999	1	0	0	$ 30,000.00
1998	2	1	0	$ 1,000,000.00
1997	0	0	0	$ -
1996	0	0	0	$ -
1995	2	0	0	$ 550,000.00
1994	2	0	1	$ 100,000.00
1993	1	0	0	$ 75,000.00
1992	3	0	4	$ -
1991	5	1	2	$ -
1990	1	0	0	$ 950,000.00
Total	35	3	10	$ 7,419,500.00

Table A-2: Reportable Gas Incidents by Cause (**BOSTON** + **ESSEX**)

Year	Corrosion	Natural Forces	Excavation Damage	Outside Force	Material or Weld Failure	Equipment Failure	Incorrect Operation	Other
2019	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0
2017	0	1	0	0	0	0	0	0
2016	0	0	2	0	0	0	0	0
2015	0	0	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	1	0
2012	0	0	0	1	0	0	0	1
2011	0	0	0	0	0	0	0	0
2010	0	1	0	0	0	0	1	0
2009	0	1	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0
2007	0	0	1	0	0	0	0	1
2006	0	0	0	0	0	0	0	0
2005	0	1	1	0	0	0	2	0
2004	0	0	0	0	0	0	0	0
2003	0	1	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0
2000	0	0	3	0	0	0	0	0
1999	0	1	0	0	0	0	0	0
1998	0	0	2	0	0	0	0	0
1997	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0
1995	0	2	0	0	0	0	0	0
1994	0	1	1	0	0	0	0	0
1993	0	0	1	0	0	0	0	0
1992	0	1	0	0	1	0	0	1
1991	0	0	1	0	0	0	3	1
1990	0	1	0	0	0	0	0	0
30-Year Total	0	11	12	1	1	0	7	4

Table A-3: 10-Year Incident History Details (**BOSTON + ESSEX**)

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
Boston	2017	MAIN	CI - 10"	340 HYDE PARK AVENUE	Boston	NATURAL FORCE
Details:	There was a circumferential break in main with several leaks which resulted in a fire. The fire in the hole was extinguished and an 8" bypass was built to offset the flow.					
Boston	2016	MAIN	Protected CS – 12" HP(100#)	Squire Rd and Route 1 North Side	Revere	Excavation Damage
Details:	A contractor was installing a guardrail and hit a 12" diameter, 100psi natural gas distribution main. Total of 3591 were out of service for one week.					
Boston	2016	MAIN	Protected CS – 10" IP (60#)	107 Low Street	Newburyport	Excavation Damage
Details:	Third Party Contractor hit line. Three customers were evacuated, 35 customers were out of service for two days. An 8 foot section of main was replaced.					
Boston	2013	MAIN	Plastic – 8" HP(60#)	Plank Street & Middlesex Turnpike	Middlesex	Incorrect Operation
Details:	Natural gas was introduced into 8inch plastic main prior to completion of tie-in					
Boston	2012	CUSTOMER PIPING	Steel – LP(0.5#)	Pleasant St	Winthrop	Other
Details:	Miscellaneous, Leak was on Customer Owned Piping					
Boston	2012	SERVICE	Steel – HP(60#)	Lake Warren Dr	Littleton	Other Outside Force
Details:	Customer tampered with company piping to commit suicide					
Boston	2010	MAIN	CI/WI - 6" - HP(2#)	Manning St	Reading	Natural Force
Details:	Main break					
Boston	2010	SERVICE	Plastic - Outside Set - LP	Chestnut St	Waltham	Incorrect Operations
Details:	Flash fire occurred during meter change					
Boston	2009	MAIN	CI/WI - 6" - LP	Eastern Ave	Gloucester	Natural Force
Details:	Main break					

Table A-3: 10-Year Incident History Details (**BOSTON** + **ESSEX**) – Cont.

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
Essex	NO PHMSA-Filed Incidents for Essex Gas Co for 2009-2019					

Table A-1: Reportable Gas Incidents by Year (**COLONIAL– CAPE COD + LOWELL**)

Year	Number of Incidents	Fatalities	Injuries	Property Damage
2019	0	0	0	$ -
2018	0	0	0	$ -
2017	0	0	0	$ -
2016	0	0	0	$ -
2015	2	0	0	$ 481,756
2014	1	0	0	$ 10,000
2013	0	0	0	$ -
2012	0	0	0	$ -
2011	0	0	0	$ -
2010	0	0	0	$ -
2009	1	0	0	$ 350,000
2008	0	0	0	$ -
2007	0	0	0	$ -
2006	0	0	0	$ -
2005	0	0	0	$ -
2004	0	0	0	$ -
2003	0	0	0	$ -
2002	0	0	0	$ -
2001	0	0	0	$ -
2000	0	0	0	$ -
1999	0	0	0	$ -
1998	0	0	0	$ -
1997	0	0	0	$ -
1996	0	0	0	$ -
1995	0	0	0	$ -
1994	0	0	0	$ -
1993	0	0	0	$ -
1992	0	0	0	$ -
1991	0	0	0	$ -
1990	0	0	0	$ -
Total	4	0	0	$ 841,756

Table A-2: Reportable Gas Incidents by Cause (**COLONIAL– CAPE COD + LOWELL**)

Year	Corrosion	Natural Forces	Excavation Damage	Outside Force	Material or Weld Failure	Equipment Failure	Incorrect Operation	Other
2019	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0
2015	0	2	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	1
2013	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2009	0	0	0	1	0	0	0	0
2008	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
30-Year Total	0	2	0	1	0	0	0	1

Table A-3: 10-Year Incident History Details (**COLONIAL– CAPE COD** + **LOWELL**)

Colonial Lowell	2015	OUTSIDE METER	Plastic -1"- 60#	7 Bandon Circle	Westford	Natural Force
Details:	Regulator was damaged by falling ice from the roof which caused the release of gas					
Colonial Lowell	2015	OUTSIDE METER	Coated Steel - LP	85 Rounsevell Road	Tewksbury	Natural Force
Details:	Service regulator was damaged from fallen snow, caused gas leak and fire					
Colonial Lowell	2014	I&R	Coated Steel - 8" - 60#	271 Littleton Rd	Westford	Other
Details:	Small amount of LNG remained after the inventory was removed from a decommissioned LNG tank. When vaporizing LNG into the system, heating value was higher than anticipated which caused flames at customer appliances					
Company	**Year**	**Facility**	**Asset Class/Subclass**	**Street**	**Town**	**Leak Cause**
Cape	2009	SERVICE	Plastic - HP(60#)	West Osterville Rd	West Barnstable	Other Outside Force
Details:	Electric burn through					

MASSACHUSETTS

APPENDIX B

THREAT IDENTIFICATION

In February thru April of 2016, groups of Subject Matter Experts (SMEs) were brought together, each having knowledge of threats in the various communities served by National Grid. Details on SME qualifications as well as copies of their interview records are located in the Distribution Integrity Management Program files. A summary of the threats identified are presented below in Table 14-1 and Table 14-2.

Table 14-1: Summary of Applicable Threats

SME's to Consider the Following	YES / NO
Do you have the necessary knowledge and/or experience (skills sets) regarding the areas of expertise for which you provided knowledge or supplemental information for input into the DIMP plan? (PHMSA Q.)	Yes
Do operator personnel in the field understand their responsibilities under DIMP plan? (PHMSA Q.)	Yes
Have you received DIMP training? (PHMSA Q.)	Yes
Have you received instructions to address the discovery of pipe or components not documented in the company records? (PHMSA Q.)	Yes
Have you received instructions to address, if you find any possible issue? (ex: corrosion, dented pipe, poor fusion joints, missing coating, excavation damage, mechanical fitting failures). (PHMSA Q.)	Yes
Have you received instructions to address when you find situations where the facilities examined (e.g., Material, Diameter, Coating, etc.) are different than records indicate, what documentation do you prepare? (PHMSA Q.) • If yes, are the findings documented?	Yes
During any repairs, if you find an improperly installed fitting, do you remediate it? (PHMSA Q.) • If yes, are the findings documented?	Yes
1. Does CMS conduct atmospheric corrosion inspection when they have access to facilities? • If yes, are the findings documented?	Yes
2. Do you know the procedures to visually examine any plastic fusion that is uncovered as part of excavation? • If yes, are the findings documented?	Yes
3. Do you notify damage prevention if any municipal work is being performed near gas distribution facilities? • If yes, are the findings documented?	Yes
4. Does Cross Bore recognized as risk? • If yes, are the findings documented?	Yes

Primary Threat Category	SME's to Consider the Following	Massachusetts
Corrosion	Is there known evidence of Corrosion on the system?	Yes
	Is there a known history of leakage on the system due to Corrosion?	Yes
	Threat Applicable?	Yes
Natural Force	Is there known evidence of damage or failures on the system due to natural forces?	Yes
	Is there a known history of leakage on the system due to Natural forces?	Yes
	Threat Applicable?	Yes
Excavation Damage	Is there known evidence of damage or failures on the system due to Excavation Damage?	Yes
	Is there a known history of leakage on the system due to Excavation Damage?	Yes
	Threat Applicable?	Yes
Other Outside Forces	Is there known evidence of damage or failures on the system due to Other Outside Forces?	Yes
	Is there a known history of leakage on the system due to Other Outside Forces?	Yes
	Threat Applicable?	Yes
Material or Weld Failure	Is there known evidence of damage or failures on the system due to Material or Weld Failure?	Yes
	Is there a known history of leakage on the system due to Material or Weld Failure?	Yes
	Threat Applicable?	Yes
Equipment Failure	Is there known evidence of damage or failures on the system due to Equipment Failure?	Yes
	Is there a known history of leakage on the system due to Equipment Failure?	Yes
	Threat Applicable?	Yes

Primary Threat Category	SME's to Consider the Following	Massachusetts
Incorrect Operations	Is there known evidence of damage or failures on the system due to Incorrect Operations?	Yes
	Is there a known history of leakage on the system due to Incorrect Operations?	
	Threat Applicable?	Yes
	Is there known evidence of damage or failures on the system due to others reasons?	Yes
Others	Is there a known history of leakage on the system due to other reasons?	Yes
	Threat Applicable?	Yes

Table 14-2: Summary of SME Interview Responses for Threat Identification

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
Corrosion	Cast Iron Pipe	Does Cast Iron pipe exist in the system?	**Yes**
		Is there a known history of body-of-pipe leaks, fractures, or graphitization?	**Yes**
	Bare Steel or Wrought Iron Pipe (with no CP other than Localized hot spotting with anodes)	Do bare (uncoated) steel main or services exist in the system that are not under CP?	**Yes**
		Is there known evidence of external corrosion on bare steel or wrought iron pipes not under CP?	**Yes**
		Is there a history of leakage on bare steel or wrought iron pipes not under CP?	**Yes**
	Bare Steel or Wrought Iron Pipe (with CP other than just localized hot spotting with anodes)	Do bare (uncoated) steel main or services exist in the system that are under CP?	**Yes**
		Is there known evidence of external corrosion on bare steel pipes under CP?	**Yes**
		Is there a known history of leakage on bare steel pipes under CP?	**Yes**
	Coated Steel with CP	Is there known evidence of external corrosion on coated steel pipe with CP?	**Yes**
		Is there a known history of leakage on coated steel pipe with CP?	**Yes**
		Are some CP systems frequently down (not achieving the required level of protection); more than 10% of the time?	**Yes**
	Coated Steel w/o CP	Is there known evidence of external corrosion on coated steel pipe without CP?	**Yes**
		Is there a known history of leakage on coated steel pipe without CP?	**Yes**
	Copper Services	Are direct buried or inserted copper services known to exist in the system?	**Yes**
		Is there a known history of leakage on copper services?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
	Stray Current	Do distribution facilities exist near DC transit systems, high voltage DC transmission systems or other known sources of DC current?	**Yes**
		Are any facilities known to be impacted by sources of stray DC current that has or may result in corrosion?	**Yes**
	Internal Corrosion	Are liquids known to exist within any portions of the distribution system?	**Yes**
		Is there known evidence of internal corrosion on steel pipe?	**No**
		Is there a known history of leakage caused by internal corrosion of steel pipe?	**No**
	Atmospheric Corrosion on above ground facilities	Do above ground distribution facilities exist in areas exposed to marine atmosphere, high humidity, atmospheric pollutants or agricultural chemicals?	**Yes**
		Is there known evidence of external atmospheric corrosion on exposed steel pipe, equipment or fittings?	**Yes**
		Is there a known history of leakage caused by atmospheric corrosion of steel pipe?	**Yes**
	Atmospheric Corrosion of facilities in Vaulted areas underground	Do gas distribution facilities exist underground in vaulted areas?	**Yes**
		Is there known evidence of external atmospheric corrosion on exposed steel pipe, equipment or fittings?	**Yes**
		Is there a known history of leakage caused by atmospheric corrosion of steel pipe in vaults?	**Yes**
	Corrosion of carrier pipe in Cased Crossing	Do steel carrier pipes exist within cased crossings?	**Yes**
		Are there any existing known contacts between carrier pipes and casings?	**Yes**
		Is there known evidence of past or active external corrosion on cased steel pipe?	**Yes**
		Is there a known history of leakage caused by corrosion on cased steel pipe?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
	Other Corrosion	Are there other corrosion threats?	**wall piece, at dis-similar metals & isolated fittings**
Natural Forces	Seismic Activity	Are there any seismically active zones or fault lines that exist in the area?	**Yes**
		Is there a history of leakage associated with Seismic activity?	**No**
	Earth Movement / Landslide (Unstable Soil)	Are there any areas susceptible to earth movement or landslide in the area?	**No**
		Is there a known history of leakage associated with landslide or earth movement?	**No**
	Frost Heave	Are there any areas susceptible to frost heave that exist in the area?	**Yes**
		Is there a known history of leakage resulting from frost heave?	**Yes**
	Flooding	Are there any areas within the gas system that are subject to flooding?	**Yes**
		Is there a known history of leakage or damage associated with flooding?	**Yes**
	Over-pressure due to snow/ice blockage	Are pressure control equipment vents subject to ice blockage during the winter?	**Yes**
		Is there a known history of over-pressure events as a result of snow/ice blockage?	**Yes**
	Tree Roots	Is there a known history of leakage to pipe or fittings as a result of tree root damage?	**Yes**
	Other Natural Forces	Is there a known history of leakage or damage due to other natural force causes; including but not limited to lightning, wild fire or high winds (tornados)?	**Lightning**
Excavation Damage	Improper Excavation Practice	Has damage requiring repair or replacement occurred on properly marked facilities due to the failure of the excavator to follow proper excavation rules and procedures?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
	Facility not located or marked	Has damage requiring repair or replacement occurred due to failure to locate a valid and timely locate request?	**Yes**
	One-call notification center error	Has damage requiring repair or replacement occurred due to an error made at the one-call notification center?	**No**
	Mis-Marked Facilities	Has damage requiring repair or replacement occurred due to the mis-marking of facilities?	**Yes**
		Threat Applicable?	**Yes**
	Incorrect Facility Records	Has damage requiring repair or replacement occurred due incorrect facility records?	**Yes**
	Other Excavation Damage	Has damage requiring repair or replacement occurred due other causes?	**Yes**
Other Outside Force Damage	Vehicle Damage to Riser/Meter	Are existing risers and/or meters exposed to damage from vehicular damage that do not have barriers or other protection conforming to current design requirements?	**Yes**
		Has known leakage occurred due to vehicle damage to risers/meters.	**Yes**
	Vehicle Damage to above-ground equip/station	Are regulator stations or other above ground station equipment exposed to damage from vehicular damage that do not have barriers or other protection conforming to current design requirements?	**Yes**
		Has known leakage occurred due to vehicle damage to above ground stations or equipment?	**Yes**
	Vandalism	Are gas valves or station equipment susceptible to damage by vandalism that has the potential to pose a risk to employees or the public?	**Yes**
		Has leakage or other unsafe condition been created by vandalism?	**Yes**
	Structure Fire	Is there a history of damage to gas meters or other equipment due to structure fires?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
	Other Outside Force Damage	Has damage requiring repair or replacement occurred due other outside forces?	**Falling ice, Heat ground contamination, down electric lines**
Pipe, Weld or Joint Failure	Century Products (MDPE 2306)	Is Century Products (MDPE 2306) pipe (Tan) known to exist in the system?	**No**
		Is there a history of leakage of Century Products (MDPE 2306) pipe due to material failure?	**No**
	Aldyl A (MDPE 2306)	Is pre-1973 Aldyl A pipe (Tan, but can turn grey) known to exist in the system?	**Yes**
		Has pre-1973 Aldyl A pipe been known to leak due to brittle-like failure from rock impingement or other stresses?	**Yes**
		Is there a history of leakage of pre-1973 Aldyl A pipe due to material failure?	**Yes**
	Aldyl AAAA (MDPE 2306) Green Aldyl	Is Green Aldyl pipe known to exist in the system?	**Yes**
		Is there a history of brittle like failures of Green Aldyl pipe?	**Yes**
		Is there a history of leakage of Green Aldyl pipe due to material failure?	**Yes**
	PVC – Polyvinyl Chloride	Is PVC pipe known to exist in the system?	**No**
		Is there a history of leakage of PVC pipe due to material failure?	**No**
	ABS – Acrylonitrile Butadiene Styrene	Is ABS pipe known to exist in the system?	**No**
		Is there a history of leakage of ABS pipe due to material failure?	**No**
	CAB – Cellulose Acetate Butyrate	Is CAB pipe known to exist in the system?	**No**
		Is there a history of leakage of CAB pipe due to material failure?	**No**
	PB – Polybutylene	Is PB pipe known to exist in the system?	**No**
		Is there a history of leakage of PB pipe due to material failure?	**No**
	PP – Polypropylene	Is PP pipe known to exist in the system?	**No**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
		Is there a history of leakage of PP pipe due to material failure?	**No**
	Polyamide - PA	Is PA pipe known to exist in the distribution system?	**No**
		Is there a history of leakage of PA pipe due to material failure?	**No**
	PE Fusion failure	Is there a history of PE Fusion Failures or leakage in the system?	**Yes**
		Are any types of PE fusion (type, material, size, age, process, geographic area) more prone to leakage or failure?	**Yes**
	Pre-1940 Oxy-Acetylene Girth Weld	Do pre-1940 Oxy-Acetylene Girth Welds exist on pipe greater than 4 inch?	**No**
		Is there a history of pre-1940 Oxy-Acetylene Girth Weld failures or leakage in the system due to material failure?	**No**
	Other	Do other material failures occur that present a possible current or future risk?	**Continental Service tees, Kerotest compression end valves, Amp fittings**
Equipment Failure	Plexco Service Tee Celcon Caps	Are Plexco Service Tee Celcon Caps known to exist in the system?	**Yes**
		Is there a history of leakage of Plexco Service Tee Celcon Caps due to material failure?	**Yes**
	PP – Delrin Insert Tap Tees	Are Delrin Insert Tap Tees known to exist in the system?	**Yes**
		Is there a history of leakage of Delrin Insert Tap Tees?	**Yes**
	Stab Type Mechanical	Is there a history of Stab Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Stab Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**
	Other Equipment Failure	What Types and Manufactures of Stab Type Mechanical Fittings have you seen used in the System?	**Perfection LYCO & AMP**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
		Are any types of Stab Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**LYCO**
	Nut Follower Type Mechanical Fittings	Is there a history of Nut Follower Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Nut Follower Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**
		What Types and Manufactures of Nut Follower Type Mechanical Fittings have you seen used in the System?	**Dresser, Normac, Innertite, Kerotest**
		Are any types of Nut Follower Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**Kerotest**
	Bolted Type Mechanical Fittings	Is there a history of Bolted Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Bolted Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Early vintage**
		What Types and Manufactures of Bolted Type Mechanical Fittings have you seen used in the System?	**Dressers, Smith Blair, & CSI**
		Are any types of Bolted Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**Early vintage smith Blair**
	Other Type Mechanical Fittings	Is there a history of other types of Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of other types of Mechanical Fitting failures or leakage in the system due to seal leakage?	**CI joints**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
		What other types and manufactures of Mechanical Fittings have you seen used in the System (other than Stab, Nut-follower, or bolted type?)	**No**
		Of the "other mechanical fittings" listed above, are any types of Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**No**
	Valves	Are valves inoperable, inaccessible and or paved over without timely identification and repairs?	**Yes**
		Are certain types or makes of valves more likely to leak?	**Kerotest**
	Service Regulators	Is there a history of service regulator failures that present a threat to the public or employees?	**No**
		Are certain types or makes of service regulator more likely to create a risk?	**Farm taps & Mercury**
	Meters	Is there a history of meter failures that present a threat to the public or employees?	**No**
		Are certain types or makes of meters more likely to create a risk?	**No**
	Control/Relief Station Equipment	Is there a history of control or relief station equipment failures that present a threat to the public or employees?	**No**
		Are certain types or makes of station equipment more likely to create a risk?	**No**
	Other Equipment Failure	Is there a history of other equipment failures that present a threat to the public or employees?	**Single Stage stations**
		Are certain types or makes of other equipment more likely to create a risk?	**No**
Incorrect Operations	General	Have inadequate procedures or safety practices, or failure to follow correct procedures, or other operator error resulted in an incident that created a risk to the gas distribution system?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Massachusetts
	Gas lines bored through Sewers	Have pipes been installed via unguided or guided bore without proper procedures to ensure other facilities are not damaged?	**Yes**
		Have pipes unknowingly bored through sewer lines been damaged by sewer line cleaning operations?	**Yes**
Other	Bell Joint Leakage	Does Cast Iron pipe exist in the system?	**Yes**
		Is there a history of bell joint leaks?	**Yes**
		Are certain diameters or parts of the system known to be more prone to bell joint failure or leakage than others?	**Yes**
	Inserted Copper Puncture	Do copper services inserted in steel exist in the system?	**Yes**
		Is there a history of leakage of copper services due to puncture by a deteriorated steel outer casing?	**No**
	Copper Sulfide	Have any safety incidents occurred as a result of copper sulfide in copper services or service regulators?	**No**
	Construction over gas mains & services	Have others constructed over gas facilities or taken other action that prevents effective leak survey and other maintenance?	**Yes**
		When identified, is construction that impacts required maintenance corrected in a timely manner?	**Yes**
	Other	Are there any other known threats to the Gas Distribution system that we need to be aware of?	**Gas Mains in Catch basins, Vibration equipment, Anaerobic sealants**

MASSACHUSETTS

APPENDIX C

EVALUATION AND RANKING OF RISK

HIGHEST RANKED RISKS

STATE: MASSACHUSETTS
REGION: BOSTON + ESSEX
FACILITY: MAINS

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Cast Iron	HP	4" Thru 8"	77.31	2.92	NATURAL FORCE/ OTHER	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Wrought Iron	HP	4" Thru 8"	3.34	2.92	NATURAL FORCE/ OTHER	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	LP	4" Thru 8"	1,257.20	2.23	NATURAL FORCE/ OTHER	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Wrought Iron	LP	4" Thru 8"	12.11	2.23	NATURAL FORCE/ OTHER	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedCoated Steel	> 60 PSI,Not T	Over 8"	99.81	2.10	EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION/ MATERIAL/WELD / CORROSION	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	LP	Over 8"	225.37	1.72	NATURAL FORCE/ OTHER	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	> 60 PSI,Not T	Upto 4"	0.15	7.34	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	> 60 PSI,Not T	Over 4" Thru 8"	0.40	7.34	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedBare Steel	> 60 PSI,Not T	Upto 4"	3.37	6.24	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.55
ProtectedBare Steel	> 60 PSI,Not T	Over 4" Thru 8"	4.15	6.24	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.55
ProtectedBare Steel	> 60 PSI,Not T	Over 8"	7.43	6.24	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.55

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of incidents.

BOSTON + ESSEX MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	HP	Upto 4"	250.10	5.80	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
UnprotectedBare Steel	HP	Over 4" Thru 8"	122.52	5.80	CORROSION/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
UnprotectedBare Steel	HP	Over 8"	17.23	5.80	CORROSION/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
Cast Iron	HP	Under 4"	0.70	5.71	OTHER / NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.33
Cast Iron	HP	Over 8"	103.31	5.71	OTHER / NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.33
Wrought Iron	HP	Under 4"	4.77	5.71	OTHER/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.33
Wrought Iron	HP	Over 8"	0.11	5.71	OTHER/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.33
ProtectedBare Steel	HP	Upto 4"	63.07	5.02	CORROSION/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.05
ProtectedBare Steel	HP	Over 4" Thru 8"	34.43	5.02	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.05
ProtectedBare Steel	HP	Over 8"	3.72	5.02	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.05
UnprotectedBare Steel	LP	Upto 4"	152.09	4.06	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.66

BOSTON + ESSEX MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	LP	Over 4" Thru 8"	72.11	4.06	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.66
UnprotectedBare Steel	LP	Over 8"	5.34	4.06	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.66
ProtectedBare Steel	LP	Upto 4"	7.09	3.64	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.49
ProtectedBare Steel	LP	Over 4" Thru 8"	7.03	3.64	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.49
ProtectedBare Steel	LP	Over 8"	0.45	3.64	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.49
Cast Iron	LP	Under 4"	45.40	3.34	NATURAL FORCE/ OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.37
Wrought Iron	LP	Under 4"	21.65	3.34	NATURAL FORCE/ OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.37
Plastic	> 60 PSI,Not T	Upto 4"	112.17	2.85	MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.16
Plastic	> 60 PSI,Not T	Over 4" Thru 8"	20.47	2.85	MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.16
UnprotectedCoated Steel	> 60 PSI,Not T	Upto 4"	1.36	2.58	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.06
UnprotectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	0.13	2.58	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.06

BOSTON + ESSEX MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedCoated Steel	> 60 PSI,Not T	Over 8"	0.19	2.58	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.06
ProtectedCoated Steel	Local T	Upto 4"	0.36	2.32	EXCAVATION/ O. O. FORCE			0.95
ProtectedCoated Steel	Local T	Over 4" Thru 8"	0.85	2.32	EXCAVATION/ O. O. FORCE			0.95
ProtectedCoated Steel	Local T	Over 8"	5.91	2.32	EXCAVATION/ O. O. FORCE			0.95
Plastic	HP	Upto 4"	1,380.80	2.30	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94
Plastic	HP	Over 4" Thru 8"	470.19	2.30	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94
Plastic	HP	Over 8"	25.02	2.30	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94
ProtectedCoated Steel	> 60 PSI,Not T	Upto 4"	75.50	2.10	EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION/ MATERIAL/WELD / CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.86
ProtectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	61.03	2.10	EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION/ MATERIAL/WELD / CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.86
UnprotectedCoated Steel	HP	Upto 4"	286.10	2.06	CORROSION/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.84
UnprotectedCoated Steel	HP	Over 4" Thru 8"	37.69	2.06	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.84
UnprotectedCoated Steel	HP	Over 8"	13.18	2.06	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.84
UnprotectedCoated Steel	LP	Over 4" Thru 8"	51.66	1.49	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.61

HIGHEST RANKED RISKS

STATE: MASSACHUSETTS
REGION: BOSTON + ESSEX
FACILITY: SERVICES (Active & Inactive)

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Unprotected Bare Steel	HP	Inside	4,151	1.65	O. O. FORCE/ CORROSION/ NATURAL FORCE/ EXCAVATION	**Known incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	HP	Outside	5,188	6.43	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	HP	n/a	947	6.43	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	LP	Outside	3,390	5.07	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.36
Unprotected Bare Steel	LP	n/a	3,455	5.07	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.36
Copper	HP	Inside	330	4.37	CORROSION/ EXCAVATION/ EQ. FAILURE/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.04
Wrought Iron	HP	Inside	101	3.82	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ OTHER / EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.78
Unprotected Coated Steel	HP	Inside	2,811	3.73	CORROSION/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.74
Copper	LP	Inside	3,499	3.67	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.71
Copper	HP	Outside	5,250	3.50	CORROSION/ EQ. FAILURE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.63
Copper	HP	n/a	239	3.50	CORROSION/ EQ. FAILURE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.63

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

BOSTON + ESSEX SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Inside	12,990	3.49	EXCAVATION/ MATERIAL-WELD / NATURAL FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.63
Cast Iron	LP	Inside	23	3.42	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ OTHER/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.60
Wrought Iron	LP	Inside	1,183	3.42	CORROSION/ EXCAVATION / NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.60
Unprotected Coated Steel	LP	Inside	11,636	3.31	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.55
Plastic	LP	Inside	117,748	3.14	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.47
Cast Iron	HP	Outside	2	3.08	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.44
Wrought Iron	HP	Outside	140	3.08	CORROSION/ EXCAVATION/ NATURAL FORCE/O. O. FORCE/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.44
Unprotected Coated Steel	HP	Outside	6,675	2.98	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.39
Unprotected Coated Steel	HP	n/a	952	2.98	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.39
Wrought Iron	HP	n/a	36	2.95	CORROSION/ EXCAVATION/ NATURAL FORCE/O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.38
Copper	LP	n/a	49	2.87	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.34

BOSTON + ESSEX SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Outside	129,595	2.81	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.31
Protected Coated Steel	Local T	Inside	5	2.75	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.28
Protected Coated Steel	Local T	Outside	27	2.75	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.28
Copper	LP	Outside	77	2.71	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.27
Plastic	HP	n/a	5,119	2.70	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.26
Cast Iron	LP	Outside	2	2.60	CORROSION/ NATURAL FORCE/ EXCAVATION/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.21
Wrought Iron	LP	Outside	44	2.60	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.21
Unprotected Coated Steel	LP	Outside	1,104	2.48	CORROSION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.16
Unprotected Coated Steel	LP	n/a	511	2.48	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.16
Cast Iron	LP	n/a	3	2.46	CORROSION/ EXCAVATION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.15
Wrought Iron	LP	n/a	12	2.46	CORROSION/ EXCAVATION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.15

BOSTON + ESSEX SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	LP	Outside	52,647	2.35	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.10
Plastic	LP	n/a	1,913	2.35	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.10
Unprotected Bare Steel	LP	Inside	77,705	2.35	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.10
Protected Coated Steel	HP	Inside	3,011	2.23	CORROSION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.04
Protected Coated Steel	LP	Inside	12,985	2.02	CORROSION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.95
Protected Coated Steel	HP	Outside	15,290	1.78	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.83
Protected Coated Steel	HP	n/a	1,810	1.78	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.83
Protected Coated Steel	LP	n/a	677	1.58	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.74

HIGHEST RANKED RISKS

STATE: MASSACHUSETTS
REGION: COLONIAL- CAPE COD + LOWELL
FACILITY: MAINS

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
ProtectedBare Steel	> 60 PSI,Not T	Over 8"	0.09	6.80	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	HP	Upto 4"	17.38	6.27	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.76
UnprotectedBare Steel	HP	Over 4" Thru 8"	3.51	6.27	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.76
ProtectedBare Steel	HP	Upto 4"	7.43	5.48	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.42
UnprotectedBare Steel	LP	Upto 4"	8.88	4.39	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.94
UnprotectedBare Steel	LP	Over 4" Thru 8"	1.38	4.39	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.94
UnprotectedBare Steel	LP	Over 8"	0.34	4.39	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.94
ProtectedCoated Steel	Local T	Upto 4"	0.59	2.65	EXCAVATION/ O. O. FORCE/ NATURAL FORCE / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.17
ProtectedCoated Steel	Local T	Over 8"	35.83	2.65	EXCAVATION/ O. O. FORCE/ NATURAL FORCE / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.17
Cast Iron	LP	Under 4"	0.19	2.61	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.15
Plastic	HP	Upto 4"	2,248.10	2.54	EXCAVATION/ O. O. FORCE			1.12

COLONIAL- CAPE COD + LOWELL MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Over 4" Thru 8"	191.60	2.54	EXCAVATION/ O. O. FORCE			1.12
Plastic	HP	Over 8"	2.46	2.54	EXCAVATION/ O. O. FORCE			1.12
ProtectedCoated Steel	> 60 PSI,Not T	Upto 4"	1.36	2.42	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.07
ProtectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	21.58	2.42	NATURAL FORCE/ EXCAVATION/ O. O. FORCE/ INC. OPERATION/ MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.07
ProtectedCoated Steel	> 60 PSI,Not T	Over 8"	49.50	2.42	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.07
ProtectedCoated Steel	Local T	Over 4" Thru 8"	6.38	2.32	NATURAL FORCE/O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.02
Cast Iron	LP	4" Thru 8"	60.82	2.23	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.98
UnprotectedCoated Steel	HP	Upto 4"	23.04	2.14	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94
UnprotectedCoated Steel	HP	Over 4" Thru 8"	7.93	2.14	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94
Plastic	LP	Upto 4"	30.59	2.01	EXCAVATION			0.89
Plastic	LP	Over 4" Thru 8"	50.03	2.01	EXCAVATION			0.89
Plastic	LP	Over 8"	0.09	2.01	EXCAVATION			0.89

HIGHEST RANKED RISKS

STATE: MASSACHUSETTS
REGION: COLONIAL- CAPE COD + LOWELL
FACILITY: SERVICES (Active & Inactive)

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Outside	123,240	2.51	O. O. FORCE/ EXCAVATION/ MATERIAL-WELD	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Coated Steel	LP	Outside	162	1.48	NATURAL FORCE/ CORROSION	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Wrought Iron	HP	Outside	17	19.11	CORROSION/ NATURAL FORCE/ EXCAVATION/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	> 60 PSI,Not T	Inside	1	6.37	CORROSION/ NATURAL FORCE/ EXCAVATION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.00
Unprotected Bare Steel	> 60 PSI,Not T	Outside	7	6.37	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.00
Unprotected Bare Steel	HP	Inside	14	6.16	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.97
Unprotected Bare Steel	HP	Outside	1,964	4.93	CORROSION/ NATURAL FORCE/ EXCAVATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.77
Unprotected Bare Steel	HP	n/a	10	4.93	CORROSION/ NATURAL FORCE/ EXCAVATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.77
Unprotected Bare Steel	LP	Outside	211	4.01	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.63
Unprotected Bare Steel	LP	n/a	71	4.01	CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.63
							An additional factor will be applied to the replacement qualification and	

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of incident.

COLONIAL- CAPE COD + LOWELL SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Unprotected Coated Steel	> 60 PSI,Not T	Outside	15	3.70	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.58
Plastic	HP	Inside	668	3.60	MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.56
Plastic	> 60 PSI,Not T	Inside	8	3.60	MATERIAL-WELD / EXCAVATION/ O. O. FORCE/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.56
Plastic	> 60 PSI,Not T	Outside	760	3.60	MATERIAL-WELD / EXCAVATION/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.56
Unprotected Coated Steel	HP	Inside	83	3.58	CORROSION/ MATERIAL-WELD / INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.56
Plastic	LP	Inside	6,019	3.35	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.53
Unprotected Coated Steel	LP	Inside	1,593	3.28	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.52
Unprotected Coated Steel	HP	Outside	4,007	2.86	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.45
Unprotected Coated Steel	HP	n/a	9	2.86	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.45
Plastic	HP	n/a	2,113	2.78	EXCAVATION / O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.44
Unprotected Bare Steel	LP	Inside	1,275	2.57	NATURAL FORCE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.40

COLONIAL- CAPE COD + LOWELL SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	LP	Outside	4,330	2.51	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.39
Plastic	LP	n/a	185	2.51	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.39
Unprotected Coated Steel	LP	n/a	27	2.46	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.39
Copper	LP	Inside	1	2.38	EQ. FAILURE/ CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.37
Protected Coated Steel	> 60 PSI,Not T	Inside	3	2.15	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.34
Protected Coated Steel	> 60 PSI,Not T	Outside	292	2.15	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.34
Protected Coated Steel	LP	Inside	4,791	1.99	CORROSION/ NATURAL FORCE/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.31
Protected Coated Steel	HP	Inside	279	1.82	INC. OPERATION/ EQ. FAILURE			0.29

MASSACHUSETTS

APPENDIX D

IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS

Table 14-3: Threat Mitigation

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Massachusetts
Corrosion	Cast Iron Pipe Graphitization (including risk of crack or break due to becoming brittle)	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Bare Steel or Wrought Iron Pipe	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Coated Steel w/o CP	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Copper Services	Proactive leak surveys, service tees replaced with main replacements and leak management programs
	Stray Current	Design, Proactive leak surveys, Proactive Corrosion Control inspections
	Internal Corrosion	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Atmospheric Corrosion on above ground facilities	Design, Proactive leak surveys, Proactive Corrosion Control inspections
	Atmospheric Corrosion of facilities in Vaulted areas underground	Design, Proactive leak surveys, Proactive I&R and Corrosion Control inspections
	Corrosion of Buried Farm Tap Equipment	Proactive leak surveys, Proactive Corrosion Control inspections
	Corrosion of Service Fittings on cast iron mains that are not cathodically protected.	Proactive leak surveys, services associated with main replacement programs are replaced, proactive high-pressure service replacement program and leak management program

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Massachusetts
	Grounds installed on risers making CP ineffective	Cathodic Protection Monitoring
	Corrosion of carrier pipe in Cased Crossing	Cathodic Protection Monitoring
Natural Forces	Earth Movement / Landslide(Unstable Soil)	Proactive Leak Survey Programs
	Frost Heave	Proactive Leak Survey Programs / Winter Operations
	Flooding (including Coastal)	Proactive Leak Survey Programs
	Tree Roots	Proactive Leak Survey Programs
	Over-pressure due to snow/ice blockage or freeze up.	Design, Proactive Leak Survey Programs
	Other Natural Forces (Lightning, High winds)	Design, Proactive Leak Survey Programs
Excavation Damage	Improper Excavation Practice (including mitigation for high-risk tickets)	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Facility not located or marked	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	One-call notification practices not sufficient	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Mis-Marked Facilities	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Incorrect Facility Records	Damage Prevention Monitoring, Design, EFV's, training and emergency response (see Table 6-7)

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Massachusetts
	Shallow Mains - reduced cover	Damage Prevention Monitoring, Design, training and emergency response
	Plastic without tracer wire that cannot be located	Damage Prevention Monitoring, Design, EFV's, training and emergency response
Other Outside Force Damage	Vehicle Damage to Riser/Meter	Design, Proactive Leak Survey Programs
	Vehicle Damage to above-ground equip/station	Design, Proactive Leak Survey Programs
	Vandalism	Design, EFV's Proactive Leak Survey Programs
	Structure Fire	Design, EFV's, training and emergency response
Pipe, Weld or Joint Failure	Plexco Service Tee Celcon Caps	Not Applicable
	1973 and later Aldyl A (Tan MDPE 2306)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	1973 and later Aldyl A (Tan MDPE 2406)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Aldyl 4A (Green MDPE 2306)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	PE other than Aldyl A & 4A	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Delrin Insert Tap Tees	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Plexco Service Tee Celcon Caps	Not Applicable
Equipment Failure	Stab Type Mechanical	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Nut Follower Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Massachusetts
	Bolted Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Other Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Valves	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Service Regulators	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Meters (including Tin Meters)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Control/Relief Station Equipment	Design, I&R Inspections, Operator Qualifications, training and emergency response
Incorrect Operations	General	Operator Qualifications, training and emergency response
	Gas lines bored through Sewers	Operator Qualifications, training and emergency response
Other	Bell Joint Leakage, Cast Iron and Ductile Iron	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Construction over gas mains & services	Operator Qualifications, training and emergency response

Extensive investigation/research, monitoring and improvement works are being performed on some special projects listed below and all the reports are incorporated by reference in its most updated form.

ATMOSPHERIC CORROSION

In Massachusetts, National Grid visits all services with inside meter sets to inspect the service for atmospheric corrosion. Due to the timing of these inspections, National Grid cannot always gain access to all buildings to inspect the pipe. National Grid attempts two more times to contact the customer and schedule an appointment. However, a large number of service inspections attempted are never completed and have a result of “Can’t Get In” (CGI).

In order to address any safety concerns with these services, National Grid conducted a review to see if any other inspection programs or service work were conducted at the address in the last 6 years. National Grid determined that if the service was replaced in the last 6 years or if an atmospheric corrosion inspection was completed as a “tag-a-long” inspection to other work being completed, the service was at a lower risk to be severely corroded.

For the remaining services that have had no access to the premises in the last 6 years, National Grid prioritized the risk by year of installation and will begin to turn the customer’s gas off in the summer in order to schedule an appointment for an atmospheric corrosion inspection.

INSIDE METER SETS

The National Grid Inside Meter Sets program is dedicated to upgrading the natural gas infrastructure by relocating inside gas meter set. Natural gas meters are moved from inside to outside locations so that National Grid can continue to provide safe, high-quality customer service by replacing older leak prone pipe made of cast iron or unprotected steel. Service lines may also be replaced with modern materials if they have not previously been replaced during routine maintenance. Some of the benefits of this program are the replacement of LPP with more modern materials in order to reduce the risk of gas leaks. This program also contributes to customer and company convenience by eliminating the need to enter the home for atmospheric corrosion inspections and leak surveys. The inside meter sets program increases customer satisfaction by facilitating more frequent and comprehensive inspections and maintenance work on meters and service piping that has been placed outside. Lastly, the inside meter sets relocation program eliminates the risk of shut-off due to access issues, and provides easy access to relocated outside meters in the event of an emergency.

FARM TAPS

National Grid has several services in Massachusetts that are connected to a high pressure main at 125 psi or greater. Because of this, the services are installed with a special regulator (Farm Taps) to cut this pressure to a lower pressure that our usual service regulators operate at. These services are also installed with a fail-safe in the event that the farm tap regulator operates incorrectly. These fail-safes include a slam shut device downstream of the farm tap or a monitor control set up with two regulators.

National Grid began inspecting farm tap services in 2016 after an initial random inspection in 2014 of a sample of farm taps. These inspection results will help prioritize which farm taps will be replaced or upgraded first. Moving forward, these farm taps will be inspected on a 3 year cycle to check the equipment is operating correctly, not corroded, and not leaking to ensure the safety of the customer.

ROMBACH REGULATORS

New England Dispatch received notification from an employee of an over-pressurization incident that occurred at 164 Willow Rd, Nahant MA. The employee was on-site for a reported high pressure at the boiler and found that the Rombach Model ZR-20 service regulators had failed, causing the service to be over-pressurized by approximately 1 psi.

National Grid compiled local field work knowledge and actual service records to determine that Rombach regulators had only been installed on the 1.45 psi distribution system in Nahant and the 1 psi distribution system in Somerville, Medford, and Charlestown. To confirm this, National Grid identified all possible services tied to distribution mains from 1 psi to 2 psi and inspected a random sample on each distribution system. After finding no Rombach regulators on these systems, National Grid determined with 95% confidence that no Rombachs were installed on services except on the Nahant and Somerville Distribution Systems.

National Grid inspected all services on these systems and replaced every Rombach regulator found. In order to replace these in a timely manner, National Grid installed a J42 regulator. A random sample of these will be inspected over the next 2 years to ensure they are operating correctly. National Grid is currently working towards creating a 20 year service regulator inspection program to ensure comprehensive knowledge of every service regulator installed in our distribution system.

INNERTITE FITTINGS

National Grid had 2 incidents involving Inner-Tite fittings in 2008 and 2011 on Long Island, with the 2008 incident resulting in property damage. History has shown the Inner-Tite fittings corrode at a faster rate than the rest of the service. Because of this, National Grid has identified all plastic and plastic tube inside meter services installed in 1974 and prior for the Massachusetts Service territory to be inspected, as services meeting these conditions involve the possibility of having the Inner-Tite equipment installed as part of the fitting assembly.

From 2012 – 2014, National Grid visited every site and completed inspections when able to get access inside the building. However, despite multiple lettering and communication attempts, National Grid was not able to get access inside the house to complete the inspection. In 2015, National Grid reviewed other work done from other programs and reduced the list of services needing inspection in Massachusetts. The Inner-Tite fitting inspection was completed for services installed in 1974 and prior. The Company will continue to inspect these fittings through the Atmospheric Corrosion Program.

WATER INTRUSION/WASHOUT PROJECTS

The National Grid Water Intrusion/Washouts Program is in place to remediate situations where water has infiltrated the gas distribution system. This situation is known to cause poor pressure, resulting in repeated customer supply disruptions and decreased system reliability. The program addresses outstanding water intrusion issues in addition to allowing in-year projects to be walked-in as locations meeting criteria for inclusion in the program are identified. This program also addresses unanticipated infrastructure washouts and main exposures that can occur due to storms, heavy rains and/or seasonal snow melt. Main exposure/undermining can result in damage to facilities, emergency response and potential loss of service to customers. Distribution washouts/exposures can create potential for further damages and risks to assets if not addresses efficiently and appropriately. National Grid is required to ensure proper integrity for safe operation of its assets and to maintain proper cover and protection of its facilities.

PROACTIVE MAIN REPLACEMENT PROGRAM – LPP

This program supports the replacement of Leak Prone Pipe (LPP) inventory, defined as mains less than 16” in diameter that are non-cathodically protected steel, whether bare or coated (collectively termed “unprotected steel”), cast/ wrought iron and pre 1985 Aldyl-A plastic. The goal of this program is to reduce the risk associated with leak prone pipe in the distribution system.

CI FROST PATROL

Cast Iron (CI) is a brittle material and has tendency to break when extended periods of cold temperature allow frost to form in the ground. The downward pressure of the expanding frost line can exert such great force that it can crack smaller diameter cast iron mains. In a natural process of graphitization, iron degrades to softer elements, making iron pipelines more susceptible to cracking. Gas may leak from the joints or through cracks in the pipe if graphitization has occurred. National Grid performs periodic survey to identify CI breaks and joint leaks .

REGULATOR / VENT INSPECTION (aka Meter Set Compliance)

In 2009, the MA DPU noted numerous incidents where newly installed outside meter sets were not compliant with company standards. As a result, National grid expanded the 3 year walking survey cycle to inspect all outside risers for any vents that don’t meet the company’s installation standards regarding height, support, and location. The new Meter Set Compliance Program began in 2012 and tracks the discovery and remediation of any substandard conditions involving integrity of the equipment, corrosion of the riser, meter protection, riser support, and regulator vent clearances. National Grid reports the number of issues discovered and remediated on a yearly basis to ensure any substandard condition is repaired within 3 years of discovery.

PLASTIC FAILURES

National Grid policy requires that failed plastic parts (either leaking or visually identified as not exhibiting properties of a properly fused or assembled part) be returned to the Laboratory for analysis and testing. When possible, parts are destructively tested to assess cause of leak/failure. A log of analyzed failures is maintained and periodically reviewed in order to recognize system wide failure trends. Local analysis (frequently a leak survey) is conducted to check contemporary and contiguous installation work for similar failures. The paperwork associated with nearby failures from other years may also be examined in order to further complete the review. Certain failures, such as the identification of slow crack growth on pre-1985 plastic Aldyl-A, may lead to proactive replacement of similar pipe.

PROACTIVE SERVICE REPLACEMENT

MA proactive service replacement program lead to the review of steel services and a risk prioritization based upon recent leak history statistics. Targeted for replacement will be the services at greatest risk for leakage and those that are an inside set. All targeted services should be outside the bounds of planned main replacements.

METHANE EMISSIONS

The leak migration is based on the volume of the gas leaking from a facility i.e. a high emitting leak will have a greater extent of leak plume than that of the low emitting leak. The Company will be using this principle in evaluating and prioritizing the type-3 leaks for repair to reduce the methane emissions.

For every individual leak, adding all the bar hole readings will result in the relative size of the plume. Greater the sum of bar hole readings, larger the plume and hence larger the methane emissions. By analyzing the sum of bar-hole readings per leak across all open type-3 leaks, will relatively prioritize them based on emissions.

Every leak has a different migration pattern and the bar-hole readings will be relative to the size of the leak. For e.g., a small leak will have migrated only to limited distance and the leak investigation will get 0% readings in relatively smaller area when compared to a larger leak where the leak investigation will lead to more readings and farther migration patterns.

Material, diameter and pressure normally do not impact the size of leak plume or emission volume since the gas leaks are identified based on the gas in the air. High pressure main will have a much smaller opening in the in the pipe to have similar methane emissions as a low pressure main with larger opening.

ACCESS PROTECTION

The Access Protection program was implemented due to an Incident in the UK, where kids climbed on an elevated pipe resulting in a fatality. National Grid installs protection on any elevated structure. The program is to reduce the risk of public injury by restricting or deterring public access to the Company's elevated gas facilities. In accordance with the customer/community-first approach, the Company has installed protective barriers, such as fencing or other physical deterrents, that will restrict or deter the public from accessing or climbing on elevated gas mains.

PIPE ON BRIDGES

National Grid developed the program to replace or rehabilitated gas pipe and appurtenances on aboveground structures, typically bridges, due to integrity concerns.

MASSACHUSETTS

APPENDIX E

MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS

Appendix E, Section 1 – Number of Hazardous Leaks Either Eliminated or Repaired, Categorized by Cause

The baseline and ongoing performance of the number of Hazardous (***Type 1***) Leaks for Main and Service combined Either Eliminated or Repaired, Categorized by Cause is provided below (Including Excavation Damage Leaks):

INCLUDING Damages

BOSTON + ESSEX

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	1,080	1,266	993	1,536	1,582	1,786	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,423 for 2014 - 2018)						
Natural Forces	Actual	531	582	295	204	420	206	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (485 for 2014 - 2018)						
Excavation Damage	Actual	494	486	448	373	484	431	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (482 for 2014 - 2018)						
Other Outside Force	Actual	5	14	15	16	27	40	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (19 for 2014 - 2018)						
Pipe, Weld or Joint Failure	Actual	33	40	33	13	22	10	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (34 for 2014 - 2018)						
Equipment Failure	Actual	523	669	659	846	330	440	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (701 for 2014 - 2018)						
Incorrect Operations	Actual	3	1	2	3	5	3	
	o	Rolling average since 2014 + 0.5 standard deviation (4 for 2014 - 2018)						
Other	Actual	1,670	1,977	1,458	2,247	1,876	1,510	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,996 for 2014 - 2018)						
Total	Actual	4,339	5,035	3,903	5,238	4,746	4,426	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4,921 for 2014 - 2018)						

Above Baseline Comments:

1 - 2017 PHMSA definition for leaks caused by Equipment failure has changed per F-71001-1 (Rev 1-31-2017)

2 – Other Outside Force has been identified more clearly than before. Usually crew will pick Other when expose pipe/rock etc. Findings will be addressed.

INCLUDING Damages

CAPE COD + LOWELL

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	121	141	96	116	243	244	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (172 for 2014 - 2018)						
Natural Forces	Actual	17	38	4	5	18	22	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (23 for 2014 - 2018)						
Excavation Damage	Actual	175	188	179	176	184	144	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (183 for 2014 - 2018)						
Other Outside Force	Actual	0	1	2	1	11	15	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5 for 2014 - 2018)						
Pipe, Weld or Joint Failure	Actual	7	4	2	2	5	1	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5 for 2014 - 2018)						
Equipment Failure	Actual	212	230	269	236	81	105	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (242 for 2014 - 2018)						
Incorrect Operations	Actual	1	0	0	0	1	0	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1 for 2014 - 2018)						
Other	Actual	29	35	18	36	69	41	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (47 for 2014 - 2018)						
Total	Actual	562	637	570	572	612	572	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (607 for 2014 - 2018)						

Above Baseline Comments:

1 - Corrosion - 2017 PHMSA definition for leaks caused by Equipment failure has changed per F-71001-1 (Rev 1-31-2017)

2 – Other Outside Force has been identified more clearly than before. Usually crew will pick Other when expose pipe/rock etc. Findings will be addressed.

INCLUDING Damages

MASSACHUSETTS

Cause		2014	2015	2016	2017	2018	2019
Corrosion	Actual	1,201	1,407	1,089	1,652	1,825	2,030
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,588 for 2014 - 2018)					
Natural Forces	Actual	548	620	299	209	438	228
	Baseline	Rolling average since 2014 + 0.5 standard deviation (508 for 2014 - 2018)					
Excavation Damage	Actual	669	674	627	549	668	575
	Baseline	Rolling average since 2014 + 0.5 standard deviation (664 for 2014 - 2018)					
Other Outside Force	Actual	5	15	17	17	38	55
	Baseline	Rolling average since 2014 + 0.5 standard deviation (24 for 2014 - 2018)					
Pipe, Weld or Joint Failure	Actual	40	44	35	15	27	11
	Baseline	Rolling average since 2014 + 0.5 standard deviation (38 for 2014 - 2018)					
Equipment Failure	Actual	735	899	928	1,082	411	545
	Baseline	Rolling average since 2014 + 0.5 standard deviation (939 for 2014 - 2018)					
Incorrect Operations	Actual	4	1	2	3	6	3
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4 for 2014 - 2018)					
Other	Actual	1,699	2,012	1,476	2,283	1,945	1,551
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,037 for 2014 - 2018)					
Total	Actual	4,901	5,672	4,473	5,810	5,358	4,998
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5,520 for 2014 - 2018)					

Appendix E, Section 2 – Number of Excavation Damages

The baseline and ongoing performance of the number of excavation damages is provided below (Including Excavation Damage Leaks):

INCLUDING Damages

BOSTON + ESSEX		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	423	371	404	356	412	375
	Baseline	Rolling average since 2014 + 0.5 standard deviation (407 for 2014 - 2018)					

CAPE COD + LOWELL		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	152	160	151	154	161	128
	Baseline	Rolling average since 2014 + 0.5 standard deviation (158 for 2014 - 2018)					

MASSACHUSETTS		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	575	531	555	510	573	503
	Baseline	Rolling average since 2014 + 0.5 standard deviation (563 for 2014 - 2018)					

Appendix E, Section 3 – Number of Excavation Tickets

The baseline and ongoing performance of the number of excavation tickets are provided below (Including Excavation Damage Leaks):

INCLUDING Damages

BOSTON + ESSEX		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	131,701	132,546	135,443	139,064	136,280	163,524
	Baseline	Rolling average since 2014 + 0.5 standard deviation (136,353 for 2014 - 2018)					

CAPE COD + LOWELL		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	45,499	46,856	49,961	50,570	52,594	62,798
	Baseline	Rolling average since 2014 + 0.5 standard deviation (49,440 for 2014 - 2018)					

MASSACHUSETTS		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	177,200	179,402	185,404	189,634	188,874	226,322
	Baseline	Rolling average since 2014 + 0.5 standard deviation (185,743 for 2014 - 2018)					

Appendix E, Section 4 – Total Number of Leaks Either Eliminated or Repaired, Categorized by Cause

The baseline and ongoing performance of the number of Leaks Either Eliminated or Repaired, Categorized by Cause is provided below (Including Excavation Damage Leaks):

INCLUDING Damages

BOSTON + ESSEX

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	2,064	1,266	1,886	2,775	2,185	3,098	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,307 for 2014 - 2018)						
Natural Forces	Actual	719	582	395	289	459	256	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (572 for 2014 - 2018)						
Excavation Damage	Actual	500	486	462	383	494	439	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (489 for 2014 - 2018)						
Other Outside Force	Actual	8	14	17	19	32	49	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (22 for 2014 - 2018)						
Pipe, Weld or Joint Failure	Actual	52	40	63	22	36	22	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (50 for 2014 - 2018)						
Equipment Failure	Actual	824	669	984	1,251	451	705	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (988 for 2014 - 2018)						
Incorrect Operations	Actual	3	1	3	6	7	3	
	o	Rolling average since 2014 + 0.5 standard deviation (5 for 2014 - 2018)						
Other	Actual	3,673	1,977	3,527	5,325	2,982	4,478	*3*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4,107 for 2014 - 2018)						
Total	Actual	7,843	5,035	7,337	10,070	6,646	9,050	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (8,304 for 2014 - 2018)						

Above Baseline Comments:

1 - Corrosion - 2017 PHMSA definition for leaks caused by Equipment failure has changed per F-71001-1 (Rev 1-31-2017)

2 – Other Outside Force has been identified more clearly than before. Usually crew will pick Other when expose pipe/rock etc.

3 – Other – Cast Iron Joint Leaks. 2018 was lower due to work stoppage. It should be noted that implementation of the 2018 Work Continuation Plan had a significant impact to work in this region (June 2018 – January 2019).

INCLUDING Damages

CAPE COD + LOWELL

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	227	141	180	217	357	314	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (265 for 2014 - 2018)						
Natural Forces	Actual	20	38	9	7	18	23	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (25 for 2014 - 2018)						
Excavation Damage	Actual	179	188	181	181	187	145	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (185 for 2014 - 2018)						
Other Outside Force	Actual	0	1	2	1	11	15	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5 for 2014 - 2018)						
Pipe, Weld or Joint Failure	Actual	13	4	2	6	18	7	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (12 for 2014 - 2018)						
Equipment Failure	Actual	290	230	323	318	152	163	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (299 for 2014 - 2018)						
Incorrect Operations	Actual	1	0	0	0	1	0	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1 for 2014 - 2018)						
Other	Actual	43	35	37	94	125	63	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (87 for 2014 - 2018)						
Total	Actual	773	637	734	824	869	730	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (812 for 2014 - 2018)						

Above Baseline Comments:

1 - Corrosion - 2017 PHMSA definition for leaks caused by Equipment failure has changed per F-71001-1 (Rev 1-31-2017)

2 – Other Outside Force has been identified more clearly than before. Usually crew will pick Other when expose pipe/rock etc.

INCLUDING Damages

MASSACHUSETTS

Cause		2014	2015	2016	2017	2018	2019
Corrosion	Actual	2,291	1,407	2,066	2,992	2,542	3,411
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,553 for 2014 - 2018)					
Natural Forces	Actual	739	620	404	296	477	271
	Baseline	Rolling average since 2014 + 0.5 standard deviation (595 for 2014 - 2018)					
Excavation Damage	Actual	679	674	643	564	681	587
	Baseline	Rolling average since 2014 + 0.5 standard deviation (673 for 2014 - 2018)					
Other Outside Force	Actual	8	15	19	20	43	64
	Baseline	Rolling average since 2014 + 0.5 standard deviation (28 for 2014 - 2018)					
Pipe, Weld or Joint Failure	Actual	65	44	65	28	54	29
	Baseline	Rolling average since 2014 + 0.5 standard deviation (59 for 2014 - 2018)					
Equipment Failure	Actual	1,114	899	1,307	1,569	603	870
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,284 for 2014 - 2018)					
Incorrect Operations	Actual	4	1	3	6	8	3
	Baseline	Rolling average since 2014 + 0.5 standard deviation (6 for 2014 - 2018)					
Other	Actual	3,716	2,012	3,564	5,419	3,107	4,576
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4,180 for 2014 - 2018)					
Total	Actual	8,616	5,672	8,071	10,894	7,515	9,811
	Baseline	Rolling average since 2014 + 0.5 standard deviation (9,099 for 2014 - 2018)					

Appendix E, Section 5 – Number of Hazardous Leaks Either Eliminated or Repaired, Categorized by Material

The baseline and ongoing performance of the number of Hazardous (Type 1) Leaks for Main and Service combined Either Eliminated or Repaired, Categorized by Material is provided below (Excluding Excavation Damage Leaks):

INCLUDING Damages

BOSTON + ESSEX

Cause		2014	2015	2016	2017	2018	2019	
Cast Iron / Wrought Iron	Actual	1,977	2,432	1,500	2,399	2,314	1,823	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,321 for 2014 - 2018)						
Unprotected Bare	Actual	1,233	1,324	1,191	1,478	1,072	1,230	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,336 for 2014 - 2018)						
Unprotected Coated	Actual	188	271	246	240	175	182	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (244 for 2014 - 2018)						
Protected Bare	Actual	12	19	0	16	12	10	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (15 for 2014 - 2018)						
Protected Coated	Actual	30	20	0	18	30	39	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (26 for 2014 - 2018)						
Plastic	Actual	321	356	445	602	580	478	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (524 for 2014 - 2018)						
Copper	Actual	72	118	73	86	70	85	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (94 for 2014 - 2018)						
Other	Actual	12	9	0	26	9	148	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (16 for 2014 - 2018)						
Total	Actual	3,845	4,549	3,455	4,865	4,262	3,995	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4,475 for 2014 - 2018)						

Above Baseline Comments:

1 – Protected Coated – We are monitoring the and will take appropriate action if the number keeps increasing

2 – Other- During service repair, crew identify missing material as "Other". Under Investigation and findings will be addressed.

INCLUDING Damages

CAPE COD + LOWELL

Cause		2014	2015	2016	2017	2018	2019	
Cast Iron / Wrought Iron	Actual	39	53	12	27	84	67	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (57 for 2014 - 2018)						
Unprotected Bare	Actual	101	112	62	68	81	52	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (95 for 2014 - 2018)						
Unprotected Coated	Actual	142	133	163	140	114	71	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (147 for 2014 - 2018)						
Protected Bare	Actual	1	1	0	3	4	1	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3 for 2014 - 2018)						
Protected Coated	Actual	6	9	0	8	5	8	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (7 for 2014 - 2018)						
Plastic	Actual	97	141	154	144	134	148	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (145 for 2014 - 2018)						
Copper	Actual	0	0	0	0	1	0	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)						
Other	Actual	1	0	0	6	5	81	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4 for 2014 - 2018)						
Total	Actual	387	449	391	396	428	428	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (424 for 2014 - 2018)						

Above Baseline Comments:

1 – Cast Iron / Wrought Iron / Plastic – We are monitoring and will take appropriate action if the number keeps increasing

2 – Other – During service repair, crew identify missing material as "Other". Under Investigation and findings will be addressed

INCLUDING Damages

MASSACHUSETTS

Cause		2014	2015	2016	2017	2018	2019
Cast Iron / Wrought Iron	Actual	2,016	2,485	1,512	2,426	2,398	1,890
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,335 for 2014 - 2018)					
Unprotected Bare	Actual	1,334	1,436	1,253	1,546	1,153	1,282
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,456 for 2014 - 2018)					
Unprotected Coated	Actual	330	404	409	380	289	253
	Baseline	Rolling average since 2014 + 0.5 standard deviation (399 for 2014 - 2018)					
Protected Bare	Actual	13	20	0	19	16	11
	Baseline	Rolling average since 2014 + 0.5 standard deviation (18 for 2014 - 2018)					
Protected Coated	Actual	36	29	0	26	35	47
	Baseline	Rolling average since 2014 + 0.5 standard deviation (31 for 2014 - 2018)					
Plastic	Actual	418	497	599	746	714	626
	Baseline	Rolling average since 2014 + 0.5 standard deviation (636 for 2014 - 2018)					
Copper	Actual	72	118	73	86	71	85
	Baseline	Rolling average since 2014 + 0.5 standard deviation (98 for 2014 - 2018)					
Other	Actual	13	9	0	32	14	229
	Baseline	Rolling average since 2014 + 0.5 standard deviation (20 for 2014 - 2018)					
Total	Actual	4,232	4,998	3,846	5,261	4,690	4,423
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4,913 for 2014 - 2018)					

Appendix E, Section 6 – Additional Performance Measures

The baseline and ongoing performance of the number of known system leaks at the end of the year scheduled for repair are provided below:

Workable Leak Backlog		2014	2015	2016	2017	2018	2019	
Boston Gas + Essex	Actual	212	226	181	194	1,397	964	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (709 for 2014 - 2018)						
Cape Cod + Lowell	Actual	0	0	4	1	17	40	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (8 for 2014 - 2018)						
Massachusetts	Actual	212	226	185	195	1,414	1,004	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (717 for 2014 - 2018)						

Above Baseline Comments:

1 – It should be noted that implementation of the 2018 work stoppage had a significant impact to work in this region (June 2018 – January 2019).

The baseline and ongoing performance of total damages per 1000 tickets are provided below (**INCLUDING** Excavation Damage Leaks):

Total Excavation Damages per 1000 Tickets		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Boston Gas + Essex	Actual	3.22	2.83	3.11	2.57	3.02	2.29
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3.08 for 2014 - 2018)					
Cape Cod + Lowell	Actual	3.70	3.87	3.41	2.85	3.06	2.04
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3.59 for 2014 - 2018)					
Massachusetts	Actual	3.24	2.96	2.99	2.69	3.03	2.22
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3.08 for 2014 - 2018)					

The baseline and ongoing performance of Total Leak Receipts are provided below (**EXCLUDING** Excavation Damage Leaks):

Total Leak Receipts		2014	2015	2016	2017	2018	2019
Boston Gas + Essex	Actual	6,534	8,346	6,360	7,251	6,951	7,069
	Baseline	Rolling average since 2014 + 0.5 standard deviation (7,481 for 2014 - 2018)					
Cape Cod + Lowell	Actual	714	979	641	654	707	740
	Baseline	Rolling average since 2014 + 0.5 standard deviation (808 for 2014 - 2018)					
Massachusetts	Actual	7,248	9,325	7,001	7,905	7,658	7,809
	Baseline	Rolling average since 2014 + 0.5 standard deviation (8,281 for 2014 - 2018)					

The baseline and ongoing performance of the Response Time Performance are provided below:

30-Minute Response Time		2014	2015	2016	2017	2018	2019
Boston Gas + Essex	Actual	74.90%	68.76%	73.92%	73.48%	66.54%	72.66%
	Baseline	75% as established by NGrid					
Cape Cod + Lowell	Actual	71.95%	70.84%	70.94%	71.24%	71.55%	74.97%
	Baseline	75% as established by NGrid					

45-Minute Response Time		2014	2015	2016	2017	2018	2019
Boston Gas + Essex	Actual	92.70%	90.45%	93.14%	93.45%	90.28%	93.11%
	Baseline	90% as established by NGrid					
Cape Cod + Lowell	Actual	94.35%	92.37%	93.85%	93.34%	93.79%	94.98%
	Baseline	90% as established by NGrid					

60-Minute Response Time		2014	2015	2016	2017	2018	2019
Boston Gas + Essex	Actual	98.20%	97.42%	98.65%	98.37%	97.86%	97.86%
	Baseline	97% as established with DPU, MA					
Cape Cod + Lowell	Actual	98.60%	98.24%	99.07%	98.37%	98.77%	98.77%
	Baseline	97% as established with DPU, MA					

The baseline and ongoing performance of the Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material are provided below (**Excluding Excavation Damage Leaks**):

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material							
Boston + Essex		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Cast Iron	**Actual**	1.59	2.10	1.48	2.19	1.63	2.83
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.96 for 2014 - 2018)					
All Steel	**Actual**	0.28	0.315	0.265	0.36	0.24	0.50
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.32 for 2014 - 2018)					
Plastic	**Actual**	0.03	0.03	0.04	0.04	0.02	0.02
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.03 for 2014 - 2018)					

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material							
Cape Cod + Lowell		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Cast Iron	**Actual**	0.26	0.61	0.18	0.45	0.80	1.12
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.58 for 2014 - 2018)					
All Steel	**Actual**	0.12	0.155	0.09	0.11	0.13	0.01
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.13 for 2014 - 2018)					
Plastic	**Actual**	0.01	0.01	0.01	0.02	0.04	0.01
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.02 for 2014 - 2018)					

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material

Massachusetts Total		2014	2015	2016	2017	2018	2019
Cast Iron	Actual	1.93	2.19	1.78	2.93	1.89	2.75
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.38 for 2014 - 2018)					
All Steel	Actual	0.3	0.34	0.28	0.38	0.28	0.34
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.34 for 2014 - 2018)					
Plastic	Actual	0.02	0.02	0.03	0.02	0.02	0.02
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.02 for 2014 - 2018)					

The baseline and ongoing performance of the Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material are provided below **(Excluding Excavation Damage Leaks)**:

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material

Boston + Essex		2014	2015	2016	2017	2018	2019
Copper	**Actual**	4.65	7.75	4.35	6.04	4.40	13.16
	Baseline	Rolling average since 2014 + 0.5 standard deviation (6.17 for 2014 - 2018)					
All Steel	**Actual**	9.35	11.24	9.6	10.91	6.65	11.91
	Baseline	Rolling average since 2014 + 0.5 standard deviation (10.46 for 2014 - 2018)					
Plastic	**Actual**	1.14	1.60	1.69	2.17	1.74	1.60
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.85 for 2014 - 2018)					

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material

Cape Cod + Lowell		2014	2015	2016	2017	2018	2019
Copper	**Actual**	0.00	0.00	0.00	0.00	0.00	0.00
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.00 for 2014 - 2018)					
All Steel	**Actual**	4.82	4.625	4.76	4.83	4.32	2.74
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4.78 for 2014 - 2018)					
Plastic	**Actual**	0.78	0.63	1.53	1.23	0.99	1.10
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.21 for 2014 - 2018)					

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material

Massachusetts Total		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Copper	Actual	9.3	15.50	8.83	12.07	9.04	13.16
	Baseline	Rolling average since 2014 + 0.5 standard deviation (12.38 for 2014 - 2018)					
All Steel	Actual	9.57	10.07	10.23	13.58	6.84	9.60
	Baseline	Rolling average since 2014 + 0.5 standard deviation (11.26 for 2014 - 2018)					
Plastic	Actual	1.16	1.38	1.6	2.51	1.64	1.45
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.91 for 2014 - 2018)					

MASSACHUSETTS
APPENDIX F
PERIODIC EVALUATION AND IMPROVEMENT

2019 REGIONAL DISTRIBUTION INTEGRITY ASSESSMENT

Distribution Engineering has reviewed all of the findings in the annual Trend-Based Distribution System Integrity Analysis (System Integrity Report) in accordance with our Distribution Integrity Management Plan (DIMP). There are no immediate causes for concern that would warrant changes to DIMP.

Below is a summary of the individual key integrity measure results for the following federal (PHMSA) filing entities that constitute National Grid-US.

NATIONAL GRID

2019 System Integrity Report Summary

REGIONS ITEMS	BGC + EGC	CCC + CLW
• Leak Receipts	⇧	⇧
• Workable Leak Backlog	⬇	⬆
• LPP Main and Service Inventories	⬇	⬇
• Overall Main Leak Rate	⇧	⬇
• Cast Iron Main Break Rate	⬇	⬆
• Steel Main Corrosion Leak Rate	⇧	⬇
• Service Leak Rate	⬆	⇧

⬆ Increase ⇧ Slight Increase ▬ No Change ⬇ Decrease

Form F-1: Periodic Updating and Review (BOSTON + ESSEX)

Annual Evaluation of Performance Measures that Exceeded Baseline				
Performance Measure	Actual Performance for Year 2019	Established Baseline	Are additional measures beyond minimum code requirement necessary?	Has an engineering evaluation been completed and documented?
1 Leak Receipts	7,069	7,481	NO	Annual System Integrity Report
Workable leak Backlog	964	709	NO	Annual System Integrity Report
2 LPP Main Inventory	2,803 miles	2,901 miles (2018)	NO	Annual System Integrity Report
Overall Main Leak Rate	0.86	0.68	YES	Annual System Integrity Report
2 Cast Iron Main Break Rate	0.14	0.18	NO	Annual System Integrity Report
2 Steel main Corrosion Leak Rate	0.59	0.42	YES	Annual System Integrity Report
Service Leak Rate	4.96	3.97	YES	Annual System Integrity Report

Existing Date for Complete Program re-evaluation:____08/2021______ Is a shorter timeframe for complete program re-evaluation warranted? : __NO____

Complete Re-evaluation was performed on 9/1/2016 - DIMP REV 5

Saadat Khan (Director) and Leomary Bader (DIMP Manager) Gas Distribution Engineering

Required frequency	Program Re-evaluation Element	Date Completed
Required Annually	Evaluate Performance Measures	8/2020
As needed	Update Knowledge of System Characteristics, Environmental Factors and Threats	8/2020
As needed	Update General Information	8/2020
As needed	Update Threat Identification	8/2020
As needed	Update Risk Evaluation and Ranking Process	8/2020
Required Annually	Update Risk Evaluation and Ranking of Risks	8/2020
As needed	Update Risk Evaluation and Ranking Validation	8/2020
As needed	Update Risk Evaluation and Ranking Process Improvement Action Plans	8/2020
As needed*	Update Action Plans	

Above Baseline Comments:

1 – It should be noted that implementation of the 2018 work stoppage had a significant impact to work in this region (June 2018 – January 2019).

2 – Remediation projects: Main & Service Replacement – LPP and DIMP factor to prioritize segments.

Form F-1: Periodic Updating and Review (Colonial-CAPE + LOWELL)

	Annual Evaluation of Performance Measures that Exceeded Baseline				
	Performance Measure	**Actual Performance for Year 2019**	**Established Baseline**	**Are additional measures beyond minimum code requirement necessary?**	**Has an engineering evaluation been completed and documented?**
	Leak Receipts	740	808	NO	Annual System Integrity Report
1	Workable leak Backlog	40	8	NO	Annual System Integrity Report
	LPP Main Inventory	165 miles	186 miles (2018)	NO	Annual System Integrity Report
	Overall Main Leak Rate	0.06	0.11	NO	Annual System Integrity Report
2	Cast Iron Main Break Rate	0.27	0.12	YES	Annual System Integrity Report
	Steel main Corrosion Leak Rate	0.06	0.11	NO	Annual System Integrity Report
2	Service Leak Rate	2.60	2.09	YES	Annual System Integrity Report

Existing Date for Complete Program re-evaluation: 08/2021 Is a shorter timeframe for complete program re-evaluation warranted? : NO

Complete Re-evaluation was performed on 9/1/2016 - DIMP REV 5

Saadat Khan (Director) and Leomary Bader (DIMP Manager) Gas Distribution Engineering

Required frequency	Program Re-evaluation Element	Date Completed
Required Annually	Evaluate Performance Measures	8/2020
As needed	Update Knowledge of System Characteristics, Environmental Factors and Threats	8/2020
As needed	Update General Information	8/2020
As needed	Update Threat Identification	8/2020
As needed	Update Risk Evaluation and Ranking Process	8/2020
Required Annually	Update Risk Evaluation and Ranking of Risks	8/2020
As needed	Update Risk Evaluation and Ranking Validation	8/2020
As needed	Update Risk Evaluation and Ranking Process Improvement Action Plans	8/2020
As needed*	Update Action Plans	

Above Baseline Comments:

1 – It should be noted that implementation of the 2018 work stoppage had a significant impact to work in this region (June 2018 – January 2019).

2 – Remediation projects: Main & Service Replacement – LPP and DIMP factor to prioritize segments.

MASSACHUSETTS
APPENDIX G
CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE DIM PLAN

The table below provides a cross reference between 49 CFR Part 192, Subpart P (Gas Distribution Pipeline Integrity Management) and this Gas Distribution Integrity Management Plan.

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1005 No later than August 2, 2011 a gas distribution operator must develop and implement an integrity management program that includes a written integrity management plan as specified in § 192.1007.	4.0
§192.1007 A written integrity management plan must contain procedures for developing and implementing the following elements:	
§192.1007 (a) *Knowledge.* An operator must demonstrate an understanding of its gas distribution system developed from reasonably available information.	6.0
§192.1007 (a) (1) Identify the characteristics of the pipeline’s design and operations and the environmental factors that are necessary to assess the applicable threats and risks to its gas distribution pipeline.	6.3
§192.1007 (a) (2) Consider the information gained from past design, operations, and maintenance.	6.2
§192.1007 (a) (3) Identify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities).	6.4
§192.1007 (a) (4) Develop and implement a process by which the IM program will be reviewed periodically and refined and improved as needed.	11.0
§192.1007 (a) (5) Provide for the capture and retention of data on any new pipeline installed. The data must include, at a minimum, the location where the new pipeline is installed and the material of which it is constructed.	6.5
§192.1007 (b) *Identify threats.* The operator must consider the following categories of threats to each gas distribution pipeline: corrosion, natural forces, excavation damage, other outside force damage, material, weld or joint failure, equipment failure, incorrect operation, and other concerns that could threaten the integrity of the pipeline.	7.0
§192.1007 (b) An operator must consider reasonably available information to identify existing and potential threats. Sources of data may include, but are not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, and excavation damage experience.	6.1, 7.0
§192.1007 (c) *Evaluate and rank risk.* An operator must evaluate the risks associated with its distribution pipeline. In this evaluation, the operator must determine the relative importance of each threat and estimate and rank the risks posed to its pipeline. This evaluation must consider each applicable current and potential threat, the likelihood of failure associated with each threat, and the potential consequences of such a failure.	8.0
§192.1007 (c) An operator may subdivide its pipeline into regions with similar characteristics (e.g., contiguous areas within a distribution pipeline consisting of mains, services and other appurtenances; areas with common materials or environmental factors), and for which similar actions likely would be effective in reducing risk.	Non-Mandatory

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1007 (d) *Identify and implement measures to address risks.* Determine and implement measures designed to reduce the risks from failure of its gas distribution pipeline. These measures must include an effective leak management program (unless all leaks are repaired when found).	9.0
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* Develop and monitor performance measures from an established baseline to evaluate the effectiveness of its IM program. …… These performance measures must include the following: (i) Number of hazardous leaks either eliminated or repaired, per § 192.703(c), categorized by cause; (ii) Number of excavation damages; (iii) Number of excavation tickets (receipt of information by the underground facility operator from the notification center); (iv) Total number of leaks either eliminated or repaired, categorized by cause; (v) Number of hazardous leaks either eliminated or repaired per § 192.703(c), categorized by material; and (vi) Any additional measures the operator determines are needed to evaluate the effectiveness of the operator's IM program in controlling each identified threat.	10.0
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* …. An operator must consider the results of its performance monitoring in periodically re-evaluating the threats and risks.	11.2
§192.1007 (f) *Periodic Evaluation and Improvement.* An operator must re-evaluate threats and risks on its entire pipeline and consider the relevance of threats in one location to other areas.	8.1, 11.1
§192.1007 (f) Each operator must determine the appropriate period for conducting complete program evaluations based on the complexity of its system and changes in factors affecting the risk of failure. The operator must conduct a complete program reevaluation at least every five years. The operator must consider the results of the performance monitoring in these evaluations.	11.2
§192.1007 (g) *Report results.* Report, on an annual basis, the four measures listed in paragraphs (e)(1)(i) through (e)(1)(iv) of this section, as part of the annual report required by § 191.11. An operator also must report the four measures to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	12.1
§192.1009 Each operator must report, on an annual basis, information related to failure of mechanical fittings, excluding those that result only in nonhazardous leaks, as part of the annual report required by §191.11 beginning with the report submitted March 15, 2011. This information must include, at a minimum, location of the failure in the system, nominal pipe size, material type, nature of failure including any contribution of local pipeline environment, coupling manufacturer, lot number and date of manufacture, and other information that can be found in markings on the failed coupling. An operator also must report this information to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	12.1
§192.1011 An operator must maintain records demonstrating compliance with the requirements of this subpart for at least 10 years. The records must include copies of superseded integrity management plans developed under this subpart.	13.0

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1013 (a) An operator may propose to reduce the frequency of periodic inspections and tests required in this part on the basis of the engineering analysis and risk assessment required by this subpart. (b) An operator must submit its proposal to the PHMSA Associate Administrator for Pipeline Safety or, in the case of an intrastate pipeline facility regulated by the State, the appropriate State agency. The applicable oversight agency may accept the proposal on its own authority, with or without conditions and limitations, on a showing that the operator's proposal, which includes the adjusted interval, will provide an equal or greater overall leve0l of safety. (c) An operator may implement an approved reduction in the frequency of a periodic inspection or test only where the operator has developed and implemented an integrity management program that provides an equal or improved overall level of safety despite the reduced frequency of periodic inspections.	Not covered by DIM Plan

15.0 APPENDICES FOR NEW YORK

NEW YORK
APPENDIX A
KNOWLEDGE OF FACILITIES

A summary of PHMSA Reportable Gas Incidents (reported on PHMSA F7100-1) as well as details of recent incidents are provided in Tables A-1, A-2 and A-3 below.

Table A-1: Reportable Gas Incidents by Year (**New York City**)

Year	Number of Incidents	Fatalities	Injuries	Property Damage
2019	1	0	0	$53,195
2018	3	0	1	$687,854
2017	3	0	0	$354,807
2016	4	0	0	$547,590
2015	5	0	1	$1,378,908
2014	3	0	1	$303,362
2013	2	0	2	$336,033
2012	0	0	0	-
2011	0	0	0	-
2010	0	0	0	-
2009	0	0	0	-
2008	0	0	0	-
2007	0	0	0	-
2006	1	0	0	$50,000
2005	0	0	0	-
2004	0	0	0	-
2003	0	0	0	-
2002	0	0	0	-
2001	0	0	0	-
2000	1	3	0	-
1999	1	0	2	-
1998	2	0	0	-
1997	0	0	0	-
1996	1	0	12	-
1995	1	0	1	-
1994	0	0	0	-
1993	0	0	0	-
1992	1	0	0	$400,000
1991	2	0	1	-
1990	1	0	1	-
Total	**32**	**3**	**22**	**$4,111,749**

Table A-2: Reportable Gas Incidents by Cause **(New York City)**

Year	Corrosion	Natural Forces	Excavation Damage	Outside Force	Material or Weld Failure	Equipment Failure	Incorrect Operation	Other
2019	0	0	1	0	0	0	0	0
2018	0	1	0	2	0	0	0	0
2017	0	0	2	0	0	1	0	0
2016	0	0	2	0	0	0	1	1
2015	0	0	0	1	0	0	0	4
2014	0	1	0	0	0	0	0	2
2013	0	0	0	0	0	0	0	2
2012	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
2006	0	0	1	0	0	0	0	0
2005	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	1
1999	0	0	0	0	0	0	0	1
1998	0	0	0	1	0	0	0	1
1997	0	0	0	0	0	0	0	0
1996	0	0	1	0	0	0	0	0
1995	0	0	0	0	0	0	0	1
1994	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	1
1991	0	0	0	0	0	0	0	2
1990	0	1	0	0	0	0	0	0
30-Year Total	**0**	**3**	**7**	**4**	**0**	**1**	**1**	**16**

Table A-3: 10-Year Incident History Details **(New York City)**

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
NYC	2019	Main	Cast Iron - 12" - LP	Kent Avenue and Broadway	Brooklyn	Excavation Damage
Details:	City/State construction activity struck gas main during work on new water main.					
NYC	2018	Main	Cast Iron - 6" - LP	408 South 2nd Street	Brooklyn	Other Outside Force
Details:	Water main break occurred in the area which potentially caused damage to the 6” gas main.					
NYC	2018	Main	Plastic - 8" - LP	99 Meserole Avenue	Brooklyn	Other Outside Force
Details:	Broken water service caused water erosion and sand abrasion/intrusion into an 8" plastic low-pressure main feeding a 6" low-pressure steel main.					
NYC	2018	Main	Cast Iron - 6" - LP	151 Bay 49th Street	Brooklyn	Natural Force
Details:	Frost Heave caused a crack on 6” cast iron main. On 07/2018, NGrid retired existing 6” CI and replaced with new 8" plastic main.					
NYC	2017	Main	Cast Iron - 24" -HP	172 Wythe Ave	Brooklyn	Excavation Damage
Details:	Contractor struck a 24 inch, high pressure, cast iron main with a backhoe.					
NYC	2017	Main	Steel - 12.75" - HP	7117 Roosevelt Ave	Queens	Excavation Damage
Details:	Third party contractor was performing pile boring using a boring drill rig and damage was caused to HP gas main in front of 7117 Roosevelt Ave.					
NYC	2017	Outside Meter	Flange - 3"	1583 Victory Blvd	Richmond	Equipment Failure
Details:	Malfunction of control/relief equipment caused a gas leak on a 3" Flange in the basement of the school(P.S. 029 Bardwell), 875 students and faculty members were evacuated for safety.					

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
NYC	2016	Service	Plastic - 3" - HP	40 Clinton Street	Brooklyn	Incorrect Operation
Details:	Due to improper installation of the vent lines, water collected on top of the primary regulator diaphragm and froze. This caused overpressurization of the gas service.					
NYC	2016	Main	Protected CS - 8" - LP	840 Fulton Street	Brooklyn	Excavation Damage
Details:	Third Party contractor drilled a bore hole throught low pressure main, infiltrated coolant water into main resulting in poor pressure in area. A total of 24 customers were impacted.					
NYC	2016	Main	Cast Iron - 30" - HP	Foster Ave	Brooklyn	Excavation Damage
Details:	Main was damaged when third party contractor was performing test borings. Apprpxmately, 111 service supplying 839 customers have been affected.					
NYC	2016	Main	Plastic - 8" - HP	43RD Ave at 104th Street	Corona	All Other Causes
Details:	A faulty underground electrical cable damaged National Grid Gas Main, and cause fire in a manhole. Four customers were out of service for almost a month.					
NYC	2015	MAIN	Plastic - 6" - LP	442 Pacific Street	Brooklyn	Miscellaneous
Details:	A Con Ed burnout was cause of the leak. Con Ed employee working using a light bulb became a source of ignition setting the manhole on fire					
NYC	2015	OTHER	Unknown	Var Loc's in Northern	New York	Miscellaneous
Details:	Gas odor complaints were received and investigated, it was determined that the liquefaction plant feed gas purification process reinjection system requires adjustment					
NYC	2015	MAIN	Steel - 12" - LP	Kings Highway and East 98th Street	Brooklyn	Other Outside Force
Details:	A 60" steel water main, operating in the range of 90 to 105 psi ruptured. Jetting caused by the water pressure bore a 2.5" hole into steel main					
NYC	2015	OTHER	Unknown	Var Loc's in Northern Queens	Queens	Miscellaneous
Details:	Gas odor complaints were received and investigated, it was determined that the liquefaction plant feed gas purification process reinjection system requires adjustment.					

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
NYC	2015	MAIN	Plastic - 6" - HP	West 22nd Street and Neptune Ave	Brooklyn	Excavation
Details:	A construction crew was performing scheduled work when they lost gas pressure to the main causing interruption to services					
NYC	2014	MAIN	Cast Iron – 4” - LP	101 Delaware Street	New York	Other
Details:	There was a crack in the CI main on this street					
NYC	2014	SERVICE (At Meter Set)	Unknown – 15# System	149-156 Ave from 77 St. to 80 St.	Howard Beach	Natural Force
Details:	Heavy flooding in the area submerged meters. There was no impact on performance					
NYC	2014	MAIN	Plastic – 8” – 60#	45 Trantor Place	New York	Other
Details:	A steel protection plate on top of a service tee caused a leak					
NYC	2013	CUSTOMER PIPING	Customer Piping – LP	8740 124th Street	Queens	Other
Details:	House piping after meter; still under investigation					
NYC	2013	CUSTOMER PIPING	Customer Piping – HP (10#)	7009 Ridge Blvd	Brooklyn	Other
Details:	Incident was isolated to a range within the apartment building. Still under investigation.					

Table A-1: Reportable Gas Incidents by Year **(Long Island)**

Year	Number of Incidents	Fatalities	Injuries	Property Damage
2019	1	0	0	$ 142,697.00
2018	0	0	0	-
2017	0	0	0	-
2016	0	0	0	-
2015	1	0	2	$500,050
2014	0	0	0	-
2013	2	0	0	$159,833
2012	4	0	5	$4,425,666
2011	1	0	0	$9,250
2010	0	0	0	-
2009	1	0	0	$300,000
2008	2	0	0	$650,000
2007	0	0	0	-
2006	1	0	0	$400,000
2005	1	0	0	$1,000,000
2004	3	0	0	$1,702,720
2003	0	0	0	-
2002	0	0	0	-
2001	1	0	0	$100,000
2000	2	6	0	$400,000
1999	1	0	3	-
1998	0	0	0	-
1997	1	0	0	-
1996	0	0	0	-
1995	0	0	0	-
1994	4	0	1	$500,000
1993	3	0	1	-
1992	2	0	1	-
1991	0	0	0	-
1990	0	0	0	-
Total	**31**	**6**	**13**	**$ 10,290,216.00**

Table A-2: Reportable Gas Incidents by Cause **(Long Island)**

Year	Corrosion	Natural Forces	Excavation Damage	Outside Force	Material or Weld Failure	Equipment Failure	Incorrect Operation	Other
2019	0	0	1	0	0	0	0	0
2018	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0
2015	0	0	0	1	0	0	0	0
2014	0	0	0	0	0	0	0	0
2013	0	1	0	1	0	0	0	0
2012	0	1	0	0	0	0	1	2
2011	0	0	0	0	0	0	0	1
2010	0	0	0	0	0	0	0	0
2009	0	0	0	0	1	0	0	0
2008	1	0	0	0	0	1	0	0
2007	0	0	0	0	0	0	0	0
2006	0	0	1	0	0	0	0	0
2005	0	0	1	0	0	0	0	0
2004	1	0	1	0	1	0	0	0
2003	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0
2001	0	0	1	0	0	0	0	0
2000	0	0	1	0	0	0	0	1
1999	0	0	0	0	0	0	0	1
1998	0	0	0	0	0	0	0	0
1997	0	0	0	1	0	0	0	0
1996	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1994	0	0	3	0	0	0	1	0
1993	0	0	1	0	0	0	1	1
1992	0	1	1	0	0	0	0	0
1991	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
30-Year Total	**2**	**3**	**11**	**3**	**2**	**1**	**3**	**6**

Table A-3: 10-Year Incident History Details **(Long Island)**

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
LI	2019	MAIN	Steel - 2" - HP (60#)	Mill Road and Peninsula Blvd	Hewlett	Excavation Damage
Details:	Markouts were not maintained and third party construction company damaged purge riser during parking lot milling.					
LI	2015	CUSTOMER PIPING	Steel	21 Old Country Road	Water Mill	Other Outside Force
Details:	Gas leak emanated from piping located in the basement					
LI	2013	MAIN	Cast Iron - 6”- LP	527 Beach 64th Street	Arverne	Natural force
Details:	Heavy rain (4” -6”) on coastal area caused water intrusion into the low pressure main and 140 customer outage					
LI	2013	SERVICE	Bare Steel Outside Set – HP(60#)	4 Choate Ave	Selden	Other Outside Force
Details:	Outside regulator/meter set sustained vehicular damage					
LI	2012	OTHER	Unknown material – HP (60#)	St Marks Ave	Freeport	Other
Details:	Hurricane Sandy					
LI	2012	OTHER	Unknown material – HP (60#)	Forest Ave	Massapequa	Other
Details:	Hurricane Sandy					
LI	2012	SERVICE	Plastic - LP	Kenwood Rd	Garden City	Natural Force
Details:	Tree uprooted during Hurricane Sandy pulled out service					
LI	2012	SERVICE	Plastic – Outside Set– HP (60#)	Feller Dr	Central Islip	Incorrect Operations
Details:	Employee left a valve open on an open customer line					
LI	2011	SERVICE	Plastic –Inside Set- HP (60#)	Lincoln St	Elmont	Unknown
Details:	House explosion, cause undetermined					

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
LI	2009	SERVICE	Unprotected Bare Steel – Inside Set - HP (60#)	Harbor Ln	Southhold	Matl/Weld Failure
Details:	Improper cold bend					
LI	2008	SERVICE	Protected Coated Steel - Inside Set - HP(60#)	Meadow Ln	Amityville	Equipment
Details:	Sudden failure of plastic-to-steel transition fitting (Inner-tite service head adapter) that had experienced significant atmospheric corrosion					
LI	2008	SERVICE	Steel (Unknown Coating/Protection) - Inside Set - HP(60#)	Carleton Ave	Central Islip	Equipment
Details:	Water seeped into an outside regulator vent for an inside meter set and froze up causing regulator failure leading to over pressurization					

Table A-1: Reportable Gas Incidents by Year (**Upstate**)

Year	Number of Incidents	Fatalities	Injuries	Property Damage
2019	2	0	0	$76,482
2018	2	0	0	$503,764
2017	0	0	0	-
2016	0	0	0	-
2015	0	0	0	-
2014	2	0	0	$140,000
2013	0	0	0	-
2012	2	0	0	$313,624
2011	3	0	0	$122,888
2010	0	0	0	-
2009	0	0	0	-
2008	0	0	0	-
2007	0	0	0	-
2006	0	0	0	-
2005	0	0	0	-
2004	1	0	0	$82,429
2003	1	0	0	-
2002	2	0	1	-
2001	0	0	0	-
2000	2	0	1	$450,000
1999	2	0	0	$75,000
1998	0	0	0	-
1997	0	0	0	-
1996	2	0	3	$135,000
1995	0	0	0	-
1994	2	1	0	$52,000
1993	1	0	0	$150,000
1992	1	2	0	$100,000
1991	0	0	0	-
1990	0	0	0	-
Total	**25**	**3**	**5**	**$2,201,187**

Table A-2: Reportable Gas Incidents by Cause (**Upstate**)

Year	Corrosion	Natural Forces	Excavation Damage	Outside Force	Material or Weld Failure	Equipment Failure	Incorrect Operation	Other
2019	0	0	1	0	0	0	1	0
2018	0	0	0	0	1	0	0	1
2017	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0
2014	1	0	0	0	0	0	0	1
2013	0	0	0	0	0	0	0	0
2012	0	0	1	0	0	0	0	0
2011	0	2	1	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	1	0
2003	0	0	1	0	0	0	0	0
2002	0	0	0	0	0	0	1	1
2001	0	0	0	0	0	0	0	0
2000	0	0	1	0	0	0	0	1
1999	0	0	1	0	0	0	0	1
1998	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0
1996	0	0	2	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1994	0	0	1	0	0	0	1	0
1993	0	0	0	0	0	0	1	0
1992	0	1	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
30-Year Total	**1**	**3**	**9**	**0**	**1**	**0**	**5**	**5**

Table A-3: 10-Year Incident History Details (**Upstate**)

<table>
<tr><th>Company</th><th>Year</th><th>Facility</th><th>Asset Class/Subclass</th><th>Street</th><th>Town</th><th>Leak Cause</th></tr>
<tr><td>NIMO</td><td>2019</td><td>Regulator Station</td><td>Steel - HP (90#)</td><td>270 George Washington Blvd</td><td>Oswego</td><td>Incorrect Operation</td></tr>
<tr><td>Details:</td><td colspan="6">Following annual performance of relief valve test, relief valve was not returned to correct operating position and vented before reaching desired setpoint.</td></tr>
<tr><td>NIMO</td><td>2019</td><td>Main</td><td>Steel - 12" - HP (225#)</td><td>47 Ingalls Ave</td><td>Troy</td><td>Excavation</td></tr>
<tr><td>Details:</td><td colspan="6">While impacting shale, impactor was set to automatic and made contact with pipe.</td></tr>
<tr><td>NIMO</td><td>2018</td><td>Other</td><td>UNK</td><td>381-383 West Main Street</td><td>Little Falls</td><td>Other</td></tr>
<tr><td>Details:</td><td colspan="6">Cause of the incident is undetermined.</td></tr>
<tr><td>NIMO</td><td>2018</td><td>Main</td><td>Plastic - 4" - HP (24#)</td><td>1700 Broad Street</td><td>Utica</td><td>Material Failure</td></tr>
<tr><td>Details:</td><td colspan="6">Upon air test, the source of the leak was determined to be a pl-pl compression coupling on a 4" main.</td></tr>
<tr><td>NIMO</td><td>2014</td><td>SERVICE</td><td>Steel – 1.25” – 12#</td><td>Paige St</td><td>Schenectady</td><td>Other</td></tr>
<tr><td>Details:</td><td colspan="6">An explosion prompted this service to be shut down at 310 Paige St. Still under investigation</td></tr>
<tr><td>NIMO</td><td>2014</td><td>MAIN</td><td>Steel – 12” – HP</td><td>Indian River Rd</td><td>Castorland</td><td>Corrosion</td></tr>
<tr><td>Details:</td><td colspan="6">Failing pipe joint due to corrosion</td></tr>
<tr><td>NIMO</td><td>2012</td><td>SERVICE</td><td>Plastic – HP (32#)</td><td>Avenue B</td><td>Schenectady</td><td>Excavation</td></tr>
<tr><td>Details:</td><td colspan="6">Contractor damaged gas service</td></tr>
</table>

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
NIMO	2011	CUSTOMER PIPING	Customer Piping	Ablett Ave	Whitesboro	N/A
Details:	House explosion, not caused by leaking on jurisdictional piping					
NIMO	2011	MAIN	Protected Coated Steel -6"– HP (99#)	Mohawk Turnpike	Rotterdam Junction	Natural Force
Details:	Excessive flooding took out bridge and subsequently the gas main					
NIMO	2011	MAIN	Protected Coated Steel –12"- HP (220#)	Woodlake Rd	Albany	Excavation
Details:	Contractor damaged main					
NIMO	2011	SERVICE	Steel – Outside Set – HP (60#)	S 5th St	Fulton	Natural Force
Details:	Ice fell off of the roof damaging the meter set					

NEW YORK
APPENDIX B
THREAT IDENTIFICATION

In February thru April of 2016, groups of Subject Matter Experts (SMEs) were brought together, each having knowledge of threats in the various communities served by National Grid. Details on SME qualifications as well as copies of their interview records are located in the Distribution Integrity Management Program files. A summary of the threats identified are presented below in Table 15-1 and Table 15-2.

Table 15-1: Summary of Applicable Threats

SME's to Consider the Following	YES / NO
Do you have the necessary knowledge and/or experience (skills sets) regarding the areas of expertise for which you provided knowledge or supplemental information for input into the DIMP plan? (PHMSA Q.)	Yes
Do operator personnel in the field understand their responsibilities under DIMP plan? (PHMSA Q.)	Yes
Have you received DIMP training? (PHMSA Q.)	Yes
Have you received instructions to address the discovery of pipe or components not documented in the company records? (PHMSA Q.)	Yes
Have you received instructions to address, if you find any possible issue? (ex: corrosion, dented pipe, poor fusion joints, missing coating, excavation damage, mechanical fitting failures). (PHMSA Q.)	Yes
Have you received instructions to address when you find situations where the facilities examined (e.g., Material, Diameter, Coating, etc.) are different than records indicate, what documentation do you prepare? (PHMSA Q.) • If yes, are the findings documented?	Yes
During any repairs, if you find an improperly installed fitting, do you remediate it? (PHMSA Q.) • If yes, are the findings documented?	Yes
1. Does CMS conduct atmospheric corrosion inspection when they have access to facilities? • If yes, are the findings documented?	Yes
2. Do you know the procedures to visually examine any plastic fusion that is uncovered as part of excavation? • If yes, are the findings documented?	Yes
3. Do you notify damage prevention if any municipal work is being performed near gas distribution facilities? • If yes, are the findings documented?	Yes
4. Does Cross Bore recognized as risk? • If yes, are the findings documented?	Yes

Primary Threat Category	SME's to Consider the Following	New York
Corrosion	Is there known evidence of Corrosion on the system?	Yes
	Is there a known history of leakage on the system due to Corrosion?	Yes
	Threat Applicable?	Yes
Natural Force	Is there known evidence of damage or failures on the system due to natural forces?	Yes
	Is there a known history of leakage on the system due to Natural forces?	Yes
	Threat Applicable?	Yes
Excavation Damage	Is there known evidence of damage or failures on the system due to Excavation Damage?	Yes
	Is there a known history of leakage on the system due to Excavation Damage?	Yes
	Threat Applicable?	Yes
Other Outside Forces	Is there known evidence of damage or failures on the system due to Other Outside Forces?	Yes
	Is there a known history of leakage on the system due to Other Outside Forces?	Yes
	Threat Applicable?	Yes
Material or Weld Failure	Is there known evidence of damage or failures on the system due to Material or Weld Failure?	Yes
	Is there a known history of leakage on the system due to Material or Weld Failure?	Yes
	Threat Applicable?	Yes
Equipment Failure	Is there known evidence of damage or failures on the system due to Equipment Failure?	Yes
	Is there a known history of leakage on the system due to Equipment Failure?	Yes
	Threat Applicable?	Yes
Incorrect Operations	Is there known evidence of damage or failures on the system due to Incorrect Operations?	Yes
	Is there a known history of leakage on the system due to Incorrect Operations?	Yes

Primary Threat Category	SME's to Consider the Following	New York
	Threat Applicable?	Yes
Others	Is there known evidence of damage or failures on the system due to others reasons?	Yes
	Is there a known history of leakage on the system due to other reasons?	Yes
	Threat Applicable?	Yes

Table 15-2: Summary of SME Interview Responses for Threat Identification

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
Corrosion	Cast Iron Pipe	Does Cast Iron pipe exist in the system?	**Yes**
		Is there a known history of body-of-pipe leaks, fractures, or graphitization?	**Yes**
	Bare Steel or Wrought Iron Pipe (with no CP other than Localized hot spotting with anodes)	Do bare (uncoated) steel main or services exist in the system that are not under CP?	**Yes**
		Is there known evidence of external corrosion on bare steel or wrought iron pipes not under CP?	**Yes**
		Is there a history of leakage on bare steel or wrought iron pipes not under CP?	**Yes**
	Bare Steel or Wrought Iron Pipe (with CP other than just localized hot spotting with anodes)	Do bare (uncoated) steel main or services exist in the system that are under CP?	**Yes**
		Is there known evidence of external corrosion on bare steel pipes under CP?	**Yes**
		Is there a known history of leakage on bare steel pipes under CP?	**Yes**
	Coated Steel with CP	Is there known evidence of external corrosion on coated steel pipe with CP?	**Yes**
		Is there a known history of leakage on coated steel pipe with CP?	**Yes**
		Are some CP systems frequently down (not achieving the required level of protection); more than 10% of the time?	**No**
	Coated Steel w/o CP	Is there known evidence of external corrosion on coated steel pipe without CP?	**Yes**
		Is there a known history of leakage on coated steel pipe without CP?	**Yes**
	Copper Services	Are direct buried or inserted copper services known to exist in the system?	**Yes**
		Is there a known history of leakage on copper services?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
	Stray Current	Do distribution facilities exist near DC transit systems, high voltage DC transmission systems or other known sources of DC current?	**Yes**
		Are any facilities known to be impacted by sources of stray DC current that has or may result in corrosion?	**Yes**
	Internal Corrosion	Are liquids known to exist within any portions of the distribution system?	**Yes**
		Is there known evidence of internal corrosion on steel pipe?	**Yes**
		Is there a known history of leakage caused by internal corrosion of steel pipe?	**Yes**
	Atmospheric Corrosion on above ground facilities	Do above ground distribution facilities exist in areas exposed to marine atmosphere, high humidity, atmospheric pollutants or agricultural chemicals?	**Yes**
		Is there known evidence of external atmospheric corrosion on exposed steel pipe, equipment or fittings?	**Yes**
		Is there a known history of leakage caused by atmospheric corrosion of steel pipe?	**Yes**
	Atmospheric Corrosion of facilities in Vaulted areas underground	Do gas distribution facilities exist underground in vaulted areas?	**Yes**
		Is there known evidence of external atmospheric corrosion on exposed steel pipe, equipment or fittings?	**Yes**
		Is there a known history of leakage caused by atmospheric corrosion of steel pipe in vaults?	**Yes**
	Corrosion of carrier pipe in Cased Crossing	Do steel carrier pipes exist within cased crossings?	**Yes**
		Are there any existing known contacts between carrier pipes and casings?	**No**
		Is there known evidence of past or active external corrosion on cased steel pipe?	**Yes**
		Is there a known history of leakage caused by corrosion on cased steel pipe?	**No**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
	Other Corrosion	Are there other corrosion threats?	**wall piece, at dis-similar metals & isolated fittings**
Natural Forces	Seismic Activity	Are there any seismically active zones or fault lines that exist in the area?	**Yes**
		Is there a history of leakage associated with Seismic activity?	**No**
	Earth Movement / Landslide (Unstable Soil)	Are there any areas susceptible to earth movement or landslide in the area?	**Yes**
		Is there a known history of leakage associated with landslide or earth movement?	**Yes**
	Frost Heave	Are there any areas susceptible to frost heave that exists in the area?	**Yes**
		Is there a known history of leakage resulting from frost heave?	**Yes**
	Flooding	Are there any areas within the gas system that are subject to flooding?	**Yes**
		Is there a known history of leakage or damage associated with flooding?	**Yes**
	Over-pressure due to snow/ice blockage	Are pressure control equipment vents subject to ice blockage during the winter?	**Yes**
		Is there a known history of over-pressure events as a result of snow/ice blockage?	**Yes**
	Tree Roots	Is there a known history of leakage to pipe or fittings as a result of tree root damage?	**Yes**
	Other Natural Forces	Is there a known history of leakage or damage due to other natural force causes; including but not limited to lightning, wild fire or high winds (tornados)?	**Lightning, Rodents (upstate)**
Excavation Damage	Improper Excavation Practice	Has damage requiring repair or replacement occurred on properly marked facilities due to the failure of the excavator to follow proper excavation rules and procedures?	**Yes**
	Facility not located or marked	Has damage requiring repair or replacement occurred due to failure to locate a valid and timely locate request?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
	One-call notification center error	Has damage requiring repair or replacement occurred due to an error made at the one-call notification center?	**Yes**
	Mis-Marked Facilities	Has damage requiring repair or replacement occurred due to the mis-marking of facilities?	**Yes**
		Threat Applicable?	**Yes**
	Incorrect Facility Records	Has damage requiring repair or replacement occurred due incorrect facility records?	**Yes**
	Other Excavation Damage	Has damage requiring repair or replacement occurred due other causes?	**Yes**
Other Outside Force Damage	Vehicle Damage to Riser/Meter	Are existing risers and/or meters exposed to damage from vehicular damage that do not have barriers or other protection conforming to current design requirements?	**Yes**
		Has known leakage occurred due to vehicle damage to risers/meters.	**Yes**
	Vehicle Damage to above-ground equip/station	Are regulator stations or other above ground station equipment exposed to damage from vehicular damage that do not have barriers or other protection conforming to current design requirements?	**Yes**
		Has known leakage occurred due to vehicle damage to above ground stations or equipment?	**Yes**
	Vandalism	Are gas valves or station equipment susceptible to damage by vandalism that has the potential to pose a risk to employees or the public?	**Yes**
		Has leakage or other unsafe condition been created by vandalism?	**Yes**
	Structure Fire	Is there a history of damage to gas meters or other equipment due to structure fires?	**Yes**
	Other Outside Force Damage	Has damage requiring repair or replacement occurred due other outside forces?	**Falling ice, Heat ground contamination, down electric lines**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
Pipe, Weld or Joint Failure	Century Products (MDPE 2306)	Is Century Products (MDPE 2306) pipe (Tan) known to exist in the system?	**No**
		Is there a history of leakage of Century Products (MDPE 2306) pipe due to material failure?	**No**
	Aldyl A (MDPE 2306)	Is pre-1973 Aldyl A pipe (Tan, but can turn grey) known to exist in the system?	**Yes**
		Has pre-1973 Aldyl A pipe been known to leak due to brittle-like failure from rock impingement or other stresses?	**Yes**
		Is there a history of leakage of pre-1973 Aldyl A pipe due to material failure?	**Yes**
	Aldyl AAAA (MDPE 2306) Green Aldyl	Is Green Aldyl pipe known to exist in the system?	**Yes**
		Is there a history of brittle like failures of Green Aldyl pipe?	**Yes**
		Is there a history of leakage of Green Aldyl pipe due to material failure?	**Yes**
	PVC – Polyvinyl Chloride	Is PVC pipe known to exist in the system?	**No**
		Is there a history of leakage of PVC pipe due to material failure?	**No**
	ABS – Acrylonitrile Butadiene Styrene	Is ABS pipe known to exist in the system?	**No**
		Is there a history of leakage of ABS pipe due to material failure?	**No**
	CAB – Cellulose Acetate Butyrate	Is CAB pipe known to exist in the system?	**No**
		Is there a history of leakage of CAB pipe due to material failure?	**No**
	PB – Polybutylene	Is PB pipe known to exist in the system?	**No**
		Is there a history of leakage of PB pipe due to material failure?	**No**
	PP – Polypropylene	Is PP pipe known to exist in the system?	**No**
		Is there a history of leakage of PP pipe due to material failure?	**No**
	Polyamide - PA	Is PA pipe known to exist in the distribution system?	**No**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
		Is there a history of leakage of PA pipe due to material failure?	**No**
	PE Fusion failure	Is there a history of PE Fusion Failures or leakage in the system?	**Yes**
		Are any types of PE fusion (type, material, size, age, process, geographic area) more prone to leakage or failure?	**Yes**
	Pre-1940 Oxy-Acetylene Girth Weld	Do pre-1940 Oxy-Acetylene Girth Welds exist on pipe greater than 4 inch?	**Yes**
		Is there a history of pre-1940 Oxy-Acetylene Girth Weld failures or leakage in the system due to material failure?	**Yes**
	Other	Do other material failures occur that present a possible current or future risk?	**Kerotest compression end valves, Amp fittings**
Equipment Failure	Plexco Service Tee Celcon Caps	Are Plexco Service Tee Celcon Caps known to exist in the system?	**Yes**
		Is there a history of leakage of Plexco Service Tee Celcon Caps due to material failure?	**Yes**
	PP – Delrin Insert Tap Tees	Are Delrin Insert Tap Tees known to exist in the system?	**Yes**
		Is there a history of leakage of Delrin Insert Tap Tees?	**Yes**
	Stab Type Mechanical	Is there a history of Stab Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Stab Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**
	Other Equipment Failure	What Types and Manufactures of Stab Type Mechanical Fittings have you seen used in the System?	**Perfection LYCO & AMP**
		Are any types of Stab Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**LYCO**
	Nut Follower Type Mechanical Fittings	Is there a history of Nut Follower Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
		Is there a history of Nut Follower Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**
		What Types and Manufactures of Nut Follower Type Mechanical Fittings have you seen used in the System?	**Dresser, Normac, Innertite, Kerotest**
		Are any types of Nut Follower Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**Normac & Kerotest**
	Bolted Type Mechanical Fittings	Is there a history of Bolted Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Bolted Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Early vintage**
		What Types and Manufactures of Bolted Type Mechanical Fittings have you seen used in the System?	**Dressers, Smith Blair, & CSI**
		Are any types of Bolted Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**Early vintage smith Blair**
	Other Type Mechanical Fittings	Is there a history of other types of Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of other types of Mechanical Fitting failures or leakage in the system due to seal leakage?	**Muller hot line clamps**
		What other types and manufactures of Mechanical Fittings have you seen used in the System (other than Stab, Nut-follower, or bolted type?)	**Hydraulic Dresser**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
		Of the "other mechanical fittings" listed above, are any types of Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**No**
	Valves	Are valves inoperable, inaccessible and or paved over without timely identification and repairs?	**Yes**
		Are certain types or makes of valves more likely to leak?	**Kerotest Gate**
	Service Regulators	Is there a history of service regulator failures that present a threat to the public or employees?	**No**
		Are certain types or makes of service regulator more likely to create a risk?	**Mercury**
	Meters	Is there a history of meter failures that present a threat to the public or employees?	**No**
		Are certain types or makes of meters more likely to create a risk?	**No**
	Control/Relief Station Equipment	Is there a history of control or relief station equipment failures that present a threat to the public or employees?	**No**
		Are certain types or makes of station equipment more likely to create a risk?	**No**
	Other Equipment Failure	Is there a history of other equipment failures that present a threat to the public or employees?	**No**
		Are certain types or makes of other equipment more likely to create a risk?	**No**
Incorrect Operations	General	Have inadequate procedures or safety practices, or failure to follow correct procedures, or other operator error resulted in an incident that created a risk to the gas distribution system?	**Yes**
	Gas lines bored through Sewers	Have pipes been installed via unguided or guided bore without proper procedures to ensure other facilities are not damaged?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	New York
		Have pipes unknowingly bored through sewer lines been damaged by sewer line cleaning operations?	**Yes**
Other	Bell Joint Leakage	Does Cast Iron pipe exist in the system?	**Yes**
		Is there a history of bell joint leaks?	**Yes**
		Are certain diameters or parts of the system known to be more prone to bell joint failure or leakage than others?	**Yes**
	Inserted Copper Puncture	Do copper services inserted in steel exist in the system?	**Yes**
		Is there a history of leakage of copper services due to puncture by a deteriorated steel outer casing?	**No**
	Copper Sulfide	Have any safety incidents occurred as a result of copper sulfide in copper services or service regulators?	**No**
	Construction over gas mains & services	Have others constructed over gas facilities or taken other action that prevents effective leak survey and other maintenance?	**Yes**
		When identified, is construction that impacts required maintenance corrected in a timely manner?	**Yes**
	Other	Are there any other known threats to the Gas Distribution system that we need to be aware of?	**Gas mains in Catch basins, Vibration equipment, Anaerobic sealants and small diameter CI**

NEW YORK
APPENDIX C
EVALUATION AND RANKING OF RISK

HIGHEST RANKED RISKS

STATE: New York
REGION: NYC
FACILITY: MAINS

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Over 4" Thru 8"	404.63	3.13	EXCAVATION/ OTHER/ MATERIAL - WELD/ O. O. FORCE	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Plastic	HP	Over 8"	34.28	3.08	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	HP	Over 8"	102.10	2.13	EXCAVATION/ OTHER / NATURAL FORCE	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	HP	Over 8"	34.92	2.01	EXCAVATION / CORROSION	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedCoated Steel	HP	Over 8"	179.62	1.98	EXCAVATION	Known Incident		3.00
ProtectedCoated Steel	LP	Over 8"	141.59	1.81	EXCAVATION/ OTHER	Known Incident		3.00
Plastic	LP	Over 4" Thru 8"	767.19	2.34	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	LP	Over 8"	200.54	1.26	EXCAVATION/ OTHER/ NATURAL FORCE	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	LP	4" Thru 8"	896.09	1.12	NATURAL FORCE/O. O. FORCE/OTHER	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	HP	Under 4"	0.07	5.63	NATURAL FORCE/ OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	HP	4" Thru 8"	0.03	5.63	NATURAL FORCE/ OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

NYC – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	HP	Upto 4"	31.08	4.12	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.20
UnprotectedBare Steel	HP	Over 4" Thru 8"	24.03	4.12	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.20
ProtectedCoated Steel	Local T	Upto 4"	0.34	3.36	EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.79
ProtectedCoated Steel	Local T	Over 4" Thru 8"	2.02	3.36	EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.79
ProtectedCoated Steel	Local T	Over 8"	26.08	3.36	EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.79
Cast Iron	LP	Under 4"	1.03	3.18	NATURAL FORCE / OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.69
Wrought Iron	LP	Under 4"	0.12	3.18	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.69
Plastic	HP	Upto 4"	258.55	3.13	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.67
Wrought Iron	LP	Under 4"	0.12	3.10	OTHER			1.65
Wrought Iron	LP	4" Thru 8"	0.42	3.10	OTHER			1.65
Wrought Iron	LP	4" Thru 8"	0.42	3.04	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.62

NYC – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	LP	Upto 4"	0.54	2.88	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.54
UnprotectedBare Steel	LP	Over 4" Thru 8"	108.04	2.88	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.54
UnprotectedBare Steel	LP	Over 8"	27.53	2.88	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.54
Plastic	LP	Upto 4"	2.71	2.48	EXCAVATION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.32
Plastic	LP	Over 8"	72.02	2.48	EXCAVATION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.32
ProtectedCoated Steel	LP	Over 4" Thru 8"	555.76	0.32	OTHER			0.17

HIGHEST RANKED RISKS

STATE: New York
REGION: NYC
FACILITY: SERVICES (Active & Inactive)

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Note

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Inside	49,142	0.00	INC. OPERATION / EXCAVATION/MATERIAL-WELD	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	> 60 PSI,Not T	Inside	3	4.44	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	HP	Inside	6,920	4.29	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.90
Unprotected Bare Steel	LP	Outside	169	3.94	CORROSION /EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.66
Plastic	LP	Inside	308,395	3.66	MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.47
Unprotected Bare Steel	HP	Outside	180	3.43	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.32
Unprotected Bare Steel	LP	Inside	14,795	3.12	MATERIAL-WELD / NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.11
Copper	LP	Inside	93,112	2.96	NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.00
Protected Coated Steel	LP	Inside	17,443	2.96	CORROSION/ MATERIAL-WELD / NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.00
Plastic	LP	Outside	25,030	2.74	EXCAVATION/ O. O. FORCE/MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.85
Copper	HP	Inside	1,228	2.34	EQ. FAILURE			1.59

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

NYC – SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Copper	LP	Outside	2,331	2.19	EQ. FAILURE			1.48
Copper	HP	Outside	105	1.88	EQ. FAILURE			1.27
Plastic	> 60 PSI,Not T	Outside	28	1.59	EXCAVATION /MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.08
Plastic	> 60 PSI,Not T	Inside	198	1.59	EXCAVATION /MATERIAL-WELD		v	1.08
Plastic	HP	Outside	35,561	0.60	MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.40

HIGHEST RANKED RISKS

STATE: New York
REGION: LI
FACILITY: MAINS

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Cast Iron	LP	4" Thru 8"	180.76	2.16	NATURAL FORCE	**Known Incident**	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedCoated Steel	> 60 PSI,Not T	Upto 4"	52.41	1.30	EXCAVATION /INC. OPERATION / O. O. FORCE	**Known Incident**		3.00
UnprotectedBare Steel	> 60 PSI,Not T	Upto 4"	10.51	2.95	CORROSION/ MATERIAL/WELD / NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	> 60 PSI,Not T	Over 4" Thru 8"	33.46	2.95	CORROSION/ EXCAVATION/ NATURAL FORCE/ EQ. FAILURE/ INC. OPERATION / MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	> 60 PSI,Not T	Over 8"	29.28	2.95	CORROSION/ MATERIAL-WELD / EQ. FAILURE / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	HP	4" Thru 8"	0.19	2.83	EXCAVATION/ OTHER/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.87
UnprotectedBare Steel	HP	Upto 4"	1490.19	2.33	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
UnprotectedBare Steel	HP	Over 4" Thru 8"	176.95	2.33	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
UnprotectedBare Steel	HP	Over 8"	11.10	2.33	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
Cast Iron	HP	Over 8"	0.80	2.25	OTHER/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.29
Wrought Iron	HP	Over 8"	0.06	2.25	OTHER/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.29

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

LI – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Wrought Iron	LP	4" Thru 8"	1.64	2.16	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.19
ProtectedBare Steel	> 60 PSI,Not T	Upto 4"	9.19	2.08	CORROSION/ MATERIAL-WELD / EQ. FAILURE / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.11
ProtectedBare Steel	> 60 PSI,Not T	Over 4" Thru 8"	17.28	2.08	CORROSION/ MATERIAL-WELD / NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.11
ProtectedBare Steel	> 60 PSI,Not T	Over 8"	9.48	2.08	CORROSION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION / MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.11
Plastic	> 60 PSI,Not T	Upto 4"	160.37	2.06	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.10
Plastic	> 60 PSI,Not T	Over 4" Thru 8"	54.45	2.06	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.10
Plastic	> 60 PSI,Not T	Over 8"	0.08	2.06	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.10
Cast Iron	LP	Under 4"	0.75	1.68	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.71
Wrought Iron	LP	Under 4"	0.01	1.68	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.71
ProtectedBare Steel	HP	Upto 4"	0.04	1.671837521	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.70
ProtectedBare Steel	HP	Over 4" Thru 8"	0.02	1.67	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.70

LI – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Upto 4"	3440.6	1.66	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.69
Plastic	HP	Over 4" Thru 8"	388.77	1.66	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.69
Plastic	HP	Over 8"	43.38	1.66	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.69
UnprotectedBare Steel	LP	Upto 4"	135.53	1.63	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.66
UnprotectedBare Steel	LP	Over 4" Thru 8"	143.54	1.63	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.66
UnprotectedBare Steel	LP	Over 8"	7.25	1.63	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.66
ProtectedCoated Steel	Local T	Upto 4"	0.5	1.48	EXCAVATION			1.50
ProtectedCoated Steel	Local T	Over 4" Thru 8"	43.32	1.48	EXCAVATION			1.50
ProtectedCoated Steel	Local T	Over 8"	76.34	1.48	EXCAVATION			1.50
UnprotectedCoated Steel	HP	Upto 4"	599.51	1.44	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.46
UnprotectedCoated Steel	HP	Over 4" Thru 8"	94.45	1.44	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.46

LI – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedCoated Steel	HP	Over 8"	1.75	1.44	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.46
ProtectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	53.79	1.30	O. O. FORCE / INC. OPERATION			1.32
ProtectedCoated Steel	> 60 PSI,Not T	Over 8"	45.74	1.30	O. O. FORCE / INC. OPERATION			1.32
Cast Iron	LP	Over 8"	10.46	1.04	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.06
Plastic	LP	Upto 4"	21.16	0.65	MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.66
Plastic	LP	Over 4" Thru 8"	106.4	0.65	MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.66
Plastic	LP	Over 8"	6.59	0.65	MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.66

HIGHEST RANKED RISKS

STATE: New York
REGION: LI
FACILITY: SERVICES (Active & Inactive)

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Unprotected Bare Steel	HP	Inside	7,069	2.51	EQ. FAILURE/ MATERIAL-WELD/CORROSION	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Protected Coated Steel	HP	Inside	5,250	1.31	EQ. FAILURE	Known Incident		3.00
Protected Bare Steel	HP	Inside	3,151	6.53	CORROSION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	HP	Outside	12,791	6.42	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.95
Protected Bare Steel	LP	Inside	1,512	5.43	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.49
Protected Bare Steel	HP	Outside	5,701	5.22	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.40
Unprotected Bare Steel	LP	Outside	6,139	4.97	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.28
Protected Bare Steel	LP	Outside	2,736	4.07	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.87
Copper	HP	Inside	1,409	3.79	EQ. FAILURE/ CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.74

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

LI – SERVICES (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Copper	LP	Inside	42	3.04	EQ. FAILURE			1.40
Copper	HP	Outside	2,548	3.03	EQ. FAILURE			1.39
Plastic	HP	Inside	147,195	3.03	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.39
Plastic	LP	Inside	10,059	2.62	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.20
Unprotected Coated Steel	HP	Inside	10,903	2.58	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.18
Plastic	HP	Outside	266,337	2.44	EXCAVATION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.12
Unprotected Coated Steel	LP	Inside	5,233	2.27	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.04
Copper	LP	Outside	77	2.25	EQ. FAILURE			1.03
Unprotected Bare Steel	LP	Inside	3,393	2.15	EQ. FAILURE			0.99
Unprotected Coated Steel	HP	Outside	19,728	2.06	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.95
Plastic	LP	Outside	18,200	1.30	MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.60

HIGHEST RANKED RISKS

STATE: New York
REGION: Upstate
FACILITY: MAINS

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	HP	Over 8"	5.00	3.63	CORROSION	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedCoated Steel	> 60 PSI,Not T	Over 8"	100.00	1.62	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION/ MATERIAL/WELD	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	61.00	1.62	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE/ INC. OPERATION/ MATERIAL/WELD	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Plastic	HP	Upto 4"	3,597.00	0.80	EXCAVATION/ O. O. FORCE/ EQ. FAILURE/ MATERIAL/WELD	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Wrought Iron	LP	Under 4"	2.00	6.30	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
UnprotectedBare Steel	> 60 PSI,Not T	Upto 4"	1.00	4.60	CORROSION/ EXCAVATION/ NATURAL FORCE/ MATERIAL/WELD / O. O. FORCE/ EQ. FAILURE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.19
UnprotectedBare Steel	> 60 PSI,Not T	Over 4" Thru 8"	1.00	4.60	CORROSION/ EXCAVATION/ NATURAL FORCE/ MATERIAL/WELD / O. O. FORCE/ EQ. FAILURE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.19
UnprotectedBare Steel	> 60 PSI,Not T	Over 8"	2.00	4.60	CORROSION/ EXCAVATION/ NATURAL FORCE/ MATERIAL/WELD / O. O. FORCE/ EQ. FAILURE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.19
UnprotectedBare Steel	HP	Upto 4"	11.00	3.63	CORROSION / EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.73
UnprotectedBare Steel	HP	Over 4" Thru 8"	17.00	3.63	CORROSION / EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.73
Cast Iron	HP	Over 8"	6.00	2.59	NATURAL FORCE / OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.23

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

Upstate – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	LP	Upto 4"	8.00	2.54	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.21
UnprotectedBare Steel	LP	Over 4" Thru 8"	5.00	2.54	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.21
UnprotectedBare Steel	LP	Over 8"	1.00	2.54	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.21
Plastic	> 60 PSI,Not T	Upto 4"	63.00	2.36	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION / NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.13
Plastic	> 60 PSI,Not T	Over 4" Thru 8"	27.00	2.36	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION / NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.13
Plastic	> 60 PSI,Not T	Over 8"	1.00	2.36	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION/ NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.13
Cast Iron	LP	4" Thru 8"	270.00	2.33	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.11
Wrought Iron	LP	4" Thru 8"	2.00	2.33	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.11
UnprotectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	2.00	2.09	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.99
UnprotectedCoated Steel	> 60 PSI,Not T	Over 8"	1.00	2.09	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.99
Cast Iron	LP	Over 8"	41.00	1.98	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94

Upstate – MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Wrought Iron	LP	Over 8"	1.00	1.98	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.94
Plastic	HP	Over 4" Thru 8"	883.00	1.90	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.91
Plastic	HP	Over 8"	16.00	1.90	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.91
ProtectedCoated Steel	Local T	Upto 4"	2.00	1.82	EXCAVATION/ O. O. FORCE/ NATURAL FORCE / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.86
ProtectedCoated Steel	Local T	Over 4" Thru 8"	21.00	1.82	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.86
ProtectedCoated Steel	Local T	Over 8"	304.00	1.82	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD / INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.86
UnprotectedCoated Steel	HP	Upto 4"	11.00	1.65	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.79
UnprotectedCoated Steel	HP	Over 4" Thru 8"	11.00	1.65	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.79
UnprotectedCoated Steel	HP	Over 8"	1.00	1.65	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.79
ProtectedCoated Steel	> 60 PSI,Not T	Upto 4"	29.00	1.62	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.77
Plastic	LP	Over 4" Thru 8"	111.00	1.51	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.72
Plastic	LP	Over 8"	2.00	1.51	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.72
Plastic	LP	Upto 4"	127.00	1.43	O. O. FORCE / MATERIAL/WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.68

HIGHEST RANKED RISKS

STATE: New York
REGION: Upstate
FACILITY: SERVICE (Active & Inactive)

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Unprotected Bare Steel	HP	Outside	7,851	1.98	NATURAL FORCE/ CORROSION/ EXCAVATION	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Plastic	HP	Outside	273,817	2.68	EXCAVATION/ MATERIAL-WELD/ O. O. FORCE	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Unprotected Bare Steel	LP	Inside	8,229	2.17	MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.90
Unprotected Bare Steel	HP	Inside	6,915	2.47	CORROSION/ MATERIAL-WELD / EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.17
Cast Iron	LP	Inside	316	3.42	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ INC. OPERATION/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Copper	HP	Outside	767	2.33	EQ. FAILURE/CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.05
Copper	LP	Inside	4,027	2.33	EQ. FAILURE			2.04
Unprotected Bare Steel	LP	Outside	4,728	2.89	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.53
Cast Iron	LP	Outside	152	0.81	CORROSION/ EXCAVATION/ NATURAL FORCE/ O. O. FORCE/ EQ. FAILURE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.71
Unprotected Coated Steel	HP	Inside	101	1.51	CORROSION/ O. O. FORCE/ INC. OPERATION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.32
Plastic	LP	Inside	37,597	1.96	MATERIAL-WELD / EXCAVATION/ O. O. FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.72

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

Upstate – SERVICE (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	HP	Inside	74,117	3.33	MATERIAL-WELD / EXCAVATION/ O. O. FORCE/ INC. OPERATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.92
Copper	HP	Inside	700	2.92	EQ. FAILURE/ INC. OPERATION / CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.56
Unprotected Coated Steel	LP	Inside	57,842	2.47	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.17
Unprotected Coated Steel	LP	Outside	36,480	0.78	EQ. FAILURE/ CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.68
Plastic	LP	Outside	39,878	2.08	EXCAVATION/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.82
Unprotected Coated Steel	HP	Outside	175	2.32	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.04

NEW YORK

APPENDIX D

IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS

Table 15-3: Threat Mitigation

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions New York
Corrosion	Cast Iron Pipe Graphitization (including risk of crack or break due to becoming brittle)	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Bare Steel or Wrought Iron Pipe	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Coated Steel w/o CP	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Copper Services	Proactive leak surveys, service tees replaced with main replacements and leak management programs
	Stray Current	Design, Proactive leak surveys, Proactive Corrosion Control inspections
	Internal Corrosion	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Atmospheric Corrosion on above ground facilities	Design, Proactive leak surveys, Proactive Corrosion Control inspections
	Atmospheric Corrosion of facilities in Vaulted areas underground	Design, Proactive leak surveys, Proactive I&R and Corrosion Control inspections
	Corrosion of Buried Farm Tap Equipment	Proactive leak surveys, Proactive Corrosion Control inspections
	Corrosion of Service Fittings on cast iron mains that are not cathodically protected.	Proactive leak surveys, services associated with main replacement programs are replaced, proactive high pressure service replacement program and leak management program

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions New York
	Grounds installed on risers making CP ineffective	Cathodic Protection Monitoring
	Corrosion of carrier pipe in Cased Crossing	Cathodic Protection Monitoring
Natural Forces	Earth Movement / Landslide(Unstable Soil)	Proactive Leak Survey Programs
	Frost Heave	Proactive Leak Survey Programs / Winter Operations
	Flooding (including Coastal)	Proactive Leak Survey Programs
	Tree Roots	Proactive Leak Survey Programs
	Over-pressure due to snow/ice blockage or freeze up.	Design, Proactive Leak Survey Programs
	Other Natural Forces (Lightning, High winds)	Design, Proactive Leak Survey Programs
Excavation Damage	Improper Excavation Practice (including mitigation for high-risk tickets)	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Facility not located or marked	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	One-call notification practices not sufficient	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Mis-Marked Facilities	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Incorrect Facility Records	Damage Prevention Monitoring, Design, EFV's, training and emergency response (see Table 6-7)

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions New York
	Shallow Mains - reduced cover	Damage Prevention Monitoring, Design, training and emergency response
	Plastic without tracer wire that cannot be located	Damage Prevention Monitoring, Design, EFV's, training and emergency response
Other Outside Force Damage	Vehicle Damage to Riser/Meter	Design, Proactive Leak Survey Programs
	Vehicle Damage to above-ground equip/station	Design, Proactive Leak Survey Programs
	Vandalism	Design, EFV's Proactive Leak Survey Programs
	Structure Fire	Design, EFV's, training and emergency response
Pipe, Weld or Joint Failure	Pre-1973 Aldyl A (Tan MDPE 2306)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	1973 and later Aldyl A (Tan MDPE 2306)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	1973 and later Aldyl A (Tan MDPE 2406)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Aldyl 4A (Green MDPE 2306)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	PE other than Aldyl A & 4A	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Delrin Insert Tap Tees	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Plexco Service Tee Celcon Caps	Not Applicable.
	PE Fusion failure	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions New York
	Pre-1940 Oxy-Acetylene Girth Weld	Proactive Leak Survey, Review risk potential replacement of 99 and 124 psi piping.
Equipment Failure	Stab Type Mechanical	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Nut Follower Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Bolted Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Other Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Valves	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Service Regulators	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Meters (including Tin Meters)	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Control/Relief Station Equipment	Design, I&R Inspections, Operator Qualifications, training and emergency response
Incorrect Operations	General	Operator Qualifications, training and emergency response
	Gas lines bored through Sewers	Operator Qualifications, training and emergency response
Other	Bell Joint Leakage, Cast Iron and Ductile Iron	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Construction over gas mains & services	Operator Qualifications, training and emergency response

Extensive investigation/research, monitoring and improvement works are being performed on some special projects listed below and all the reports are incorporated by reference in its most updated form.

ATMOSPHERIC CORROSION

In Upstate New York, National Grid visits all services with inside meter sets to inspect the service for atmospheric corrosion. Due to the timing of these inspections, National Grid cannot always gain access to all buildings to inspect the pipe. National Grid attempts two more times to contact the customer and schedule an appointment. However, a large number of service inspections attempted are never completed and have a result of “Can’t Get In” (CGI).

In order to address any safety concerns with these services, National Grid conducted a review to see if any other inspection programs or service work were conducted at the address in the last 6 years. National Grid determined that if the service was replaced in the last 6 years or if an atmospheric corrosion inspection was completed as a “tag-a-long” inspection to other work being completed, the service was at a lower risk to be severely corroded.

For the remaining services that have had no access to the premises in the last 6 years, National Grid prioritized the risk by year of installation and will begin to turn the customer’s gas off in the summer in order to schedule an appointment for an atmospheric corrosion inspection.

INSIDE METER SETS

The National Grid Inside Meter Sets program is dedicated to upgrading the natural gas infrastructure by relocating inside gas meter set. Natural gas meters are moved from inside to outside locations so that National Grid can continue to provide safe, high-quality customer service by replacing older leak prone pipe made of cast iron or unprotected steel. Service lines may also be replaced with modern materials if they have not previously been replaced during routine maintenance. Some of the benefits of this program are the replacement of LPP with more modern materials in order to reduce the risk of gas leaks. This program also contributes to customer and company convenience by eliminating the need to enter the home for atmospheric corrosion inspections and leak surveys. The inside meter sets program increases customer satisfaction by facilitating more frequent and comprehensive inspections and maintenance work on meters and service piping that has been placed outside. Lastly, the inside meter sets relocation program eliminates the risk of shut-off due to access issues and provides easy access to relocated outside meters in the event of an emergency.

FARM TAPS

National Grid has several services in Massachusetts that are connected to a high pressure main at 125 psi or greater. Because of this, the services are installed with a special regulator (Farm Taps) to cut this pressure to a lower pressure that our usual service regulators operate at. These services are also installed with a fail-safe in the event that the farm tap regulator operates incorrectly. These fail-safes include a slam shut device downstream of the farm tap or a monitor control set up with two regulators.

National Grid began inspecting farm tap services in 2016 after an initial random inspection in 2014 of a sample of farm taps. These inspection results will help prioritize which farm taps will be replaced or upgraded first. Moving forward, these farm taps will be inspected on a 3 year cycle to check the equipment is operating correctly, not corroded, and not leaking to ensure the safety of the customer

INNERTITE FITTINGS

National Grid had 2 incidents involving Inner-Tite fittings in 2008 and 2011 on Long Island, with the 2008 incident resulting in property damage. History has shown the Inner-Tite fitting has corroded at a faster rate than the rest of the service. Because of this, National Grid has identified all plastic and plastic tube inside meter services installed in 1974 and prior for the New York Service territory to be inspected, as services meeting these conditions involve the possibility of having the Inner-Tite equipment installed as part of the fitting assembly.

From 2012 – 2014, National Grid visited every site and completed inspections when able to get access inside the building. However, despite multiple lettering and communication attempts, National Grid was not able to get access inside the house to complete the inspection. In 2015, National Grid reviewed other work done from other programs and reduced the list of services needing inspection in New York City. In 2017, National Grid combined this program with Atmospheric Corrosion Program.

LATENT DAMAGE VERIFICATION PROGRAM

National Grid's number one priority is the safety of the public, our customers and employees. The Latent Damage Verification Program is in response to the January 26, 2011 Horseheads, NY incident in which a residential home was destroyed by an explosion and fire resulting in one fatality and two serious injuries. The incident was found to be caused by a fractured gas service line to the house. Due to this fracture, gas was released into the basement and caused the explosion. In response to the incident the PSC issued an order requiring risk assessments and remediation of New York gas facilities. National Grid was directed to perform risk assessment of their systems to determine if conditions similar to those found in the Horseheads incident are present or likely to exist, primarily where third-party excavations occurred subsequent to and beneath or adjacent to gas facility installations. National Grid conducts its risk assessment by first evaluating the potential for latent damage from third party excavations by requesting data from the municipality operating within the service territory, identifying all gas facilities that has water and sewer facilities subsequently installed, reviewing all internal records from leak management, and using GTI developed statistical methods to select random dig locations for inspection. Lastly, National Grid conducts field verification of random dig locations across its operating regions to verify if any of its gas facilities are damaged due to other underground infrastructure that was subsequently installed.

WATER INTRUSION/WASHOUT PROJECTS

The National Grid Water Intrusion/Washouts Program is in place to remediate situations where water has infiltrated the gas distribution system. This situation is known to cause poor pressure, resulting in repeated customer supply disruptions and decreased system reliability. The program addresses outstanding water intrusion issues in addition to allowing in-year projects to be walked-in as locations meeting criteria for inclusion in the program are identified. This program also addresses unanticipated infrastructure washouts and main exposures that can occur due to storms, heavy rains and/or seasonal snow melt. Main exposure/undermining can result in damage to facilities, emergency response and potential loss of service to customers. Distribution washouts/exposures can create potential for further damages and risks to assets if not addresses efficiently and appropriately. National Grid is required to ensure proper integrity for safe operation of its assets and to maintain proper cover and protection of its facilities.

PROACTIVE MAIN REPLACEMENT PROGRAM – LPP

This program supports the replacement of Leak Prone Pipe (LPP) inventory, defined as mains less than 16” in diameter that are non-cathodically protected steel, whether bare or coated (collectively termed “unprotected steel”) or cast/ wrought iron or pre 1985 Aldyl-A plastic. The goal of this program is to reduce the risk associated with leak prone pipe in the distribution system.

National Grid is the second oldest gas company in the country with a high concentration of cast iron in its system. The company faces a higher leak rate on Cast Iron which exhibits 75% of the leak repairs on Cast Mains. As a result, the algorithm was revised to increase the replacement of cast Iron main.

Replacement candidates are chosen based on a risk ranking algorithm that considers probability of failure as well as consequence of failure. Leaks are one of the factors considered in the risk ranking algorithm (refer to section 8-2 Main & Services for algorithm details).

CROSS BORE

National Grid has installed several plastic gas mains through Horizontal Directional Drilling (HDD) technology where the pipe can bore through an unverified sewer lateral. If a mechanical cleaning tool is used to remove the blockage, it may lead to damaging the gas line, causing the gas to migrate into the building that can lead to an explosion. National Grid cross bore inspection program address all previous HDD installations to review if a cross bore incident has occurred and if so, take proactive steps to remediate the situation.

LARGE DIAMETER PIPE LINING & CISBOT

The program supports large diameter distribution piping on KEDNY system. The CISBOT (Cast Iron Sealing Robot) program involves the use of a robotic internal sealing for cast iron mains 16 inches to 42 inches. Unlike other methods of joint repair, CISBOT allows pipe to seal more than 80 joints from one excavation without shutting down the main.

The Lining project extends the life of the main for more than 50 years. This proven technology has been successfully used by the National Grid for several years. In congested metropolitan areas, where it is almost impossible to find another lane in the roadway to install new large diameter main, installation of the lining is the most cost effective way to recondition the existing mains, reduce costs and minimize disruptions to the public.

CI FROST PATROL

Cast Iron (CI) is a brittle material and has tendency to break when extended periods of cold temperature allow frost to form in the ground. The downward pressure of the expanding frost line can exert such great force that it can crack smaller diameter cast iron mains. In a natural process of graphitization, iron degrades to softer elements, making iron pipelines more susceptible to cracking. Gas may leak from the joints or through cracks in the pipe if graphitization has occurred. National Grid performs periodic survey to identify CI breaks and joint leaks.

BURIED VENT LINES

Buried vent lines program is to recognize potential risk and eliminate or minimize those risks to achieve zero injuries and safeguard public by inspecting buried vent lines.

National Grid is to perform visual inspection and responding to, investigating and remediating of buried vent lines where that have occurred.

STORM HARDENING

Storm Hardening program structured to install remotely operated service shut-off valves with flood sensors to automatically shut down the gas when experience flooding and provide an accurate count of services impacted by the flooding which enable improved emergency response in the event of flooding by disconnecting only the services affected by flooding as opposed to larger gas service district, sending alerts to the customers impacted, isolating the system and alerting the company of the loss of service to our customers in real time. National Grid implementing storm hardening devices to ensure the safety and reliability of the gas assets within the flood zone which also generate improvements in emergency planning.

CITIZENS GATE TUNNEL

The Citizens Gate tunnel was constructed in mid-1920's to supply gas customers in the Red Hook area of Brooklyn, NY. The tunnel accommodates two (2) 30" Cast Iron gas mains operating at 15 psig (one retired and one active), one (1) 16" Steel main operating at 60 psig and one (1) retired 8" steel main. Currently, the mains through this tunnel supply to more than 17,600 customers including 300 customers supplied by a single feed 60 psig main. The tunnel is at the end of its useful life and the environmental clean-up project initiated by New York City that will include dredging the canal will have a significant impact on the tunnel. Furthermore, during the Superstorm Sandy, the tunnel was filled with salt water to the top and took more than three (3) weeks to pump the water out. The current status of the tunnel not only requires regular maintenance, but also poses a significant safety and reliability threat to our system due to the heavy corrosion of supporting structures and deterioration of the tunnel.

National Grid plan is to (i) Rehabilitation of two (2) 30" – 15# Cast Iron/ unprotected steel gas mains with Starline 2000 Cured-In-Place lining inside citizens gate tunnel, (ii) connect both mains together with 36" headers on both sides of the tunnel and (iii) filling tunnel with cementitious concrete under Gowanus Canal, Brooklyn NY

PLASTIC FUSION EXPOSED INSPECTIONS

Recent New York State PUC ruling (14-G-0212 Plastic Fusion Order) mandated two new forms of inspection during the installation of plastic pipe: Newly completed plastic fusions are required to be inspected by a second person other than the one that performed the fuse. Inspection results shall be recorded for every plastic fusion that is being made. This visual inspection is to confirm joint integrity. A failed joint may not be leaking, but is also considered a failure when, upon visual inspection, it does not exhibit the properties of a properly fused joint. The inspection record shall include the location, date and identification of both the fuser and the inspector. This inspection record must be kept in an auditable database.

In-service plastic fusions that are exposed for any reason must receive a similar inspection by one person and the same information must be recorded, except for the identification of a fuser, since the original fusion may have taken place on a different date.

PLASTIC FAILURES

National Grid policy requires that failed plastic parts (either leaking or visually identified as not exhibiting properties of a properly fused or assembled part) be returned to the Laboratory for analysis and testing. When possible, parts are destructively tested to assess cause of leak/failure. A log of analyzed failures is maintained and periodically reviewed in order to recognize system wide failure trends. Local analysis (frequently a leak survey) is conducted to check contemporary and contiguous installation work for similar failures. The paperwork associated with nearby failures from other years may also be examined in order to further complete the review. Certain failures, such as the identification of slow crack growth on pre-1985 plastic, may lead to proactive replacement of similar pipe.

PROACTIVE SERVICE REPLACEMENT

NY proactive service replacement program lead to the review of steel services and a risk prioritization based upon recent leak history statistics. Targeted for replacement will be the services at greatest risk for leakage and those that are an inside set. All targeted services should be outside the bounds of planned main replacements.

METHANE EMISSIONS:

The leak migration is based on the volume of the gas leaking from a facility i.e. a high emitting leak will have a greater extent of leak plume than that of the low emitting leak. The Company will be using this principle in evaluating and prioritizing the type-3 leaks for repair to reduce the methane emissions.

For every individual leak, adding all the bar hole readings will result in the relative size of the plume. Greater the sum of bar hole readings, larger the plume and hence larger the methane emissions. By analyzing the sum of bar-hole readings per leak across all open type-3 leaks, will relatively prioritize them based on emissions.

Every leak has a different migration pattern and the bar-hole readings will be relative to the size of the leak. For e.g., a small leak will have migrated only to limited distance and the leak investigation will get

0% readings in relatively smaller area when compared to a larger leak where the leak investigation will lead to more readings and farther migration patterns.

Material, diameter and pressure normally do not impact the size of leak plume or emission volume since the gas leaks are identified based on the gas in the air. High pressure main will have a much smaller opening in the in the pipe to have similar methane emissions as a low pressure main with larger opening. Furthermore, we should repair any type 3 which may be 5-7 year old and not on a pipe which is scheduled to be replaced in next two years.

ACCESS PROTECTION

The Access Protection program was implemented due to an Incident in the UK, where kids climbed on an elevated pipe resulting in a fatality. National Grid installs protection on any elevated structure. The program is to reduce the risk of public injury by restricting or deterring public access to the Company's elevated gas facilities. In accordance with the customer/community-first approach, the Company has installed protective barriers, such as fencing or other physical deterrents, that will restrict or deter the public from accessing or climbing on elevated gas mains.

PIPE ON BRIDGES

National Grid developed the program to replace or rehabilitated gas pipe and appurtenances on aboveground structures, typically bridges, due to integrity concerns.

NEW YORK

APPENDIX E

MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS

Appendix E, Section 1 – Number of Hazardous Leaks Either Eliminated or Repaired, Categorized by Cause

The 5 years baseline and ongoing performance of the number of Hazardous (***Type 1***) Leaks for Main and Service combined Either Eliminated or Repaired, Categorized by Cause is provided below (Including Excavation Damage Leaks):

INCLUDING Damage

New York City

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	489	400	334	340	452	607	1
	Baseline	Rolling average since 2014 + 0.5 standard deviation (437 for 2014 - 2018)						
Natural Forces	Actual	193	265	112	124	184	147	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (206 for 2014 - 2018)						
Excavation Damage	Actual	214	266	252	272	249	131	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (262 for 2014 - 2018)						
Other Outside Force	Actual	42	44	60	61	36	17	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (54 for 2014 - 2018)						
Material or Welds	Actual	3	3	5	1	4	2	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4 for 2014 - 2018)						
Equipment Failure	Actual	852	955	642	754	734	394	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (847 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	0	5	0	2	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2 for 2014 - 2018)						
Other	Actual	2,122	1,983	1,835	2,113	2,393	2,234	2
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,192 for 2014 - 2018)						
Total	Actual	3,915	3,916	3,240	3,670	4,052	3,534	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3,919 for 2014 - 2018)						

Above Baseline Comments:

1 - Corrosion Leaks elevated due to PHMSA definition change, which also impacted lowering the Equipment Failure Leaks

2 - Other – Approx. 95% of Other leaks are Cast Iron Joint Leaks Repair.

INCLUDING Damages

Long Island

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	593	593	516	440	435	423	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (554 for 2014 - 2018)						
Natural Forces	Actual	90	87	43	30	82	43	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (80 for 2014 - 2018)						
Excavation Damage	Actual	497	495	436	446	457	436	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (480 for 2014 - 2018)						
Other Outside Force	Actual	11	12	24	20	20	24	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (20 for 2014 - 2018)						
Material or Welds	Actual	27	24	19	21	19	19	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (24 for 2014 - 2018)						
Equipment Failure	Actual	194	236	264	218	239	264	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (243 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	0	3	2	0	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2 for 2014 - 2018)						
Other	Actual	37	44	22	15	10	22	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (33 for 2014 - 2018)						
Total	Actual	1449	1,491	1,324	1,193	1,264	1,231	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,407 for 2014 - 2018)						

Above Baseline Comments:

1 – Other Outside Force- We are monitoring the Other Outside Force and will take appropriate action if the number keeps increasing

2 – Equipment Failure- We are reporting all types leak (including non-hazardous) with Lubrication, Adjustment and Tightening to PSC.

INCLUDING Damages

Upstate

Cause		2014	2015	2016	2017	2018	2019
Corrosion	Actual	175	252	117	171	131	117
	Baseline	Rolling average since 2014 + 0.5 standard deviation (196 for 2014 - 2018)					
Natural Forces	Actual	107	143	61	55	86	61
	Baseline	Rolling average since 2014 + 0.5 standard deviation (108 for 2014 - 2018)					
Excavation Damage	Actual	273	336	288	301	256	288
	Baseline	Rolling average since 2014 + 0.5 standard deviation (306 for 2014 - 2018)					
Other Outside Force	Actual	5	18	3	12	7	3
	Baseline	Rolling average since 2014 + 0.5 standard deviation (12 for 2014 - 2018)					
Material or Welds	Actual	6	16	7	9	8	7
	Baseline	Rolling average since 2014 + 0.5 standard deviation (11 for 2014 - 2018)					
Equipment Failure	Actual	154	122	61	68	118	61
	Baseline	Rolling average since 2014 + 0.5 standard deviation (124 for 2014 - 2018)					
Incorrect Operations	Actual	0	0	1	1	1	1
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1 for 2014 - 2018)					
Other	Actual	171	333	74	87	108	74
	Baseline	Rolling average since 2014 + 0.5 standard deviation (208 for 2014 - 2018)					
Total	Actual	891	1220	612	704	715	612
	Baseline	Rolling average since 2014 + 0.5 standard deviation (949 for 2014 - 2018)					

INCLUDING Damages

New York State

Cause		2014	2015	2016	2017	2018	2019
Corrosion	Actual	1,257	1,245	967	951	1,018	1,147
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,163 for 2014 - 2018)					
Natural Forces	Actual	390	495	216	209	352	251
	Baseline	Rolling average since 2014 + 0.5 standard deviation (393 for 2014 - 2018)					
Excavation Damage	Actual	984	1,097	976	1,019	962	855
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,035 for 2014 - 2018)					
Other Outside Force	Actual	58	74	87	93	63	44
	Baseline	Rolling average since 2014 + 0.5 standard deviation (83 for 2014 - 2018)					
Material or Welds	Actual	36	43	31	31	31	28
	Baseline	Rolling average since 2014 + 0.5 standard deviation (37 for 2014 - 2018)					
Equipment Failure	Actual	1,200	1,313	967	1,040	1,091	719
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,190 for 2014 - 2018)					
Incorrect Operations	Actual	0	0	1	9	3	3
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4 for 2014 - 2018)					
Other	Actual	2,330	2,360	1,931	2,215	2,511	2,330
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,378 for 2014 - 2018)					
Total	Actual	6,255	6,627	5,176	5,567	6,031	5,377
	Baseline	Rolling average since 2014 + 0.5 standard deviation (6,216 for 2014 - 2018)					

Appendix E, Section 2 – Number of Excavation Damages

The 5 years baseline and ongoing performance of the number of excavation damages is provided below (Including Excavation Damage Leaks):

INCLUDING Damages

New York City		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	263	289	286	286	328	301
	Baseline	Rolling average since 2014 + 0.5 standard deviation (302 for 2014 - 2018)					

Long Island		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	333	370	345	325	354	320
	Baseline	Rolling average since 2014 + 0.5 standard deviation (354 for 2014 - 2018)					

Upstate		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	245	300	238	220	238	230
	Baseline	Rolling average since 2014 + 0.5 standard deviation (263 for 2014 - 2018)					

New York State		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	841	959	869	831	920	851
	Baseline	Rolling average since 2014 + 0.5 standard deviation (911 for 2014 - 2018)					

Appendix E, Section 3 – Number of Excavation Tickets

The 5 years baseline and ongoing performance of the number of excavation tickets is provided below (Including Excavation Damage Leaks):

INCLUDING Damages

New York City		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	172,673	177,824	191,140	283,474	281,328	288,821
	Baseline	Rolling average since 2014 + 0.5 standard deviation (249,387 for 2014 - 2018)					

Long Island		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	174,833	156,964	164,892	185,313	208,075	268,644
	Baseline	Rolling average since 2014 + 0.5 standard deviation (187,960 for 2014 - 2018)					

Upstate		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	96,672	104,422	103,125	102,770	103,125	109,076
	Baseline	Rolling average since 2014 + 0.5 standard deviation (103,551 for 2014 - 2018)					

New York State		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	444,178	439,210	459,157	571,557	592,528	666,541
	Baseline	Rolling average since 2014 + 0.5 standard deviation (538,535 for 2014 - 2018)					

Appendix E, Section 4 – Total Number of Leaks Either Eliminated or Repaired, Categorized by Cause

The 5 years baseline and ongoing performance of the number of Leaks Either Eliminated or Repaired, Categorized by Cause is provided below (Including Excavation Damage Leaks):

INCLUDING Damages

New York City

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	602	482	427	455	533	864	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (534 for 2014 - 2018)						
Natural Forces	Actual	232	282	138	146	202	171	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (230 for 2014 - 2018)						
Excavation Damage	Actual	214	269	256	276	251	137	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (265 for 2014 - 2018)						
Other Outside Force	Actual	44	45	60	65	38	18	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (56 for 2014 - 2018)						
Material or Welds	Actual	3	3	6	2	5	2	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5 for 2014 - 2018)						
Equipment Failure	Actual	1,029	1,152	859	914	860	496	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,026 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	0	6	0	3	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3 for 2014 - 2018)						
Other	Actual	2,799	2,518	2,710	2,786	2,921	2,937	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,821 for 2014 - 2018)						
Total	Actual	4,923	4,751	4,456	4,650	4,810	4,628	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4,806 for 2014 - 2018)						

Above Baseline Comments:

1 - Corrosion Leaks elevated due to PHMSA definition change, which also impacted lowering the Equipment Failure Leaks

2 - Other - Cast Iron Joint Leaks Repair

INCLUDING Damages

Long Island

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	1,627	1,452	1,396	1,392	1,487	1,396	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,519 for 2014 - 2018)						
Natural Forces	Actual	151	144	78	76	137	78	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (136 for 2014 - 2018)						
Excavation Damage	Actual	532	538	457	469	475	457	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (513 for 2014 - 2018)						
Other Outside Force	Actual	24	23	34	27	25	34	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (29 for 2014 - 2018)						
Material or Welds	Actual	81	56	46	59	55	46	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (66 for 2014 - 2018)						
Equipment Failure	Actual	526	708	1,066	783	967	1,066	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (917 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	1	8	4	1	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4 for 2014 - 2018)						
Other	Actual	126	163	180	111	94	180	*3*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (153 for 2014 - 2018)						
Total	Actual	3,067	3,084	3,258	2,925	3,244	3,258	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3,185 for 2014 - 2018)						

Above Baseline Comments:

1 – Other Outside Force- We are monitoring the other outside Force and will take appropriate action if the number keeps increasing

2 – Equipment Failure- We are verifying field crew asset/threats entry in the system. Under Investigation and findings will be addressed

3 – Other- We are monitoring the Other causes and will take appropriate action if the number keeps increasing

INCLUDING Damages

Upstate

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	404	607	269	401	314	269	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (464 for 2014 - 2018)						
Natural Forces	Actual	173	229	126	124	141	126	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (181 for 2014 - 2018)						
Excavation Damage	Actual	286	343	293	302	256	293	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (312 for 2014 - 2018)						
Other Outside Force	Actual	10	34	7	22	9	7	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (22 for 2014 - 2018)						
Material or Welds	Actual	19	30	22	30	24	22	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (27 for 2014 - 2018)						
Equipment Failure	Actual	445	695	162	247	307	162	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (475 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	3	1	3	3	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2 for 2014 - 2018)						
Other	Actual	520	941	216	327	301	216	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (606 for 2014 - 2018)						
Total	Actual	1,857	2,879	1,098	1,454	1,355	1,098	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,078 for 2014 - 2018)						

Above Baseline Comments:

1 – Incorrect Operations leaks are under investigation and findings will be addressed.

INCLUDING Damages

New York State

Cause		2014	2015	2016	2017	2018	2019
Corrosion	Actual	2,633	2,541	2,092	2,248	2,665	2,529
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,562 for 2014 - 2018)					
Natural Forces	Actual	556	655	342	346	449	375
	Baseline	Rolling average since 2014 + 0.5 standard deviation (538 for 2014 - 2018)					
Excavation Damage	Actual	1,032	1,150	1,006	1,047	868	887
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,071 for 2014 - 2018)					
Other Outside Force	Actual	78	102	101	114	52	59
	Baseline	Rolling average since 2014 + 0.5 standard deviation (102 for 2014 - 2018)					
Material or Welds	Actual	103	89	74	91	81	70
	Baseline	Rolling average since 2014 + 0.5 standard deviation (93 for 2014 - 2018)					
Equipment Failure	Actual	2,000	2,555	2,087	1,944	1,770	1,724
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,218 for 2014 - 2018)					
Incorrect Operations	Actual	0	0	4	15	10	7
	Baseline	Rolling average since 2014 + 0.5 standard deviation (9 for 2014 - 2018)					
Other	Actual	3,445	3,622	3,106	3,224	3,332	3,333
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3,445 for 2014 - 2018)					
Total	Actual	9,847	10,714	8,812	9,029	9,227	8,984
	Baseline	Rolling average since 2014 + 0.5 standard deviation (9,910 for 2014 - 2018)					

Appendix E, Section 5 – Number of Hazardous Leaks Either Eliminated or Repaired, Categorized by Material

The 5 years baseline and ongoing performance of the number of Hazardous (***Type 1***) Leaks for Main and Service combined Either Eliminated or Repaired, Categorized by Material is provided below (Excluding Excavation Damage Leaks):

EXCLUDING Damages

New York City

Material		2014	2015	2016	2017	2018	2019
Cast Iron / Wrought Iron	Actual	2,166	2,169	1,979	2,260	2,568	2,328
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,336 for 2014 - 2018)					
Unprotected Bare	Actual	552	475	306	289	311	318
	Baseline	Rolling average since 2014 + 0.5 standard deviation (446 for 2014 - 2018)					
Unprotected Coated	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Protected Bare	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Protected Coated	Actual	397	433	232	305	288	158
	Baseline	Rolling average since 2014 + 0.5 standard deviation (372 for 2014 - 2018)					
Plastic	Actual	262	264	270	321	335	290
	Baseline	Rolling average since 2014 + 0.5 standard deviation (308 for 2014 - 2018)					
Copper	Actual	325	309	201	223	301	258
	Baseline	Rolling average since 2014 + 0.5 standard deviation (300 for 2014 - 2018)					
Other	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Total	Actual	3,702	3,650	2,988	3,398	3,803	3,352
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3,672 for 2014 - 2018)					

EXCLUDING Damages

Long Island

Material		2014	2015	2016	2017	2018	2019	
Cast Iron / Wrought Iron	Actual	97	103	55	39	77	57	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (88 for 2014 - 2018)						
Unprotected Bare	Actual	558	600	424	360	421	430	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (523 for 2014 - 2018)						
Unprotected Coated	Actual	149	137	73	86	69	48	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (122 for 2014 - 2018)						
Protected Bare	Actual	10	15	18	14	15	33	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (16 for 2014 - 2018)						
Protected Coated	Actual	47	37	24	9	8	5	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (34 for 2014 - 2018)						
Plastic	Actual	85	97	198	237	216	214	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (202 for 2014 - 2018)						
Copper	Actual	6	7	11	5	6	8	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (8 for 2014 - 2018)						
Other	Actual	0	0	0	0	0	0	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)						
Total	Actual	952	996	803	750	812	795	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (915 for 2014 - 2018)						

Above Baseline Comments:

1 – Protected Bare – Data correction

2 – Plastic- Equipment Failure could be the main factor. Under Investigation and findings will be addressed

EXCLUDING Damages

Upstate

Material		2014	2015	2016	2017	2018	2019
Cast Iron / Wrought Iron	Actual	217	398	108	115	191	108
	Baseline	Rolling average since 2014 + 0.5 standard deviation (264 for 2014 - 2018)					
Unprotected Bare	Actual	122	164	80	70	69	59
	Baseline	Rolling average since 2014 + 0.5 standard deviation (122 for 2014 - 2018)					
Unprotected Coated	Actual	95	107	68	83	92	68
	Baseline	Rolling average since 2014 + 0.5 standard deviation (96 for 2014 - 2018)					
Protected Bare	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Protected Coated	Actual	71	75	15	30	15	15
	Baseline	Rolling average since 2014 + 0.5 standard deviation (56 for 2014 - 2018)					
Plastic	Actual	107	128	64	94	89	64
	Baseline	Rolling average since 2014 + 0.5 standard deviation (108 for 2014 - 2018)					
Copper	Actual	6	12	10	11	3	10
	Baseline	Rolling average since 2014 + 0.5 standard deviation (10 for 2014 - 2018)					
Other	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Total	Actual	618	884	345	403	459	324
	Baseline	Rolling average since 2014 + 0.5 standard deviation (650 for 2014 - 2018)					

Above Baseline Comments:

Above Ground Leaks – Data correction

EXCLUDING Damages

New York State

Material		2014	2015	2016	2017	2018	2019
Cast Iron / Wrought Iron	Actual	2,480	2,670	2,142	2,414	2,596	2,493
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,562 for 2014 - 2018)					
Unprotected Bare	Actual	1,232	1,239	810	719	808	807
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,088 for 2014 - 2018)					
Unprotected Coated	Actual	244	244	141	169	161	116
	Baseline	Rolling average since 2014 + 0.5 standard deviation (216 for 2014 - 2018)					
Protected Bare	Actual	10	15	18	14	15	33
	Baseline	Rolling average since 2014 + 0.5 standard deviation (16 for 2014 - 2018)					
Protected Coated	Actual	515	545	271	344	181	178
	Baseline	Rolling average since 2014 + 0.5 standard deviation (449 for 2014 - 2018)					
Plastic	Actual	454	489	532	652	595	568
	Baseline	Rolling average since 2014 + 0.5 standard deviation (584 for 2014 - 2018)					
Copper	Actual	337	328	222	239	267	276
	Baseline	Rolling average since 2014 + 0.5 standard deviation (305 for 2014 - 2018)					
Other	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Total	Actual	5,272	5,530	4,136	4,551	4,623	4,471
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5,106 for 2014 - 2018)					

Appendix E, Section 6 – Number of Excavation Damages

The 5 years baseline and ongoing performance of the number of known system leaks at the end of the year scheduled for repair is provided below:

Workable Leak Backlog		2014	2015	2016	2017	2018	2019
New York City	Actual	24	21	23	8	7	8
	Baseline	Rolling average since 2014 + 0.5 standard deviation (21 for 2014 - 2018)					
Long Island	Actual	8	5	1	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5 for 2014 - 2018)					
Upstate New York	Actual	5	17	21	9	0	1
	Baseline	Rolling average since 2014 + 0.5 standard deviation (15 for 2014 - 2018)					
New York State	Actual	37	43	45	17	7	9
	Baseline	Rolling average since 2014 + 0.5 standard deviation (38 for 2014 - 2018)					

The 5 years baseline and ongoing performance of total damages per 1000 tickets is provided below (**INCLUDING** Excavation Damage Leaks):

Total Excavation Damages per 1000 Tickets		2014	2015	2016	2017	2018	2019
New York City	Actual	1.52	1.61	1.5	1.01	1.17	1.04
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.60 for 2014 - 2018)					
Long Island	Actual	1.9	2.20	2.09	1.75	1.70	1.19
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.16 for 2014 - 2018)					
Upstate New York	Actual	2.53	2.87	2.31	2.14	2.31	2.11
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.82 for 2014 - 2018)					
New York State	Actual	1.89	2.18	1.89	1.45	1.55	1.28
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.14 for 2014 - 2018)					

The 5 years baseline and ongoing performance of Total Leak Receipts is provided below (**EXCLUDING** Excavation Damage Leaks):

Total Leak Receipts		2014	2015	2016	2017	2018	2019
New York City	Actual	4,984	5,812	4,340	4,075	4,171	4,002
	Baseline	Rolling average since 2014 + 0.5 standard deviation (5,040 for 2014 - 2018)					
Long Island	Actual	3,350	3,935	3,380	3,292	3,452	3,387
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3,612 for 2014 - 2018)					
Upstate New York	Actual	1,800	2,122	1,639	1,633	1,549	1,279
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,862 for 2014 - 2018)					
New York State	Actual	10,134	11,869	9,359	9,000	9,172	8,668
	Baseline	Rolling average since 2014 + 0.5 standard deviation (10,497 for 2014 - 2018)					

The 5 years baseline and ongoing performance of the Response Time Performance are provided below:

New York City

Response Time		2014	2015	2016	2017	2018	2019
30 Minutes	Actual	75.60%	75.86%	77.98%	79.08%	80.00%	79.80%
	Baseline	75% as established with State of New York Department of Public Service					
45 Minutes	Actual	93.90%	92.40%	93.53%	94.21%	95.16%	95.66%
	Baseline	90% as established with State of New York Department of Public Service					
60 Minutes	Actual	98.20%	96.58%	97.30%	97.82%	98.48%	98.87%
	Baseline	95% as established with State of New York Department of Public Service					

Long Island

Response Time		2014	2015	2016	2017	2018	2019
30 Minutes	Actual	75.50%	77.99%	80.79%	76.67%	77.21%	77.86%
	Baseline	75% as established with State of New York Department of Public Service					
45 Minutes	Actual	93.80%	94.44%	96.25%	95.04%	95.91%	95.95%
	Baseline	90% as established with State of New York Department of Public Service					
60 Minutes	Actual	99.10%	98.74%	99.68%	99.68%	99.68%	99.05%
	Baseline	95% as established with State of New York Department of Public Service					

Upstate New York							
Response Time		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
30 Minutes	Actual	79.10%	82.70%	83.49%	80.98%	80.53%	80.96%
	Baseline	75% as established with State of New York Department of Public Service					
45 Minutes	Actual	93.80%	95.30%	96.25%	95.55%	95.18%	95.54%
	Baseline	90% as established with State of New York Department of Public Service					
60 Minutes	Actual	98.10%	98.56%	99.12%	98.88%	98.96%	98.86%
	Baseline	95% as established with State of New York Department of Public Service					

The 5 years baseline and ongoing performance of the Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material are provided below (Excluding Excavation Damage Leaks):

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material								
New York City		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
Cast Iron	Actual	1.77	1.71	2.05	2.18	2.40	2.54	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.17 for 2014 - 2018)						
All Steel	Actual	0.18	0.18	0.15	0.15	0.17	0.13	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.17 for 2014 - 2018)						
Plastic	Actual	0.03	0.02	0.01	0.02	0.01	0.01	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.02 for 2014 - 2018)						

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material								
Long Island		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
Cast Iron	Actual	0.61	0.77	0.76	0.74	0.99	1.25	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.84 for 2014 - 2018)						
All Steel	Actual	0.19	0.19	0.22	0.18	0.22	0.23	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.21 for 2014 - 2018)						
Plastic	Actual	0.02	0.02	0.02	0.02	0.02	0.02	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.02 for 2014 - 2018)						

Above Baseline Comments:

1 – Cast Iron material is leaking faster than replacing.

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material

Upstate New York		2014	2015	2016	2017	2018	2019
Cast Iron	Actual	0.99	1.98	1.05	0.92	1.18	0.87
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.44 for 2014 - 2018)					
All Steel	Actual	0.05	0.10	0.03	0.03	0.03	0.02
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.06 for 2014 - 2018)					
Plastic	Actual	0.01	0.02	0.01	0.00	0.00	0.00
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.01 for 2014 - 2018)					

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material

New York State Total		2014	2015	2016	2017	2018	2019
Cast Iron	Actual	1.45	1.64	1.67	1.75	1.99	2.08
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.80 for 2014 - 2018)					
All Steel	Actual	0.13	0.15	0.14	0.11	0.13	0.14
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.14 for 2014 - 2018)					
Plastic	Actual	0.01	0.02	0.01	0.01	0.01	0.01
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.01 for 2014 - 2018)					

The 5 years baseline and ongoing performance of the Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material are provided below (Excluding Excavation Damage Leaks):

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material							
New York City		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Copper	Actual	2.89	2.79	2.15	2.39	3.57	3.87
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3.03 for 2014 - 2018)					
All Steel	Actual	13.1	13.09	7.67	8.85	7.30	7.75
	Baseline	Rolling average since 2014 + 0.5 standard deviation (11.44 for 2014 - 2018)					
Plastic	Actual	0.72	0.75	0.78	0.87	0.94	0.92
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.86 for 2014 - 2018)					

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material							
Long Island		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Copper	Actual	5.46	5.49	6.43	7.23	11.63	8.59
	Baseline	Rolling average since 2014 + 0.5 standard deviation (8.53 for 2014 - 2018)					
All Steel	Actual	9.14	8.87	9.04	8.06	9.67	9.98
	Baseline	Rolling average since 2014 + 0.5 standard deviation (9.25 for 2014 - 2018)					
Plastic	Actual	0.44	0.45	0.94	1.17	1.05	0.98
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.98 for 2014 - 2018)					

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material

Upstate New York		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	
Copper	Actual	0.74	1.64	1.33	1.94	0.53	2.78	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.53 for 2014 - 2018)						
All Steel	Actual	3.72	5.02	3.55	3.10	2.77	2.06	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (4.06 for 2014 - 2018)						
Plastic	Actual	0.64	0.86	0.59	0.46	0.37	0.31	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.68 for 2014 - 2018)						

EXCLUDING Damages

Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material

New York State Total		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
Copper	Actual	2.73	2.75	2.21	2.50	3.52	4.00
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.99 for 2014 - 2018)					
All Steel	Actual	7.72	8.07	6.37	6.04	6.12	5.98
	Baseline	Rolling average since 2014 + 0.5 standard deviation (7.34 for 2014 - 2018)					
Plastic	Actual	0.6	0.68	0.77	0.84	0.79	0.74
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.78 for 2014 - 2018)					

Above Baseline Comments:

1 – Copper Service Leak Rates - Elevated due to correction in Copper Service Inventory.

NEW YORK

APPENDIX F

PERIODIC EVALUATION AND IMPROVEMENT

2019 REGIONAL DISTRIBUTION INTEGRITY ASSESSMENT

Distribution Engineering has reviewed all of the findings in the annual Trend-Based Distribution System Integrity Analysis (*System Integrity Report*) in accordance with our Distribution Integrity Management Plan (DIMP). There are no immediate causes for concern that would warrant changes to DIMP.

Below is a summary of the individual key integrity measure results for the following federal (PHMSA) filing entities that constitute National Grid-US.

NationalGrid-NY

2019 System Integrity Report Summary

REGIONS ITEMS	NY	LI	UNY
• Leak Receipts	⬇	⬇	⬇
• Workable Leak Backlog	⬇	▬	⬇
• LPP Main and Service Inventories	⬇	⬇	⬇
• Overall Main Leak Rate	⬇	⇧	⬇
• Cast Iron Main Break Rate	⬇	⬇	⬇
• Steel Main Corrosion Leak Rate	⇧	⬇	▬
• Service Leak Rate	⬇	⇧	⬇

⬆ Increase ⇧ Slight Increase ▬ No Change ⬇ Decrease

Form F-1: Periodic Updating and Review (Region: KEDNY)

Annual Evaluation of Performance Measures that Exceeded Baseline				
Performance Measure	**Actual Performance for Year 2019**	**Established Baseline**	**Are additional measures beyond minimum code requirement necessary?**	**Has an engineering evaluation been completed and documented?**
Leak Receipts	4,002	5,040	NO	Annual System Integrity Report
Workable leak Backlog	8	21	NO	Annual System Integrity Report
LPP Main Inventory	1,453 miles	1,565 miles (2018)	NO	Annual System Integrity Report
1 Overall Main Leak Rate	0.81	0.78	YES	Annual System Integrity Report
Cast Iron Main Break Rate	0.08	0.10	NO	Annual System Integrity Report
1 Steel main Corrosion Leak Rate	0.14	0.10	YES	Annual System Integrity Report
1 Service Leak Rate	2.24	2.49	YES	Annual System Integrity Report

Existing Date for Complete Program re-evaluation:____08/2021______ Is a shorter timeframe for complete program re-evaluation warranted? : __NO____

Complete Re-evaluation was performed on 9/1/2016 - DIMP REV 5

Saadat Khan (Director) and Leomary Bader (DIMP Manager) Gas Distribution Engineering

Required frequency	Program Re-evaluation Element	Date Completed
Required Annually	Evaluate Performance Measures	8/2020
As needed	Update Knowledge of System Characteristics, Environmental Factors and Threats	8/2020
As needed	Update General Information	8/2020
As needed	Update Threat Identification	8/2020
As needed	Update Risk Evaluation and Ranking Process	8/2020
Required Annually	Update Risk Evaluation and Ranking of Risks	8/2020
As needed	Update Risk Evaluation and Ranking Validation	8/2020
As needed	Update Risk Evaluation and Ranking Process Improvement Action Plans	8/2020
As needed*	Update Action Plans	

Above Baseline Comments:

1 – Remediation projects: Main & Service Replacement – LPP and DIMP factor to prioritize segments.

Form F-1: Periodic Updating and Review (Region: KEDLI)

Annual Evaluation of Performance Measures that Exceeded Baseline

Performance Measure	Actual Performance for Year 2019	Established Baseline	Are additional measures beyond minimum code requirement necessary?	Has an engineering evaluation been completed and documented?
Leak Receipts	3,387	3,612	NO	Annual System Integrity Report
Workable leak Backlog	0	5	NO	Annual System Integrity Report
LPP Main Inventory	2,925 miles	3,075 miles (2018)	NO	Annual System Integrity Report
1 Overall Main Leak Rate	0.16	0.14	YES	Annual System Integrity Report
Cast Iron Main Break Rate	0.31	0.43	NO	Annual System Integrity Report
Steel main Corrosion Leak Rate	0.15	0.16	NO	Annual System Integrity Report
1 Service Leak Rate	3.53	2.75	YES	Annual System Integrity Report

Existing Date for Complete Program re-evaluation:____08/2021______ Is a shorter timeframe for complete program re-evaluation warranted? : __NO____

Complete Re-evaluation was performed on 9/1/2016 - DIMP REV 5

Saadat Khan (Director) and Leomary Bader (DIMP Manager) Gas Distribution Engineering

Required frequency	Program Re-evaluation Element	Date Completed
Required Annually	Evaluate Performance Measures	8/2020
As needed	Update Knowledge of System Characteristics, Environmental Factors and Threats	8/2020
As needed	Update General Information	8/2020
As needed	Update Threat Identification	8/2020
As needed	Update Risk Evaluation and Ranking Process	8/2020
Required Annually	Update Risk Evaluation and Ranking of Risks	8/2020
As needed	Update Risk Evaluation and Ranking Validation	8/2020
As needed	Update Risk Evaluation and Ranking Process Improvement Action Plans	8/2020
As needed*	Update Action Plans	

Above Baseline Comments:

1 – Remediation projects: Main & Service Replacement – LPP and DIMP factor to prioritize segments.

Form F-1: Periodic Updating and Review (Region: NMPC)

Annual Evaluation of Performance Measures that Exceeded Baseline				
Performance Measure	Actual Performance for Year 2019	Established Baseline	Are additional measures beyond minimum code requirement necessary?	Has an engineering evaluation been completed and documented?
Leak Receipts	1,279	1,862	NO	Annual System Integrity Report
Workable leak Backlog	1	15	NO	Annual System Integrity Report
1 LPP Main Inventory	520 miles	566 miles (2018)	NO	Annual System Integrity Report
Overall Main Leak Rate	0.05	0.11	NO	Annual System Integrity Report
Cast Iron Main Break Rate	0.26	0.31	NO	Annual System Integrity Report
Steel main Corrosion Leak Rate	0.02	0.03	NO	Annual System Integrity Report
Service Leak Rate	1.21	1.61	NO	Annual System Integrity Report

Existing Date for Complete Program re-evaluation:____08/2021______ Is a shorter timeframe for complete program re-evaluation warranted? : __NO____

Complete Re-evaluation was performed on 9/1/2016 - DIMP REV 5

Saadat Khan (Director) and Leomary Bader (DIMP Manager) Gas Distribution Engineering

Required frequency	Program Re-evaluation Element	Date Completed
Required Annually	Evaluate Performance Measures	8/2020
As needed	Update Knowledge of System Characteristics, Environmental Factors and Threats	8/2020
As needed	Update General Information	8/2020
As needed	Update Threat Identification	8/2020
As needed	Update Risk Evaluation and Ranking Process	8/2020
Required Annually	Update Risk Evaluation and Ranking of Risks	8/2020
As needed	Update Risk Evaluation and Ranking Validation	8/2020
As needed	Update Risk Evaluation and Ranking Process Improvement Action Plans	8/2020
As needed*	Update Action Plans	

Above Baseline Comments:

1 – Remediation projects: Main & Service Replacement – LPP and DIMP factor to prioritize segments.

NEW YORK
APPENDIX G
CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE DIM PLAN

The table below provides a cross reference between 49 CFR Part 192, Subpart P (Gas Distribution Pipeline Integrity Management) and this Gas Distribution Integrity Management Plan.

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1005 No later than August 2, 2011 a gas distribution operator must develop and implement an integrity management program that includes a written integrity management plan as specified in § 192.1007.	4.0
§192.1007 A written integrity management plan must contain procedures for developing and implementing the following elements:	
§192.1007 (a) *Knowledge.* An operator must demonstrate an understanding of its gas distribution system developed from reasonably available information.	6.0
§192.1007 (a) (1) Identify the characteristics of the pipeline's design and operations and the environmental factors that are necessary to assess the applicable threats and risks to its gas distribution pipeline.	6.3
§192.1007 (a) (2) Consider the information gained from past design, operations, and maintenance.	6.2
§192.1007 (a) (3) Identify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities).	6.4
§192.1007 (a) (4) Develop and implement a process by which the IM program will be reviewed periodically and refined and improved as needed.	11.0
§192.1007 (a) (5) Provide for the capture and retention of data on any new pipeline installed. The data must include, at a minimum, the location where the new pipeline is installed and the material of which it is constructed.	6.5
§192.1007 (b) *Identify threats.* The operator must consider the following categories of threats to each gas distribution pipeline: corrosion, natural forces, excavation damage, other outside force damage, material, weld or joint failure, equipment failure, incorrect operation, and other concerns that could threaten the integrity of the pipeline.	7.0
§192.1007 (b) An operator must consider reasonably available information to identify existing and potential threats. Sources of data may include, but are not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, and excavation damage experience.	6.1, 7.0
§192.1007 (c) *Evaluate and rank risk.* An operator must evaluate the risks associated with its distribution pipeline. In this evaluation, the operator must determine the relative importance of each threat and estimate and rank the risks posed to its pipeline. This evaluation must consider each applicable current and potential threat, the likelihood of failure associated with each threat, and the potential consequences of such a failure.	8.0
§192.1007 (c) An operator may subdivide its pipeline into regions with similar characteristics (e.g., contiguous areas within a distribution pipeline consisting of mains, services and other appurtenances; areas with common materials or environmental factors), and for which similar actions likely would be effective in reducing risk.	Non-Mandatory

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1007 (d) *Identify and implement measures to address risks.* Determine and implement measures designed to reduce the risks from failure of its gas distribution pipeline. These measures must include an effective leak management program (unless all leaks are repaired when found).	9.0
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* Develop and monitor performance measures from an established baseline to evaluate the effectiveness of its IM program. …... These performance measures must include the following: (i) Number of hazardous leaks either eliminated or repaired, per § 192.703(c), categorized by cause; (ii) Number of excavation damages; (iii) Number of excavation tickets (receipt of information by the underground facility operator from the notification center); (iv) Total number of leaks either eliminated or repaired, categorized by cause; (v) Number of hazardous leaks either eliminated or repaired per § 192.703(c), categorized by material; and (vi) Any additional measures the operator determines are needed to evaluate the effectiveness of the operator's IM program in controlling each identified threat.	10.0
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* …. An operator must consider the results of its performance monitoring in periodically re-evaluating the threats and risks.	11.2
§192.1007 (f) *Periodic Evaluation and Improvement.* An operator must re-evaluate threats and risks on its entire pipeline and consider the relevance of threats in one location to other areas.	8.1, 11.1
§192.1007 (f) Each operator must determine the appropriate period for conducting complete program evaluations based on the complexity of its system and changes in factors affecting the risk of failure. The operator must conduct a complete program reevaluation at least every five years. The operator must consider the results of the performance monitoring in these evaluations.	11.2
§192.1007 (g) *Report results.* Report, on an annual basis, the four measures listed in paragraphs (e)(1)(i) through (e)(1)(iv) of this section, as part of the annual report required by § 191.11. An operator also must report the four measures to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	12.1
§192.1009 Each operator must report, on an annual basis, information related to failure of mechanical fittings, excluding those that result only in nonhazardous leaks, as part of the annual report required by §191.11 beginning with the report submitted March 15, 2011. This information must include, at a minimum, location of the failure in the system, nominal pipe size, material type, nature of failure including any contribution of local pipeline environment, coupling manufacturer, lot number and date of manufacture, and other information that can be found in markings on the failed coupling. An operator also must report this information to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	12.1
§192.1011 An operator must maintain records demonstrating compliance with the requirements of this subpart for at least 10 years. The records must include copies of superseded integrity management plans developed under this subpart.	13.0

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1013 (a) An operator may propose to reduce the frequency of periodic inspections and tests required in this part on the basis of the engineering analysis and risk assessment required by this subpart. (b) An operator must submit its proposal to the PHMSA Associate Administrator for Pipeline Safety or, in the case of an intrastate pipeline facility regulated by the State, the appropriate State agency. The applicable oversight agency may accept the proposal on its own authority, with or without conditions and limitations, on a showing that the operator's proposal, which includes the adjusted interval, will provide an equal or greater overall leve0l of safety. (c) An operator may implement an approved reduction in the frequency of a periodic inspection or test only where the operator has developed and implemented an integrity management program that provides an equal or improved overall level of safety despite the reduced frequency of periodic inspections.	Not covered by DIM Plan

16.0 APPENDICES FOR RHODE ISLAND

RHODE ISLAND
APPENDIX A
KNOWLEDGE OF FACILITIES

Table A-1: Reportable Gas Incidents by Year

Year	Number of Incidents	Fatalities	Injuries	Property Damage
2019	0	0	0	-
2018	0	0	0	-
2017	3	0	0	$403,895
2016	0	0	0	-
2015	1	0	0	$58,140
2014	0	0	0	-
2013	1	0	0	$29,184
2012	1	0	0	$133,377
2011	0	0	0	-
2010	0	0	0	-
2009	1	0	2	$100,000
2008	0	0	0	-
2007	0	0	0	-
2006	0	0	0	-
2005	0	0	0	-
2004	2	0	2	$118,000
2003	1	0	0	$100,000
2002	0	0	0	-
2001	0	0	0	-
2000	2	0	0	$250,000
1999	0	0	0	-
1998	0	0	0	-
1997	0	0	0	-
1996	1	0	0	$250,000
1995	0	0	0	-
1994	1	0	1	$100,000
1993	1	0	0	$300,000
1992	2	0	1	$142,500
1991	0	0	0	-
1990	0	0	0	-
Total	**17**	**0**	**6**	**$1,985,096**

Table A-2: Reportable Gas Incidents by Cause

Year	Corrosion	Natural Forces	Excavation Damage	Outside Force	Material or Weld Failure	Equipment Failure	Incorrect Operation	Other
2019	0	0	0	0	0	0	0	0
2018	0	0	0	0	0	0	0	0
2017	0	0	1	1	0	0	0	1
2016	0	0	0	0	0	0	0	0
2015	0	1	0	0	0	0	0	0
2014	0	0	0	0	0	0	0	0
2013	0	0	1	0	0	0	0	0
2012	0	0	0	1	0	0	0	0
2011	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0
2009	0	0	0	1	0	0	0	0
2008	0	0	0	0	0	0	0	0
2007	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2005	0	0	0	0	0	0	0	0
2004	0	2	0	0	0	0	0	0
2003	0	1	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	2
1999	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0
1996	0	0	1	0	0	0	0	0
1995	0	0	0	0	0	0	0	0
1994	1	0	0	0	0	0	0	0
1993	0	0	1	0	0	0	0	0
1992	0	1	1	0	0	0	0	0
1991	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0
30-Year Total	**1**	**5**	**5**	**3**	**0**	**0**	**0**	**3**

Table A-3: 10-Year Incident History Details (**Rhode Island**)

Company	Year	Facility	Asset Class/Subclass	Street	Town	Leak Cause
NIMO (RI)	2017	MAIN	Steel - 3"	Intersection Baker St and Water St	WARREN	Excavation Damage
Details:	The contractor while installing the water main hit a 3 inch gas main with a backhoe. During pipe repair process 310 customers were shut off and were all restored successfully after repair.					
NIMO (RI)	2017	SERVICE RISER	Plastic (PE) - 5/8"	110 Toll Gate Road	WARWICK	Other outside force damage
Details:	Vehicle driver crashed into a service riser and (3) meter assembly, causing the gas leak. This caused fire and one person was hospitalized. A 5/8" pe plastic end cap was installed and tested.					
NIMO (RI)	2017	MAIN	Steel - 12" - LP	30 Allens Avenue	Providence	Other Incident Cause
Details:	There was insufficient support of a live gas as the earth was removed during construction allowing vibration and pressure to pull the two 12 inch 99 psig pipe segments out from a 12inch dresser coupling					
NIMO (RI)	2015	MAIN	CI -6"- LP	130 Woodbury Street	Providence	Natural Force
Details:	Pipe in frozen ground caused disturbance and odor in area					
NIMO (RI)	2013	MAIN	Protected Coated Steel – 8" – HP(35#)	Rocky Hill Road & Rte-116	Providence	Excavation
Details:	Mechanical puncture on gas main by excavator					
NIMO (RI)	2012	I&R	Valve	Purgatory Road	Middletown	Other Outside Force
Details:	Vandalism, Contractor working for St. George's School hit an underground gas main, forcefully entered into NG's District Regulator building & closed a valve which caused 483 service outage.					
NIMO (RI)	2009	SERVICE (@ METER SET)	Protected Coated Steel - LP - Outside Set	Rugby St	Providence	Other Outside Force
Details:	Vehicular Damage					

RHODE ISLAND
APPENDIX B
THREAT IDENTIFICATION

In February thru April of 2016, groups of Subject Matter Experts (SMEs) were brought together, each having knowledge of threats in the various communities served by National Grid. Details on SME qualifications as well as copies of their interview records are located in the Distribution Integrity Management Program files. A summary of the threats identified are presented below in Table 16-1 and Table 16-2.

Table 16-1: Summary of Applicable Threats

SME's to Consider the Following	YES / NO
Do you have the necessary knowledge and/or experience (skills sets) regarding the areas of expertise for which you provided knowledge or supplemental information for input into the DIMP plan? (PHMSA Q.)	Yes
Do operator personnel in the field understand their responsibilities under DIMP plan? (PHMSA Q.)	Yes
Have you received DIMP training? (PHMSA Q.)	Yes
Have you received instructions to address the discovery of pipe or components not documented in the company records? (PHMSA Q.)	Yes
Have you received instructions to address, if you find any possible issue? (ex: corrosion, dented pipe, poor fusion joints, missing coating, excavation damage, mechanical fitting failures). (PHMSA Q.)	Yes
Have you received instructions to address when you find situations where the facilities examined (e.g., Material, Diameter, Coating, etc.) are different than records indicate, what documentation do you prepare? (PHMSA Q.) • If yes, are the findings documented?	Yes
During any repairs, if you find an improperly installed fitting, do you remediate it? (PHMSA Q.) • If yes, are the findings documented?	Yes
1. Does CMS conduct atmospheric corrosion inspection when they have access to facilities? • If yes, are the findings documented?	Yes
2. Do you know the procedures to visually examine any plastic fusion that is uncovered as part of excavation? • If yes, are the findings documented?	Yes
3. Do you notify damage prevention if any municipal work is being performed near gas distribution facilities? • If yes, are the findings documented?	Yes
4. Does Cross Bore recognized as risk? • If yes, are the findings documented?	Yes

Primary Threat Category	SME's to Consider the Following	Rhode Island
Corrosion	Is there known evidence of Corrosion on the system?	Yes
	Is there a known history of leakage on the system due to Corrosion?	Yes
	Threat Applicable?	Yes
Natural Force	Is there known evidence of damage or failures on the system due to natural forces?	Yes
	Is there a known history of leakage on the system due to Natural forces?	Yes
	Threat Applicable?	Yes
Excavation Damage	Is there known evidence of damage or failures on the system due to Excavation Damage?	Yes
	Is there a known history of leakage on the system due to Excavation Damage?	Yes
	Threat Applicable?	Yes
Other Outside Forces	Is there known evidence of damage or failures on the system due to Other Outside Forces?	Yes
	Is there a known history of leakage on the system due to Other Outside Forces?	Yes
	Threat Applicable?	Yes
Material or Weld Failure	Is there known evidence of damage or failures on the system due to Material or Weld Failure?	Yes
	Is there a known history of leakage on the system due to Material or Weld Failure?	Yes
	Threat Applicable?	Yes
Equipment Failure	Is there known evidence of damage or failures on the system due to Equipment Failure?	Yes
	Is there a known history of leakage on the system due to Equipment Failure?	Yes
	Threat Applicable?	Yes
Incorrect Operations	Is there known evidence of damage or failures on the system due to Incorrect Operations?	Yes
	Is there a known history of leakage on the system due to Incorrect Operations?	Yes
	Threat Applicable?	Yes
Others	Is there known evidence of damage or failures on the system due to others reasons?	Yes
	Is there a known history of leakage on the system due to other reasons?	Yes
	Threat Applicable?	Yes

Table 16-2: Summary of SME Interview Responses for Threat Identification

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
Corrosion	Cast Iron Pipe	Does Cast Iron pipe exist in the system?	**Yes**
		Is there a known history of body-of-pipe leaks, fractures, or graphitization?	**Yes**
	Bare Steel or Wrought Iron Pipe (with no CP other than Localized hot spotting with anodes)	Do bare (uncoated) steel main or services exist in the system that are not under CP?	**Yes**
		Is there known evidence of external corrosion on bare steel or wrought iron pipes not under CP?	**Yes**
		Is there a history of leakage on bare steel or wrought iron pipes not under CP?	**Yes**
	Bare Steel or Wrought Iron Pipe (with CP other than just localized hot spotting with anodes)	Do bare (uncoated) steel main or services exist in the system that are under CP?	**No**
		Is there known evidence of external corrosion on bare steel pipes under CP?	**No**
		Is there a known history of leakage on bare steel pipes under CP?	**No**
	Coated Steel with CP	Is there known evidence of external corrosion on coated steel pipe with CP?	**Yes**
		Is there a known history of leakage on coated steel pipe with CP?	**Yes**
		Are some CP systems frequently down (not achieving the required level of protection); more than 10% of the time?	**Yes**
	Coated Steel w/o CP	Is there known evidence of external corrosion on coated steel pipe without CP?	**Yes**
		Is there a known history of leakage on coated steel pipe without CP?	**Yes**
	Copper Services	Are direct buried or inserted copper services known to exist in the system?	**Yes**
		Is there a known history of leakage on copper services?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
	Stray Current	Do distribution facilities exist near DC transit systems, high voltage DC transmission systems or other known sources of DC current?	**Yes**
		Are any facilities known to be impacted by sources of stray DC current that has or may result in corrosion?	**No**
	Internal Corrosion	Are liquids known to exist within any portions of the distribution system?	**Yes**
		Is there known evidence of internal corrosion on steel pipe?	**No**
		Is there a known history of leakage caused by internal corrosion of steel pipe?	**No**
	Atmospheric Corrosion on above ground facilities	Do above ground distribution facilities exist in areas exposed to marine atmosphere, high humidity, atmospheric pollutants or agricultural chemicals?	**Yes**
		Is there known evidence of external atmospheric corrosion on exposed steel pipe, equipment or fittings?	**Yes**
		Is there a known history of leakage caused by atmospheric corrosion of steel pipe?	**Yes**
	Atmospheric Corrosion of facilities in Vaulted areas underground	Do gas distribution facilities exist underground in vaulted areas?	**Yes**
		Is there known evidence of external atmospheric corrosion on exposed steel pipe, equipment or fittings?	**Yes**
		Is there a known history of leakage caused by atmospheric corrosion of steel pipe in vaults?	**Yes**
	Corrosion of carrier pipe in Cased Crossing	Do steel carrier pipes exist within cased crossings?	**Yes**
		Are there any existing known contacts between carrier pipes and casings?	**Yes**
		Is there known evidence of past or active external corrosion on cased steel pipe?	**Yes**
		Is there a known history of leakage caused by corrosion on cased steel pipe?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
	Other Corrosion	Are there other corrosion threats?	**wall piece, at dis-similar metals & isolated fittings**
Natural Forces	Seismic Activity	Are there any seismically active zones or fault lines that exist in the area?	**Yes**
		Is there a history of leakage associated with Seismic activity?	**No**
	Earth Movement / Landslide (Unstable Soil)	Are there any areas susceptible to earth movement or landslide in the area?	**No**
		Is there a known history of leakage associated with landslide or earth movement?	**No**
	Frost Heave	Are there any areas susceptible to frost heave that exist in the area?	**Yes**
		Is there a known history of leakage resulting from frost heave?	**Yes**
	Flooding	Are there any areas within the gas system that are subject to flooding?	**Yes**
		Is there a known history of leakage or damage associated with flooding?	**Yes**
	Over-pressure due to snow/ice blockage	Are pressure control equipment vents subject to ice blockage during the winter?	**Yes**
		Is there a known history of over-pressure events as a result of snow/ice blockage?	**Yes**
	Tree Roots	Is there a known history of leakage to pipe or fittings as a result of tree root damage?	**Yes**
	Other Natural Forces	Is there a known history of leakage or damage due to other natural force causes; including but not limited to lightning, wild fire or high winds (tornados)?	**Lightning**
Excavation Damage	Improper Excavation Practice	Has damage requiring repair or replacement occurred on properly marked facilities due to the failure of the excavator to follow proper excavation rules and procedures?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
	Facility not located or marked	Has damage requiring repair or replacement occurred due to failure to locate a valid and timely locate request?	**Yes**
	One-call notification center error	Has damage requiring repair or replacement occurred due to an error made at the one-call notification center?	**Yes**
	Mis-Marked Facilities	Has damage requiring repair or replacement occurred due to the mis-marking of facilities?	**Yes**
		Threat Applicable?	**Yes**
	Incorrect Facility Records	Has damage requiring repair or replacement occurred due incorrect facility records?	**Yes**
	Other Excavation Damage	Has damage requiring repair or replacement occurred due other causes?	**Yes**
	Blow off Riser Damage	Has damage requiring repair or replacement occurred due mapping, marking and contractor communication issue?	**Yes**
Other Outside Force Damage	Vehicle Damage to Riser/Meter	Are existing risers and/or meters exposed to damage from vehicular damage that do not have barriers or other protection conforming to current design requirements?	**Yes**
		Has known leakage occurred due to vehicle damage to risers/meters.	**Yes**
	Vehicle Damage to above-ground equip/station	Are regulator stations or other above ground station equipment exposed to damage from vehicular damage that do not have barriers or other protection conforming to current design requirements?	**Yes**
		Has known leakage occurred due to vehicle damage to above ground stations or equipment?	**Yes**
	Vandalism	Are gas valves or station equipment susceptible to damage by vandalism that has the potential to pose a risk to employees or the public?	**Yes**
		Has leakage or other unsafe condition been created by vandalism?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
	Structure Fire	Is there a history of damage to gas meters or other equipment due to structure fires?	**Yes**
	Other Outside Force Damage	Has damage requiring repair or replacement occurred due other outside forces?	**Falling ice, Heat ground contamination, down electric lines**
Pipe, Weld or Joint Failure	Century Products (MDPE 2306)	Is Century Products (MDPE 2306) pipe (Tan) known to exist in the system?	**No**
		Is there a history of leakage of Century Products (MDPE 2306) pipe due to material failure?	**No**
	Aldyl A (MDPE 2306)	Is pre-1973 Aldyl A pipe (Tan, but can turn grey) known to exist in the system?	**Yes**
		Has pre-1973 Aldyl A pipe been known to leak due to brittle-like failure from rock impingement or other stresses?	**Yes**
		Is there a history of leakage of pre-1973 Aldyl A pipe due to material failure?	**Yes**
	Aldyl AAAA (MDPE 2306) Green Aldyl	Is Green Aldyl pipe known to exist in the system?	**Yes**
		Is there a history of brittle like failures of Green Aldyl pipe?	**Yes**
		Is there a history of leakage of Green Aldyl pipe due to material failure?	**Yes**
	PVC – Polyvinyl Chloride	Is PVC pipe known to exist in the system?	**No**
		Is there a history of leakage of PVC pipe due to material failure?	**No**
	ABS – Acrylonitrile Butadiene Styrene	Is ABS pipe known to exist in the system?	**No**
		Is there a history of leakage of ABS pipe due to material failure?	**No**
	CAB – Cellulose Acetate Butyrate	Is CAB pipe known to exist in the system?	**No**
		Is there a history of leakage of CAB pipe due to material failure?	**No**
	PB – Polybutylene	Is PB pipe known to exist in the system?	**Yes**
		Is there a history of leakage of PB pipe due to material failure?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
	PP – Polypropylene	Is PP pipe known to exist in the system?	**No**
		Is there a history of leakage of PP pipe due to material failure?	**No**
	Polyamide - PA	Is PA pipe known to exist in the distribution system?	**No**
		Is there a history of leakage of PA pipe due to material failure?	**No**
	PE Fusion failure	Is there a history of PE Fusion Failures or leakage in the system?	**Yes**
		Are any types of PE fusion (type, material, size, age, process, geographic area) more prone to leakage or failure?	**Yes**
	Pre-1940 Oxy-Acetylene Girth Weld	Do pre-1940 Oxy-Acetylene Girth Welds exist on pipe greater than 4 inch?	**Yes**
		Is there a history of pre-1940 Oxy-Acetylene Girth Weld failures or leakage in the system due to material failure?	**Yes**
	Other	Do other material failures occur that present a possible current or future risk?	**Yes**
Equipment Failure	Plexco Service Tee Celcon Caps	Are Plexco Service Tee Celcon Caps known to exist in the system?	**Yes**
		Is there a history of leakage of Plexco Service Tee Celcon Caps due to material failure?	**Yes**
	PP – Delrin Insert Tap Tees	Are Delrin Insert Tap Tees known to exist in the system?	**Yes**
		Is there a history of leakage of Delrin Insert Tap Tees?	**Yes**
	Stab Type Mechanical	Is there a history of Stab Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Stab Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**
	Other Equipment Failure	What Types and Manufactures of Stab Type Mechanical Fittings have you seen used in the System?	**Perfection LYCO & AMP**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
		Are any types of Stab Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**LYCO**
	Nut Follower Type Mechanical Fittings	Is there a history of Nut Follower Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Nut Follower Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**
		What Types and Manufactures of Nut Follower Type Mechanical Fittings have you seen used in the System?	**Dresser, Normac, Innertite, Kerotest**
		Are any types of Nut Follower Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**Kerotest**
	Bolted Type Mechanical Fittings	Is there a history of Bolted Type Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of Bolted Type Mechanical Fitting failures or leakage in the system due to seal leakage?	**Early vintage**
		What Types and Manufactures of Bolted Type Mechanical Fittings have you seen used in the System?	**Dressers, Smith Blair, & CSI**
		Are any types of Bolted Type Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**Early vintage smith Blair**
	Other Type Mechanical Fittings	Is there a history of other types of Mechanical Fitting failures or leakage in the system due to pullout?	**No**
		Is there a history of other types of Mechanical Fitting failures or leakage in the system due to seal leakage?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
		What other types and manufactures of Mechanical Fittings have you seen used in the System (other than Stab, Nut-follower, or bolted type?)	**Dresser 700 posi lock**
		Of the "other mechanical fittings" listed above, are any types of Mechanical Fitting (type, material, size, age, manufacturer, geographic area) more prone to leakage or failure?	**No**
	Valves	Are valves inoperable, inaccessible and or paved over without timely identification and repairs?	**Yes**
		Are certain types or makes of valves more likely to leak?	**Kerotest**
	Service Regulators	Is there a history of service regulator failures that present a threat to the public or employees?	**Yes**
		Are certain types or makes of service regulator more likely to create a risk?	**Farm Taps & Mercury**
	Meters	Is there a history of meter failures that present a threat to the public or employees?	**No**
		Are certain types or makes of meters more likely to create a risk?	**No**
	Control/Relief Station Equipment	Is there a history of control or relief station equipment failures that present a threat to the public or employees?	**No**
		Are certain types or makes of station equipment more likely to create a risk?	**No**
	Other Equipment Failure	Is there a history of other equipment failures that present a threat to the public or employees?	**Single Stage stations**
		Are certain types or makes of other equipment more likely to create a risk?	**No**
Incorrect Operations	General	Have inadequate procedures or safety practices, or failure to follow correct procedures, or other operator error resulted in an incident that created a risk to the gas distribution system?	**Yes**

Primary Threat Category	Material or Sub-Threat	SME's to Consider the Following	Rhode Island
	Gas lines bored through Sewers	Have pipes been installed via unguided or guided bore without proper procedures to ensure other facilities are not damaged?	**Yes**
		Have pipes unknowingly bored through sewer lines been damaged by sewer line cleaning operations?	**Yes**
Other	Bell Joint Leakage	Does Cast Iron pipe exist in the system?	**Yes**
		Is there a history of bell joint leaks?	**Yes**
		Are certain diameters or parts of the system known to be more prone to bell joint failure or leakage than others?	**Yes**
	Inserted Copper Puncture	Do copper services inserted in steel exist in the system?	**Yes**
		Is there a history of leakage of copper services due to puncture by a deteriorated steel outer casing?	**No**
	Copper Sulfide	Have any safety incidents occurred as a result of copper sulfide in copper services or service regulators?	**No**
	Construction over gas mains & services	Have others constructed over gas facilities or taken other action that prevents effective leak survey and other maintenance?	**Yes**
		When identified, is construction that impacts required maintenance corrected in a timely manner?	**Yes**
	Other	Are there any other known threats to the Gas Distribution system that we need to be aware of?	**Gas mains in Catch basins, Vibration equipment, Anaerobic sealants**

RHODE ISLAND

APPENDIX C

EVALUATION AND RANKING OF RISK

HIGHEST RANKED RISKS

STATE: RHODE ISLAND
REGION: ALL
FACILITY: MAINS

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Cast Iron	LP	4" Thru 8"	572.32	1.72	NATURAL FORCE	Known Incident	An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
ProtectedCoated Steel	HP	Upto 4"	150.82	1.08	EXCAVATION	Known Incident		3.00
ProtectedCoated Steel	HP	Over 4" Thru 8"	163.80	1.08	EXCAVATION	Known Incident		3.00
Wrought Iron	HP	Under 4"	0.12	26.56	NATURAL FORCE /OTHER		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	LP	Under 4"	4.77	20.97	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
Cast Iron	HP	Under 4"	0.01	26.56	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Wrought Iron	LP	Under 4"	0.97	20.97	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.37
UnprotectedBare Steel	> 60 PSI,Not T	Upto 4"	0.55	3.23	CORROSION/ NATURAL FORCE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.36
UnprotectedBare Steel	> 60 PSI,Not T	Over 4" Thru 8"	1.70	3.23	CORROSION/ NATURAL FORCE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.36
UnprotectedBare Steel	> 60 PSI,Not T	Over 8"	2.00	3.23	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.36
UnprotectedBare Steel	HP	Upto 4"	76.61	2.55	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.29

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

RHODE ISLAND - MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	HP	Over 4" Thru 8"	31.83	2.55	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.29
UnprotectedBare Steel	HP	Over 8"	3.95	2.55	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.29
Plastic	> 60 PSI,Not T	Upto 4"	60.88	2.43	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.27
Plastic	> 60 PSI,Not T	Over 4" Thru 8"	55.60	2.43	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.27
Plastic	> 60 PSI,Not T	Over 8"	1.06	2.43	EXCAVATION/ O. O. FORCE/ MATERIAL-WELD		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.27
Cast Iron	HP	4" Thru 8"	4.18	2.26	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.25
UnprotectedCoated Steel	> 60 PSI,Not T	Upto 4"	1.01	2.18	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.25
UnprotectedCoated Steel	> 60 PSI,Not T	Over 4" Thru 8"	1.84	2.18	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.25
UnprotectedCoated Steel	> 60 PSI,Not T	Over 8"	4.23	2.18	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.25
Ductile Iron	HP	Over 4" Thru 8"	0.68	2.05	NATURAL FORCE / CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.23
Cast Iron	HP	Over 8"	16.60	1.86	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.21

RHODE ISLAND - MAINS (Cont.)

Material	Pressure	Diameter	Mileage	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
UnprotectedBare Steel	LP	Upto 4"	10.97	1.78	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.20
UnprotectedBare Steel	LP	Over 4" Thru 8"	60.82	1.78	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.20
UnprotectedBare Steel	LP	Over 8"	3.01	1.78	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.20
Wrought Iron	LP	4" Thru 8"	0.14	1.72	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.19
Ductile Iron	LP	Over 4" Thru 8"	11.75	1.54	NATURAL FORCE		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.17
ProtectedCoated Steel	HP	Over 8"	27.13	1.08	EXCAVATION			0.12

HIGHEST RANKED RISKS

STATE: RHODE ISLAND
REGION: ALL
FACILITY: SERVICE (Active & Inactive)

Mitigation Will Be As Per Appendix D, Except As Otherwise Indicated In Notes

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Plastic	LP	Outside	29,301	1.79	O. O. FORCE	**Known Incident**		3.00
Protected Coated Steel	LP	Outside	669	0.99	O. O. FORCE	**Known Incident**		3.00
Cast Iron	LP	Inside	17	14.16	NATURAL FORCE/ CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Wrought Iron	LP	Inside	1	14.16	NATURAL FORCE/ CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	3.00
Cast Iron	LP	Outside	3	10.76	NATURAL FORCE/ EXCAVATION/ CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.28
Wrought Iron	LP	Outside	1	10.76	NATURAL FORCE/ CORROSION/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	2.28
Unprotected Bare Steel	> 60 PSI,Not T	Inside	78	5.42	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.15
Unprotected Bare Steel	> 60 PSI,Not T	Outside	190	5.42	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.15
Unprotected Bare Steel	HP	Inside	641	5.25	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	1.11
Unprotected Bare Steel	HP	Outside	1,309	4.20	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.89
Unprotected Bare Steel	LP	Outside	1,988	3.43	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.73

Note: The above table shows combined threats for each asset. Refer to Appendix A – Table A-3 (10-Year Incident History Details) for a complete list of threats.

RHODE ISLAND – SERVICE (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Copper	HP	Inside	39	3.38	CORROSION/ EQ. FAILURE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.72
Unprotected Coated Steel	> 60 PSI,Not T	Inside	11	3.09	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.65
Unprotected Coated Steel	> 60 PSI,Not T	Outside	71	3.09	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.65
Unprotected Coated Steel	HP	Inside	1,563	2.99	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.63
Copper	LP	Inside	9	2.96	CORROSION/ EQ. FAILURE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.63
Plastic	HP	Inside	6,516	2.95	EXCAVATION/ O. O. FORCE			0.63
Plastic	> 60 PSI,Not T	Inside	140	2.95	EXCAVATION/ O. O. FORCE			0.63
Plastic	> 60 PSI,Not T	Outside	7,546	2.95	EXCAVATION/ O. O. FORCE			0.63
Plastic	LP	Inside	22,473	2.79	EXCAVATION/ O. O. FORCE			0.59
Unprotected Coated Steel	LP	Inside	1,582	2.77	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.59
Copper	HP	Outside	83	2.70	CORROSION/ EQ. FAILURE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.57

RHODE ISLAND – SERVICE (Cont.)

Material	Pressure	Meter Set	Quantity	Risk Score	Threat Category	Known Incident	Additional Mitigation Notes	DIMP Factor
Unprotected Coated Steel	HP	Outside	2,412	2.39	CORROSION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.51
Plastic	HP	Outside	76,343	2.38	EXCAVATION			0.50
Copper	LP	Outside	1	2.18	CORROSION/ EQ. FAILURE/ EXCAVATION		An additional factor will be applied to the replacement qualification and prioritization algorithm to account for this asset's DIMP risk ranking	0.46

RHODE ISLAND

APPENDIX D

IDENTIFICATION AND IMPLEMENTATION OF MEASURES TO ADDRESS RISKS

Table 16-3: Threat Mitigation

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Rhode Island
Corrosion	Cast Iron Pipe Graphitization (including risk of crack or break due to becoming brittle)	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Bare Steel or Wrought Iron Pipe	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Coated Steel w/o CP	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Copper Services	Proactive leak surveys, service tees replaced with main replacements and leak management programs
	Stray Current	Design, Proactive leak surveys, Proactive Corrosion Control inspections
	Internal Corrosion	Proactive leak surveys, Proactive Leak Prone Pipe replacement program, reactive pipe replacement program and Leak management programs
	Atmospheric Corrosion on above ground facilities	Design, Proactive leak surveys, Proactive Corrosion Control inspections
	Atmospheric Corrosion of facilities in Vaulted areas underground	Design, Proactive leak surveys, Proactive I&R and Corrosion Control inspections
	Corrosion of Buried Farm Tap Equipment	Proactive leak surveys, Proactive Corrosion Control inspections, Pressure Tests
	Corrosion of Service Fittings on cast iron mains that are not cathodically protected.	Proactive leak surveys, services associated with main replacement programs are replaced, proactive high-pressure service replacement program and leak management program

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Rhode Island
	Grounds installed on risers making CP ineffective	Cathodic Protection Monitoring
	Corrosion of carrier pipe in Cased Crossing	Cathodic Protection Monitoring
Natural Forces	Earth Movement / Landslide(Unstable Soil)	Proactive Leak Survey Programs
	Frost Heave	Proactive Leak Survey Programs / Winter Operations
	Flooding (including Coastal)	Proactive Leak Survey Programs
	Tree Roots	Proactive Leak Survey Programs
	Over-pressure due to snow/ice blockage or freeze up.	Design, Proactive Leak Survey Programs
	Other Natural Forces (Lightning, High winds)	Design, Proactive Leak Survey Programs
Excavation Damage	Improper Excavation Practice (including mitigation for high-risk tickets)	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Facility not located or marked	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	One-call notification practices not sufficient	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Mis-Marked Facilities	Damage Prevention Monitoring, Design, EFV's, training and emergency response
	Incorrect Facility Records	Damage Prevention Monitoring, Design, EFV's, training and emergency response (see Table 6-7)

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Rhode Island
	Shallow Mains - reduced cover	Damage Prevention Monitoring, Design, training and emergency response
	Plastic without tracer wire that cannot be located	Damage Prevention Monitoring, Design, EFV's, training and emergency response
Other Outside Force Damage	Vehicle Damage to Riser/Meter	Design, Proactive Leak Survey Programs
	Vehicle Damage to above-ground equip/station	Design, Proactive Leak Survey Programs
	Vandalism	Design, EFV's Proactive Leak Survey Programs
	Structure Fire	Design, EFV's, training and emergency response
Pipe, Weld or Joint Failure	Pre-1973 Aldyl A (Tan MDPE 2306)	Proactive Leak Survey Continue to monitor leak rates.
	1973 and later Aldyl A (Tan MDPE 2406)	Proactive Leak Survey Continue to monitor leak rates.
	Aldyl 4A (Green MDPE 2306)	Not Applicable.
	PE other than Aldyl A & 4A	Proactive Leak Survey Continue to monitor leak rates.
	Delrin Insert Tap Tees	Proactive Leak Survey Continue to monitor leak rates.
	Plexco Service Tee Celcon Caps	Not Applicable
	PE Fusion failure	Proactive Leak Survey Continue to monitor leak rates.
	Pre-1940 Oxy-Acetylene Girth Weld	Proactive Leak Survey Continue to monitor leak rates.

Primary Threat Category	Sub-Threat	Existing Mitigation or Additional/Accelerated Actions Rhode Island
Equipment Failure	Stab Type Mechanical	Proactive Leak Survey Continue to monitor leak rates.
	Nut Follower Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates.
	Bolted Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates.
	Other Type Mechanical Fittings	Proactive Leak Survey Continue to monitor leak rates.
	Valves	Proactive Leak Survey Continue to monitor leak rates.
	Service Regulators	Proactive Leak Survey Continue to monitor leak rates.
	Meters (including Tin Meters)	Proactive Leak Survey Continue to monitor leak rates.
	Control/Relief Station Equipment	Design, I&R Inspections, Operator Qualifications, training and emergency response
Incorrect Operations	General	Operator Qualifications, training and emergency response
	Gas lines bored through Sewers	Operator Qualifications, training and emergency response
Other	Bell Joint Leakage, Cast Iron and Ductile Iron	Proactive Leak Survey Continue to monitor leak rates. Not currently an increased threat.
	Construction over gas mains & services	Operator Qualifications, training and emergency response

Extensive investigation/research, monitoring and improvement works are being performed on some special projects listed below and all the reports are incorporated by reference in its most updated form.

MITIGATION OF OIL/LIQUIDS

Natural gas pipeline liquids have been identified as recurring at some existing distribution collection points as well as some commercial customer locations within a portion of the natural gas distribution system. These liquids can be a problem in and of themselves, but they can also cause trace contaminants such as PCBS to become mobile and accumulate at different points, possibly even travelling all the way to a customer's meter set. National Grid is actively monitoring collection points, removing liquids from the system and employing mitigation measures to help limit movement of liquids and ensure customer protection.

ATMOSPHERIC CORROSION

In Rhode Island, National Grid visits all services with inside meter sets to inspect the service for atmospheric corrosion. Due to the timing of these inspections, National Grid cannot always gain access to all buildings to inspect the pipe. National Grid attempts two more times to contact the customer and schedule an appointment. However, a large number of service inspections attempted are never completed and have a result of "Can't Get In" (CGI).

In order to address any safety concerns with these services, National Grid conducted a review to see if any other inspection programs or service work were conducted at the address in the last 6 years. National Grid determined that if the service was replaced in the last 6 years or if an atmospheric corrosion inspection was completed as a "tag-a-long" inspection to other work being completed, the service was at a lower risk to be severely corroded.

For the remaining services that have had no access to the premises in the last 6 years, National Grid prioritized the risk by year of installation and will begin to turn the customer's gas off in the summer in order to schedule an appointment for an atmospheric corrosion inspection.

INSIDE METER SETS

The National Grid Inside Meter Sets program is dedicated to upgrading the natural gas infrastructure by relocating inside gas meter set. Natural gas meters are moved from inside to outside locations so that National Grid can continue to provide safe, high-quality customer service by replacing older leak prone pipe made of cast iron or unprotected steel. Service lines may also be replaced with modern materials if they have not previously been replaced during routine maintenance. Some of the benefits of this program are the replacement of LPP with more modern materials in order to reduce the risk of gas leaks. This program also contributes to customer and company convenience by eliminating the need to enter the home for atmospheric corrosion inspections and leak surveys. The inside meter sets program increases customer satisfaction by facilitating more frequent and comprehensive inspections and maintenance work on meters and service piping that has been placed outside. Lastly, the inside meter sets relocation program eliminates the risk of shut-off due to access issues, and provides easy access to relocated outside meters in the event of an emergency.

INNERTITE FITTINGS

National Grid had 2 incidents involving Inner-Tite fittings in 2008 and 2011 on Long Island, with the 2008 incident resulting in property damage. History has shown the Inner--Tite fitting has corroded at a faster rate than the rest of the service. Because of this, National Grid has identified all plastic and plastic tube inside meter services installed in 1974 and prior for the Rhode Island Service territory to be inspected, as services meeting these conditions involve the possibility of having the Inne-Tite equipment installed as part of the fitting assembly.

From 2012 – 2014, National Grid visited every site and has completed all inspections. This program will continue in conjunction with the Atmospheric Corrosion.

WATER INTRUSION/WASHOUT PROJECTS

The National Grid Water Intrusion/Washouts Program is in place to remediate situations where water has infiltrated the gas distribution system. This situation is known to cause poor pressure, resulting in repeated customer supply disruptions and decreased system reliability. The program addresses outstanding water intrusion issues in addition to allowing in-year projects to be walked-in as locations meeting criteria for inclusion in the program are identified. This program also addresses unanticipated infrastructure washouts and main exposures that can occur due to storms, heavy rains and/or seasonal snow melt. Main exposure/undermining can result in damage to facilities, emergency response and potential loss of service to customers. Distribution washouts/exposures can create potential for further damages and risks to assets if not addresses efficiently and appropriately. National Grid is required to ensure proper integrity for safe operation of its assets and to maintain proper cover and protection of its facilities.

PROACTIVE MAIN REPLACEMENT PROGRAM – LPP

This program supports the replacement of Leak Prone Pipe (LPP) inventory, defined as mains less than 16” in diameter that are non-cathodically protected steel, whether bare or coated (collectively termed “unprotected steel”) or cast/ wrought iron or pre 1985 Aldyl-A plastic. The goal of this program is to reduce the risk associated with leak prone pipe in the distribution system.

CI FROST PATROL

Cast Iron (CI) is a brittle material and has tendency to break when extended periods of cold temperature allow frost to form in the ground. The downward pressure of the expanding frost line can exert such great force that it can crack smaller diameter cast iron mains. In a natural process of graphitization, iron degrades to softer elements, making iron pipelines more susceptible to cracking. Gas may leak from the joints or through cracks in the pipe if graphitization has occurred. National Grid performs periodic survey to identify CI breaks and joint leaks.

PLASTIC FAILURES

National Grid policy requires that failed plastic parts (either leaking or visually identified as not exhibiting properties of a properly fused or assembled part) be returned to the Laboratory for analysis and testing. When possible, parts are destructively tested to assess cause of leak/failure. A log of analyzed failures is maintained and periodically reviewed in order to recognize system wide failure trends. Local analysis (frequently a leak survey) is conducted to check contemporary and contiguous installation work for similar failures. The paperwork associated with nearby failures from other years may also be examined in order to further complete the review. Certain failures, such as the identification of slow crack growth on pre-1985 Aldyl-A plastic, may lead to proactive replacement of similar pipe.

CROSS BORE

National Grid has installed several plastic gas mains through Horizontal Directional Drilling (HDD) technology where the pipe can bore through an unverified sewer lateral and cause blockage. If a mechanical cleaning tool is used to remove the blockage, it may lead to damaging the gas line, causing the gas to migrate into the building that can lead to an explosion. National Grid cross bore inspection program address all previous HDD installations to review if a cross bore incident has occurred and if so, take proactive steps to remediate the situation.

PROACTIVE SERVICE REPLACEMENT

RI proactive service replacement program is a program that targets the replacement of copper and unprotected steel services. The services are prioritized for replacement based on leak history statistics and those with inside meter sets. All targeted services should be outside the bounds of planned main replacements.

METHANE EMISSIONS

The leak migration is based on the volume of the gas leaking from a facility i.e. a high emitting leak will have a greater extent of leak plume than that of the low emitting leak. The Company will be using this principle in evaluating and prioritizing the type-3 leaks for repair to reduce the methane emissions.

For every individual leak, adding all the bar hole readings will result in the relative size of the plume. Greater the sum of bar hole readings, larger the plume and hence larger the methane emissions. By analyzing the sum of bar-hole readings per leak across all open type-3 leaks, will relatively prioritize them based on emissions.

Every leak has a different migration pattern and the bar-hole readings will be relative to the size of the leak. For e.g., a small leak will have migrated only to limited distance and the leak investigation will get 0% readings in relatively smaller area when compared to a larger leak where the leak investigation will lead to more readings and farther migration patterns.

Material, diameter and pressure normally do not impact the size of leak plume or emission volume since the gas leaks are identified based on the gas in the air. High pressure main will have a much smaller opening in the in the pipe to have similar methane emissions as a low pressure main with larger opening.

ACCESS PROTECTION

The Access Protection program was implemented due to an Incident in the UK, where kids climbed on an elevated pipe resulting in a fatality. National Grid installs protection on any elevated structure. The program is to reduce the risk of public injury by restricting or deterring public access to the Company's elevated gas facilities. In accordance with the customer/community-first approach, the Company has installed protective barriers, such as fencing or other physical deterrents, that will restrict or deter the public from accessing or climbing on elevated gas mains.

PIPE ON BRIDGES

National Grid developed the program to replace or rehabilitated gas pipe and appurtenances on aboveground structures, typically bridges, due to integrity concerns.

RHODE ISLAND

APPENDIX E

MEASUREMENT OF PERFORMANCE, MONITORING RESULTS, AND EVALUATION EFFECTIVENESS

Appendix E, Section 1 – Number of Hazardous Leaks Either Eliminated or Repaired, Categorized by Cause

The 5 years baseline and ongoing performance of the number of Hazardous (***Type 1***) Leaks for Main and Service combined Either Eliminated or Repaired, Categorized by Cause is provided below (Including Excavation Damage Leaks):

INCLUDING Damage

Rhode Island

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	545	350	292	368	251	266	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (418 for 2014 - 2018)						
Natural Forces	Actual	123	102	33	26	93	53	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (97 for 2014 - 2018)						
Excavation Damage	Actual	92	134	106	116	97	95	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (117 for 2014 - 2018)						
Other Outside Force	Actual	9	6	10	11	6	4	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (10 for 2014 - 2018)						
Material or Welds	Actual	25	5	2	2	4	2	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (13 for 2014 - 2018)						
Equipment Failure	Actual	107	127	98	74	135	24	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (120 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	0	0	0	2	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)						
Other	Actual	308	267	211	215	340	281	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (297 for 2014 - 2018)						
Total	Actual	1,209	991	752	812	926	727	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,027 for 2014 - 2018)						

Above Baseline Comments:

1 – After further investigation, it was determined that the 2 incorrect operations leaks were miscategorized. Their corrected leak causes are reflected in this revision of the DIMP and the 2019 DOT report will be updated accordingly. Gas Distribution Engineering is working with Field Operations to provide additional training on properly identifying leak causes.

Appendix E, Section 2 – Number of Excavation Damages

The 5 years baseline and ongoing performance of the number of excavation damages is provided below (Including Excavation Damage Leaks):

INCLUDING Damage

Rhode Island		2014	2015	2016	2017	2018	2019
Excavation Damages	Actual	80	135	106	116	95	102
	Baseline	Rolling average since 2014 + 0.5 standard deviation (117 for 2014 - 2018)					

Appendix E, Section 3 – Number of Excavation Tickets

The 5 years baseline and ongoing performance of the number of excavation tickets is provided below (Including Excavation Damage Leaks):

INCLUDING Damage

Rhode Island		2014	2015	2016	2017	2018	2019
Excavation Tickets	Actual	61,384	60,509	63,541	53,550	43,022	43,444
	Baseline	Rolling average since 2014 + 0.5 standard deviation (60,583 for 2014 - 2018)					

Appendix E, Section 4 – Total Number of Leaks Either Eliminated or Repaired, Categorized by Cause

The 5 years baseline and ongoing performance of the number of Leaks Either Eliminated or Repaired, Categorized by Cause is provided below (Including Excavation Damage Leaks):

INCLUDING Damage

Rhode Island

Cause		2014	2015	2016	2017	2018	2019	
Corrosion	Actual	819	461	480	562	435	465	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (630 for 2014 - 2018)						
Natural Forces	Actual	137	106	41	28	97	69	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (105 for 2014 - 2018)						
Excavation Damage	Actual	92	135	107	117	100	97	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (119 for 2014 - 2018)						
Other Outside Force	Actual	9	7	10	11	6	5	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (10 for 2014 - 2018)						
Material or Welds	Actual	30	6	4	2	7	6	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (16 for 2014 - 2018)						
Equipment Failure	Actual	159	169	142	132	193	38	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (171 for 2014 - 2018)						
Incorrect Operations	Actual	0	0	3	0	0	3	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1 for 2014 - 2018)						
Other	Actual	807	424	568	671	776	840	*2*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (728 for 2014 - 2018)						
Total	Actual	2,053	1,308	1,355	1,523	1,614	1,523	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1,719 for 2014 - 2018)						

Above Baseline Comments:

1 – After further investigation, it was determined that the 3 incorrect operations leaks were miscategorized. Their corrected leak causes are reflected in this revision of the DIMP and the 2019 DOT report will be updated accordingly. Gas Distribution Engineering is working with Field Operations to provide additional training on properly identifying leak causes.

2 - Other – CI Joint leaks

Appendix E, Section 5 – Number of Hazardous Leaks Either Eliminated or Repaired, Categorized by Material

The 5 years baseline and ongoing performance of the number of Hazardous (***Type 1***) Leaks for Main and Service combined Either Eliminated or Repaired, Categorized by Material is provided below (Excluding Excavation Damage Leaks):

EXCLUDING Damages

Rhode Island

Cause		2014	2015	2016	2017	2018	2019
Cast Iron / Wrought Iron	Actual	481	365	251	247	437	327
	Baseline	Rolling average since 2014 + 0.5 standard deviation (409 for 2014 - 2018)					
Unprotected Bare	Actual	515	372	299	351	276	235
	Baseline	Rolling average since 2014 + 0.5 standard deviation (409 for 2014 - 2018)					
Unprotected Coated	Actual	40	36	29	33	31	22
	Baseline	Rolling average since 2014 + 0.5 standard deviation (36 for 2014 - 2018)					
Protected Bare	Actual	0	0	0	0	0	0
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0 for 2014 - 2018)					
Protected Coated	Actual	0	0	2	0	2	2
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1 for 2014 - 2018)					
Plastic	Actual	78	73	68	57	76	42
	Baseline	Rolling average since 2014 + 0.5 standard deviation (75 for 2014 - 2018)					
Copper	Actual	0	0	0	2	6	3
	Baseline	Rolling average since 2014 + 0.5 standard deviation (3 for 2014 - 2018)					
Other	Actual	3	11	3	6	1	1
	Baseline	Rolling average since 2014 + 0.5 standard deviation (7 for 2014 - 2018)					
Total	Actual	1,117	857	652	696	829	632
	Baseline	Rolling average since 2014 + 0.5 standard deviation (921 for 2014 - 2018)					

Appendix E, Section 6 – Number of Excavation Damages

The 5 years baseline and ongoing performance of the number of known system leaks at the end of the year scheduled for repair is provided below:

Workable Leak Backlog		2014	2015	2016	2017	2018	2019	
Rhode Island	Actual	38	49	68	74	169	164	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (106 for 2014 - 2018)						

The 5 years baseline and ongoing performance of total damages per 1000 tickets is provided below (**INCLUDING** Excavation Damage Leaks):

Total Excavation Damages per 1000 Tickets		2014	2015	2016	2017	2018	2019
Rhode Island	Actual	1.30	2.31	1.67	2.17	2.21	2.35
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2.15 for 2014 - 2018)					

The 5 years baseline and ongoing performance of Total Leak Receipts is provided below (**EXCLUDING** Excavation Damage Leaks):

Total Leak Receipts		2014	2015	2016	2017	2018	2019
Rhode Island	Actual	2,753	2,407	1,964	1,924	1,989	2,107
	Baseline	Rolling average since 2014 + 0.5 standard deviation (2,389 for 2014 - 2018)					

Above Baseline Comments:

1 –Due to permitting issues in Providence which has been resolved.

The baseline and ongoing performance of the Response Time Performance are provided below:

The 5 years baseline and ongoing performance of the Response Time Performance are provided below:

Regular Day							
Response Time		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
30 Minutes	Actual	95.00%	95.26%	95.05%	95.48%	94.94%	94.94%
	Baseline	93.97% as established by RI PUC					

Nights & Weekends							
Response Time		**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
45 Minutes	Actual	96.30%	95.96%	96.10%	95.69%	96.17%	96.17%
	Baseline	94.38% as established by RI PUC					

The baseline and ongoing performance of the Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material are provided below (Excluding Excavation Damage Leaks):

EXCLUDING Damages

Main Leak Rates (LEAK REPAIRS BY MILE OF MAIN) by Material

Rhode Island		2014	2015	2016	2017	2018	2019
Cast Iron	**Actual**	1.19	1.22	0.83	0.98	1.25	1.22
	Baseline	Rolling average since 2014 + 0.5 standard deviation (1.19 for 2014 - 2018)					
All Steel	**Actual**	0.21	0.13	0.11	0.12	0.14	0.13
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.16 for 2014 - 2018)					
Plastic	**Actual**	0	0.01	0.01	0.01	0.01	0.01
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.01 for 2014 - 2018)					

The baseline and ongoing performance of the Service Leak Rates (LEAK REPAIRS BY 1000 SERVICES) by Material are provided below (Excluding Excavation Damage Leaks):

EXCLUDING Damages

Service Leak Rates (leak repairs per 1000 services) by Material Excluding Damages

Rhode Island		2014	2015	2016	2017	2018	2019	
Copper	**Actual**	0	0	0	26.04	37.04	22.73	*1*
	Baseline	Rolling average since 2014 + 0.5 standard deviation (21.47 for 2014 - 2018)						
All Steel	**Actual**	11.39	6.57	7.94	9.81	7.71	7.56	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (9.64 for 2014 - 2018)						
Plastic	**Actual**	0.69	0.57	0.54	0.45	0.65	0.43	
	Baseline	Rolling average since 2014 + 0.5 standard deviation (0.63 for 2014 - 2018)						

Above Baseline Comments:

1 —As a result of the Service Replacement, Gas Distribution Engineering has initiated a Proactive Service Replacement Program remediating Copper Services. The Copper Services are schedule for replacement by 2021.

RHODE ISLAND
APPENDIX F
PERIODIC EVALUATION AND IMPROVEMENT

2019 REGIONAL DISTRIBUTION INTEGRITY ASSESSMENT

Distribution Engineering has reviewed all of the findings in the annual Trend-Based Distribution System Integrity Analysis (*System Integrity Report*) in accordance with our Distribution Integrity Management Plan and found leak receipts went up and repairs went down in 2019. There are no immediate causes for concern that would warrant changes to DIMP.

Below is a summary of the individual key integrity measure results for the following federal (PHMSA) filing entity that constitutes National Grid-US.

NATIONAL GRID

2019 System Integrity Report Summary

REGIONS	RI
ITEMS	
• Leak Receipts	⬆
• Workable Leak Backlog	⬇
• LPP Main and Service Inventories	* ⬆
• Overall Main Leak Rate	⬆
• Cast Iron Main Break Rate	⬇
• Steel Main Corrosion Leak Rate	▬
• Service Leak Rate	⬆

🔺 Increase ⬆ Slight Increase ▬ No Change ⬇ Decrease

**Note- Data issue with services resulting a large number of services not being counted*

*LPP Services increase slightly on GIS system

Form F-1: Periodic Updating and Review (Region: RI)

Annual Evaluation of Performance Measures that Exceeded Baseline				
Performance Measure	Actual Performance for Year 2019	Established Baseline	Are additional measures beyond minimum code requirement necessary?	Has an engineering evaluation been completed and documented?
Leak Receipts	2,107	2,389	NO	Annual System Integrity Report
Workable leak Backlog	164	106	NO	Annual System Integrity Report
LPP Main Inventory	1,052 miles	1,100 miles (2018)	NO	Annual System Integrity Report
Overall Main Leak Rate	0.31	0.31	NO	Annual System Integrity Report
Cast Iron Main Break Rate	0.09	0.13	NO	Annual System Integrity Report
Steel main Corrosion Leak Rate	0.09	0.15	NO	Annual System Integrity Report
Service Leak Rate	2.77	3.15	NO	Annual System Integrity Report

Existing Date for Complete Program re-evaluation:____08/2021______ Is a shorter timeframe for complete program re-evaluation warranted? : __NO____

Complete Re-evaluation was performed on 9/1/2016 - DIMP REV 5

Saadat Khan (Director) and Leomary Bader (DIMP Manager) Gas Distribution Engineering

Required frequency	Program Re-evaluation Element	Date Completed
Required Annually	Evaluate Performance Measures	8/2020
As needed	Update Knowledge of System Characteristics, Environmental Factors and Threats	8/2020
As needed	Update General Information	8/2020
As needed	Update Threat Identification	8/2020
As needed	Update Risk Evaluation and Ranking Process	8/2020
Required Annually	Update Risk Evaluation and Ranking of Risks	8/2020
As needed	Update Risk Evaluation and Ranking Validation	8/2020
As needed	Update Risk Evaluation and Ranking Process Improvement Action Plans	8/2020
As needed*	Update Action Plans	

RHODE ISLAND

APPENDIX G

CROSS REFERENCE OF 49 CFR PART 192, SUBPART P REQUIREMENTS TO THE DIM PLAN

The table below provides a cross reference between 49 CFR Part 192, Subpart P (Gas Distribution Pipeline Integrity Management) and this Gas Distribution Integrity Management Plan.

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1005 No later than August 2, 2011 a gas distribution operator must develop and implement an integrity management program that includes a written integrity management plan as specified in § 192.1007.	4.0
§192.1007 A written integrity management plan must contain procedures for developing and implementing the following elements:	
§192.1007 (a) *Knowledge.* An operator must demonstrate an understanding of its gas distribution system developed from reasonably available information.	6.0
§192.1007 (a) (1) Identify the characteristics of the pipeline's design and operations and the environmental factors that are necessary to assess the applicable threats and risks to its gas distribution pipeline.	6.3
§192.1007 (a) (2) Consider the information gained from past design, operations, and maintenance.	6.2
§192.1007 (a) (3) Identify additional information needed and provide a plan for gaining that information over time through normal activities conducted on the pipeline (for example, design, construction, operations or maintenance activities).	6.4
§192.1007 (a) (4) Develop and implement a process by which the IM program will be reviewed periodically and refined and improved as needed.	11.0
§192.1007 (a) (5) Provide for the capture and retention of data on any new pipeline installed. The data must include, at a minimum, the location where the new pipeline is installed and the material of which it is constructed.	6.5
§192.1007 (b) *Identify threats.* The operator must consider the following categories of threats to each gas distribution pipeline: corrosion, natural forces, excavation damage, other outside force damage, material, weld or joint failure, equipment failure, incorrect operation, and other concerns that could threaten the integrity of the pipeline.	7.0
§192.1007 (b) An operator must consider reasonably available information to identify existing and potential threats. Sources of data may include, but are not limited to, incident and leak history, corrosion control records, continuing surveillance records, patrolling records, maintenance history, and excavation damage experience.	6.1, 7.0
§192.1007 (c) *Evaluate and rank risk.* An operator must evaluate the risks associated with its distribution pipeline. In this evaluation, the operator must determine the relative importance of each threat and estimate and rank the risks posed to its pipeline. This evaluation must consider each applicable current and potential threat, the likelihood of failure associated with each threat, and the potential consequences of such a failure.	8.0
§192.1007 (c) An operator may subdivide its pipeline into regions with similar characteristics (e.g., contiguous areas within a distribution pipeline consisting of mains, services and other appurtenances; areas with common materials or environmental factors), and for which similar actions likely would be effective in reducing risk.	Non-Mandatory

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1007 (d) *Identify and implement measures to address risks.* Determine and implement measures designed to reduce the risks from failure of its gas distribution pipeline. These measures must include an effective leak management program (unless all leaks are repaired when found).	9.0
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* Develop and monitor performance measures from an established baseline to evaluate the effectiveness of its IM program. …… These performance measures must include the following: (i) Number of hazardous leaks either eliminated or repaired, per § 192.703(c), categorized by cause; (ii) Number of excavation damages; (iii) Number of excavation tickets (receipt of information by the underground facility operator from the notification center); (iv) Total number of leaks either eliminated or repaired, categorized by cause; (v) Number of hazardous leaks either eliminated or repaired per § 192.703(c), categorized by material; and (vi) Any additional measures the operator determines are needed to evaluate the effectiveness of the operator's IM program in controlling each identified threat.	10.0
§192.1007 (e) (1) *Measure performance, monitor results, and evaluate effectiveness.* …. An operator must consider the results of its performance monitoring in periodically re-evaluating the threats and risks.	11.2
§192.1007 (f) *Periodic Evaluation and Improvement.* An operator must re-evaluate threats and risks on its entire pipeline and consider the relevance of threats in one location to other areas.	8.1, 11.1
§192.1007 (f) Each operator must determine the appropriate period for conducting complete program evaluations based on the complexity of its system and changes in factors affecting the risk of failure. The operator must conduct a complete program reevaluation at least every five years. The operator must consider the results of the performance monitoring in these evaluations.	11.2
§192.1007 (g) *Report results.* Report, on an annual basis, the four measures listed in paragraphs (e)(1)(i) through (e)(1)(iv) of this section, as part of the annual report required by § 191.11. An operator also must report the four measures to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	12.1
§192.1009 Each operator must report, on an annual basis, information related to failure of mechanical fittings, excluding those that result only in nonhazardous leaks, as part of the annual report required by §191.11 beginning with the report submitted March 15, 2011. This information must include, at a minimum, location of the failure in the system, nominal pipe size, material type, nature of failure including any contribution of local pipeline environment, coupling manufacturer, lot number and date of manufacture, and other information that can be found in markings on the failed coupling. An operator also must report this information to the state pipeline safety authority if a state exercises jurisdiction over the operator's pipeline.	12.1
§192.1011 An operator must maintain records demonstrating compliance with the requirements of this subpart for at least 10 years. The records must include copies of superseded integrity management plans developed under this subpart.	13.0

49 CFR Part 192, Subpart P	DIM Plan Reference
§192.1013 (a) An operator may propose to reduce the frequency of periodic inspections and tests required in this part on the basis of the engineering analysis and risk assessment required by this subpart. (b) An operator must submit its proposal to the PHMSA Associate Administrator for Pipeline Safety or, in the case of an intrastate pipeline facility regulated by the State, the appropriate State agency. The applicable oversight agency may accept the proposal on its own authority, with or without conditions and limitations, on a showing that the operator's proposal, which includes the adjusted interval, will provide an equal or greater overall leve0l of safety. (c) An operator may implement an approved reduction in the frequency of a periodic inspection or test only where the operator has developed and implemented an integrity management program that provides an equal or improved overall level of safety despite the reduced frequency of periodic inspections.	Not covered by DIM Plan