PUBLIC VERSION

STATE OF NEW JERSEY
BOARD OF PUBLIC UTILITIES

In the Matter of the Petition of Public Service Electric and Gas Company for Approval of the Next Phase of the Gas System Modernization Program and Associated Cost Recovery Mechanism ("GSMP II")	))))))	**BPU Docket No.: GR17070776**

DIRECT TESTIMONY OF EDWARD A. McGEE
ON BEHALF OF THE
DIVISION OF RATE COUNSEL

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Dated: January 19, 2018

PUBLIC VERSION

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DIRECT TESTIMONY OF

EDWARD A. McGEE

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NEW JERSEY DIVISION OF RATE COUNSEL

BPU DOCKET No.: GR17070776

I. Introduction

Q. WOULD YOU PLEASE STATE YOUR NAME AND BUSINESS ADDRESS?

A. My name is Edward A. McGee. My business address is P.O. Box #1659, Bethany Beach, DE. I am Principal Consultant of McGee Consulting, LLC, and I am currently working as an Engineering Associate with the Acadian Consulting Group ("ACG"). ACG is a research and consulting firm that specializes in the analysis of regulatory, economic, financial, accounting, statistical, and public policy issues associated with regulated and energy industries. ACG is a Louisiana-registered Limited Liability Company, formed in 1995, and is located at 5800 One Perkins Place, Suite 5-F, Baton Rouge, Louisiana 70808.

Q. DO YOU HOLD ANY ACADEMIC DEGREES?

A. Yes. I was graduated from the University of Notre Dame with Bachelor and Master Degrees in Chemical Engineering. I was also graduated from the University of Chicago with a Master's Degree in Business Administration ("MBA"). Attachment 1 provides my academic vita that includes a listing of my experience as a gas practice consultant and related positions in the energy industry.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. I have been retained by the New Jersey Division of Rate Counsel ("Rate Counsel") to provide an expert opinion to the Board of Public Utilities ("BPU" or "Board") on management and engineering issues associated with the Second Phase of the Gas System Modernization Program ("GSMP II") proposal by Public Service Electric and Gas Company ("PSE&G" or "the Company") filed on July 27, 2017. Dr. David Dismukes will also be testifying regarding a number of policy, program design, and economic impact issues associated with the "GSMP II" proposal for the gas system.

Q. HAVE YOU PREPARED ANY EXHIBITS IN SUPPORT OF YOUR RECOMMENDATIONS?

A. Yes. I have prepared three (3) exhibits in support of my direct testimony that were prepared by me or under my direct supervision.

Q. ARE THERE ANY OTHER RATE COUNSEL WITNESSES ADDRESSING THE COMPANY'S PROPOSAL?

A. Yes. In addition to myself and Dr. Dismukes, Rate Counsel is also sponsoring the testimony of Ms. Andrea Crane who will address a number of accounting and revenue requirement issues and Mr. Kevin O'Donnell who will address cost of capital and financial issues.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. My testimony is organized into the following sections:

- Section II. Summary of Major Findings and Recommendations
- Section III. Comparison of Proposed GSMP II Replacements to Approved GSMP I Replacements
- Section IV. Program Design Deficiencies in GSMP II Proposal

A. Proposed Timeframe for Addressing All Metallic Mains
B. Proposed Use of Service-line Leaks for Prioritization
C. New Open-Leak Performance Metric
D. Proposed Additional Types of Replacement

- Section V. Key Findings and Recommendations
- Attachment 1: Curricula Vita
- Exhibits EAM-1 through EAM-3

II. Summary of Major Findings and Recommendations

Q. WOULD YOU PLEASE SUMMARIZE YOUR MAJOR FINDINGS REGARDING THE PROPOSED SECOND PHASE OF THE GAS SYSTEM MODERNIZATION PROGRAM (GSMP II)?

A. My primary findings are that:

1) The proposed acceleration of the timeframe to address all cast iron and unprotected steel from thirty years (as it was in the first phase) to twenty years is unnecessary for a Company with major percentages of these materials.

2) The specific replacement programs proposed for the second phase of GSMP (GSMP II) deviate from the replacement programs approved in the settlement of GSMP I in eight of its essential operating components.

3) The proposed inclusion of service-line leaks in the calculation of Hazard Indices for prioritization of utilization-pressure replacements, tends to move the proposed GSMP II program away from a mains replacement program and towards a service-line replacement program, which would be a major change from the settled first phase of GSMP.

4) The current leak performance metric is insufficient since it applies only to open leaks that exist prior to the program, rather than to open leaks in existence each year of the GSMP II program.

Q. WOULD YOU PLEASE SUMMARIZE YOUR RECOMMENDATIONS REGARDING THE SECOND PHASE OF THE GAS SYSTEM MODERNIZATION PROGRAM (GSMP II) IN THE EVENT THE BOARD DOES NOT REJECT IT ENTIRELY?

A. Yes. I have several recommendations in the event the Board disagrees with Rate Counsel's recommendation to reject the GSMP II proposal:

1) I recommend that the approved replacement activities and prioritization techniques be limited to those approved for GSMP I, in order to focus resources on the primary task of replacing the most-risky assets, namely Utilization Pressure Cast Iron.
2) The timeframe for addressing all of the Company's cast iron and unprotected steel should remain at thirty (30) years as it was in GSMP I.
3) All mains replacements should be prioritized through map-grid techniques in order to take advantage of contractor economies of scale.
4) All mains replacements should be prioritized (by map-grids) through use of the original Hazard Index which was based on cast iron breakage rates.
5) Costs for district regulator replacement, uprating of the UP portions of the system that are being replaced, and the installation of Excess Flow Valves on replaced service-lines, where appropriate, should also be approved.
6) Service-line leaks should be excluded from the prioritization of UPCI and steel piping replacements.

7) The open-leak performance measure should be changed to one that recognizes all open leaks. Specifically, a cap should be placed on the total number of open leaks. The cap should be set at the average of open leaks for the past five years, and should be reduced by 1% per year for each succeeding year of the program. If the Company fails to meet this target in the first two years of its program, the Company should be required to notify the Board and Rate Counsel and schedule a conference to discuss any failure to meet its agreed-upon leak reduction target. If this failure extends to a three year period, then the Company would reduce its return on equity ("ROE") by 50 basis points until it is able to achieve the leak reduction target.

III. Comparison of Proposed GSMP II Replacements to Approved GSMP I Replacements

Q. PLEASE DESCRIBE THE COMPANY'S PROPOSAL FOR THE SECOND PHASE OF THE GSMP.

A. Under the proposal for the second phase, the Company would make certain gas distribution system capital infrastructure investments over a five-year period. The GSMP II program is comprised of gas utility projects designed to replace cast iron ("CI") mains, both utilization pressure ("UP") and elevated pressure ("EP"); replace non-cathodically protected ("unprotected") steel mains and services, both bare and with protective coatings; abandon district regulators associated with this cast iron and unprotected steel plant; rehabilitate large diameter elevated pressure cast iron (via bell joint reinforcement); upgrade UP portions of the system to EP; replace limited amounts of protected steel and plastic mains; and relocate inside meter sets.[1]

[1] Company Petition at ¶4.

The proposed Program would result in the replacement of approximately 250 miles of main per year, with an estimated investment of approximately $2.68 billion for the full five years, or approximately $536 million per year. At this time, the Company anticipates these expenditures would result in the replacement of approximately 870 miles of UPCI main (of PSE&G's current inventory of 3,294 miles), 130 miles of EPCI main, 200 miles of unprotected steel main, 50 miles of UP cathodically-protected steel and plastic main, and reinforcement of approximately 4,000 EPCI bell joints. This main replacement would result in approximately 266 abandoned district regulators, replacement of approximately 99,200 unprotected steel services, and the relocation of approximately 70,900 inside meter sets to the outside. Where appropriate, services will have excess flow valves installed for improved safety.[2]

The cast iron and unprotected steel mains would be replaced with either high-density polyethylene plastic pipes or with coated, cathodically-protected welded steel pipes.

Q. WHAT IS THE PURPOSE OF THE COMPANY'S PROPOSED PIPE REPLACEMENT PROGRAM?

A. The purpose of the pipe replacement program, as stated in the Company's GSMP II Petition, is to carry out the systematic replacement of aging infrastructure within PSE&G's system. The Company justifies this investment based on its belief that it will enable the Company to improve the reliability and safety of its gas distribution system in a cost-effective manner.[3] This represents a change from the primary focus of first phase of the GSMP program, which was to minimize the number of leaks and breaks in the gas system by removing the materials that are most prone to leakage and/or breakage and replace them with more modern materials that exhibit lower

[2] Company Petition at ¶5.
[3] Company Petition at ¶8-12

leakage and/or breakage rates as is consistent with PHMSA's Call-to-Action recommendation to replace the highest-risk materials.

Q. WHEN THE FIRST PHASE OF THE GSMP WAS SETTLED, WHAT WERE ITS MOST ESSENTIAL REPLACEMENT-RELATED COMPONENTS?

A. The key operating activities approved for accelerated rate treatment in phase one of the GSMP were:

1) Timeframe to Address All Metallic Mains.

The rate of replacements was consistent with a thirty (30) year timeframe for upgrading the entire system.[4]

2) Duration of Program

The first phase of the replacement program was approved for a term of three (3) years.[5]

3) Map-Grid Basis for Replacements

Pipe replacements were to be conducted on a map-grid basis. The intent was to replace all UP mains in grids of approximately one square mile in size.[6] The map-grid basis was proposed and approved in order to achieve efficiencies, and cost savings through large scale replacements.[7]

4) Prioritization of Replacements

[4] Company Petition at ¶6.
[5] Phase One Stipulation at ¶9.
[6] Phase One Stipulation at ¶15.

Prioritization of grids would be based on a Hazard Index model developed by PSE&G.[8] This was based on historical cast iron breaks within each grid and certain environmental factors, such as nearness to occupied buildings. The Hazard Index model was designed to align with the intent of PHMSA's recommended "Call to Action", which was directed toward replacement of high-risk piping that is most likely to cause major risks to the general public.

5) EPCI Replacements

EPCI replacement costs that had been proposed were excluded in the settlement.[9]

6) Meter Set Relocations

Relocation costs for meter sets that had been proposed were excluded in the settlement.[10]

7) Plastic and Protected Steel Replacements

Replacements of plastic and protected steel mains were not requested in the GSMP I Petition, and thus not approved.

8) Joint Reinforcement for EPCI

Reinforcement of EPCI joints was not requested in the GSMP I Petition, and thus not approved.

9) Uprating of UP Grids

Uprating of the portions of the system with replaced UP mains to EP was approved.

10) Abandonment of District Regulators

[8] Phase One Stipulation at ¶15.
[9] Phase One Stipulation at ¶11.
[10] Phase One Stipulation at ¶11.

Abandonment of certain district regulators when a grid is uprated from utilization pressure was approved.

11) EFV Installations

Installation of Excess Flow Valves on replaced services, where appropriate, was approved.

Q. DOES THE COMPANY'S PROPOSAL FOR THE SECOND PHASE OF THE GSMP PROGRAM CONFORM TO THE ELEVEN KEY SETTLED COMPONENTS OF THE FIRST PHASE OF THE GSMP THAT ARE LISTED ABOVE?

A. No. In fact, the Company's proposal for the extension of the GSMP program deviates in major ways from the first eight (8) key components of the on-going GSMP shown above.

Q. WOULD YOU PLEASE EXPLAIN EXACTLY HOW THE CURRENT PROPOSAL DEVIATES FROM THE FIRST EIGHT KEY SETTLED TERMS OF THE ORIGINAL GSMP PROGRAM?

A. Yes. I'll compare the first eight settled components of the original GSMP to the proposed components of the GSMP extension one-by-one:

Component 1- Timeframe to Address All Metallic Mains.

The settlement for the first phase of the GSMP was consistent with a thirty-year (30) timeframe to address all cast iron and unprotected steel mains, whereas the Company's proposal for the second phase of the GSMP has been accelerated substantially to a twenty-year (20) timeframe to address all of these materials.[11]

Component 2- Duration of Program

[11] Company Petition at ¶6.

The settlement for the first phase of the GSMP included approval for a three-year duration, whereas the Company's proposal for the second phase of the GSMP has been increased to a five-year timeframe.[12]

Component 3- Map-Grid Basis for Replacements

In contrast to GSMP I, the Company's proposal for the second phase of the GSMP has several sub-programs (e.g. EPCI Replacement, EPCI Joint Reinforcement) in which selection is based on "targeted" piping segments anywhere in the entire system, as opposed to selected map-grid areas.

Component 4- Prioritization of Replacements

In contrast to GSMP I, the Company's proposal for the second phase of the GSMP prioritizes less than 5% of the UP cast iron by breakage, in accordance with the original Hazard Index model. The remainder would be prioritized by joint and service-line leaks.[13]

Component 5- EPCI Replacements

The proposed second phase of GSMP would include EPCI replacement which, as noted, was excluded in the settlement of the first phase.[14]

Component 6- Meter Set Relocations

The settlement for the first phase of the GSMP struck down meter set relocation costs which were proposed by the Company, whereas the Company has again proposed meter set relocation costs for the second phase of GSMP.[15]

Component 7- Plastic and Protected Steel Replacements

[12] Company Petition at ¶3.
[13] Direct Testimony of Wade E. Miller, 50:19-21.
[14] Direct Testimony of Wade E. Miller, 51:9.
[15] Direct Testimony of Wade E. Miller, 51:10-11.

Replacement costs for plastic and coated/protected steel mains were not requested in the first phase of GSMP, and thus not approved; whereas the Company has now proposed these replacement costs for the second phase of GSMP.[16]

Component 8- Joint Reinforcement for EPCI

Joint reinforcement costs for large-diameter EPCI were not requested in the first phase of GSMP, and thus not approved; whereas the Company has now proposed these reinforcement costs for the second phase of GSMP.[17]

IV. Program Design Deficiencies in GSMP II Proposal

Q. WOULD YOU PLEASE SUMMARIZE THE DEFICIENCIES YOU FOUND IN THE GSMP II PROPOSAL?

A. I disagree with the eight proposed deviations from the GSMP I essential operating components detailed above. The proposed 5-year duration for the GSMP II program is addressed in Dr. Dismukes' testimony. The remaining deviations will be discussed below. In addition, as discussed below, the leak performance metric adopted for GSMP I is not effective and needs to be revised.

A. Proposed Timeframe for Addressing All Metallic Mains

Q. DO YOU AGREE WITH THE COMPANY'S PROPOSAL TO ACCELERATE ITS PLANNED REPLACEMENT OF ALL METALLIC MAINS FROM A 30-YEAR TO A 20-YEAR TIMEFRAME?

A. No. A twenty-year timeframe to replace/address all remaining cast iron and unprotected steel, as proposed by the Company, requires a mains replacement rate of approximately 250 miles

[16] Direct Testimony of Wade E. Miller, 51:13-18.
[17] Direct Testimony of Wade E. Miller, 51:19-22.

per year. This would be a major increase over replacement rates in past programs such as both gas Capital Infrastructure Programs (CIP-I and CIP-II) (below 100 miles per year), Energy Strong (below 150 miles in any year), and even in the first phase of this program (limited to an average 133 miles per year). The Company has not replaced 250 miles of piping, even when concurrent programs are considered. The Company points out that when multiple programs running concurrently are considered, and if base replacements are also considered, they have replaced over 200 miles per year in the most recent year. However, there could be additional concurrent replacement programs before GSMP II is completed, and there will be base replacements in addition to these. In my opinion, there is no need to accelerate the pace of replacements as proposed.

PSE&G currently operates a safe system as shown by their long-term declining numbers of reportable incidents. Other utilities with similar amounts of leak-prone metallic mains have not found it necessary to pursue this unreasonable schedule. Exhibit EAM-1 shows that the Company has the 16th highest percentage of leak-prone metallic mains of all U.S. gas utilities. Companies with large amounts of obsolete materials in their systems – such as PSE&G - would be expected to require longer timeframes to complete their replacements. Exhibit EAM-2 shows planned replacement timeframes for the utilities that have as high or higher percentages of obsolete mains than PSE&G. While some of these utilities are planning to replace their obsolete metallic mains in 20 years or less, others plan to take up to 50 years. The average number of years planned for replacement of all obsolete mains for the utilities shown on the exhibit (EAM-2) is 27.2 years. This average replacement timeframe of 27.2 years is supportive of the timeframe of thirty (30) years that was contemplated in GSMP I

B. Proposed Use of Service-line Leaks for Prioritization

Q. HAS THE COMPANY'S REVISED PRIORITIZATION METHOD SHIFTED THE FOCUS OF REPLACEMENTS MADE UNDER THE GSMP II?

A. Yes. As noted, the Company has proposed the use of service-line leaks (as well as joint leaks) for prioritization of UPCI and unprotected steel replacements during the second phase of GSMP. My opinion is that this should not be permitted.

Under the current phase of GSMP only cast-iron breaks are used to prioritize the replacement of mains. This is done through use of the (original) Hazard Index. If service-line leaks were used to prioritize the replacement of mains, the current accelerated mains replacement program would shift toward an accelerated service-line replacement program, which was never intended when the program was approved.

A mains replacement program targets the most-risky mains and replaces them along with any service lines that happen to be associated with them. A service-line replacement program targets the most-risky service-lines and replaces them along with any mains that happen to be associated with them. Such a service-line replacement program was never envisioned when the first phase of GSMP was approved, and this shift in focus does not target the high risk pipe that was the subject of the federal "Call to Action."

In this regard, it is critically important to define and understand the term "*high-risk*" to clarify the objectives of the accelerated infrastructure replacement program. In its correspondence, PHMSA virtually always uses the term "high-risk" pipeline segments or infrastructure when describing its suggested accelerated-treatment for replacement of pipe. PHMSA also regularly cited the three highly-publicized incidents in Philadelphia, Allentown, and San Bruno when making a case for public safety through the prevention of these types of incidents. Together, the

three incidents resulted in fourteen fatalities, thirty-three injuries, thirty-eight homes destroyed, and over two million dollars in other property damage. These incidents were all caused by the breakage of mains, not leaks on service lines.

For this reason, all replacements in GSMP I were prioritized through use of the original Hazard Index which was based on breakage records of the cast iron segments in each grid. Breaks were considered to be much more dangerous than leaks, due to the amount of gas that would be released, and therefore were considered to conform most closely with PHMSA's recommendations.

Q. WHAT IS THE COMPANY'S JUSTIFICATION FOR ITS PROPOSAL TO CHANGE ITS PRIORITIZATION METHOD?

A. The Company contends that the Hazard Index values for much of the remaining piping no longer show sufficient differentiation, resulting in similar values (ties or near-ties) for large numbers of grids. The Company states that this necessitates the use of additional prioritization techniques to break virtual ties.

Q. ARE YOU IN AGREEMENT WITH THE COMPANY'S PROPOSAL TO USE NEW SUB-PRIORITIZATION TECHNIQUES INSTEAD OF THE ORIGINAL HAZARD INDEX?

A. No. The Company is apparently contending that breaks and leaks are becoming scarce in their system. I believe that is a good result and in-fact is proof that the hazard index used in the first phase of the GSMP program is working. I believe the original hazard index prioritization technique is still appropriate for use in GSMP II. In reality, hazard indices are calculated to several decimals, virtually eliminating ties.

C. Proposed Additional Types of Replacement Work

Q. DO YOU AGREE WITH THE COMPANY'S PROPOSAL TO EXPAND THE SCOPE OF THE WORK INCLUDED IN THE SECOND PHASE OF THE GSMP?

A. No. As noted, for GSMP II the Company is proposing to include several categories of work that were excluded from the original GSMP I program: EPCI replacements, meter set relocations, plastic and protected steel main replacements, and EPCI joint reinforcement. As explained in more detail in the testimonies of Dr. Dismukes and Ms. Crane, these should be undertaken as part of the Company's normal capital spending, recoverable after a base rate case rather than under an accelerated rate mechanism. In addition, some of the additional work is not justified for safety-related reasons.

Meter set relocations are described by the Company as a "modernizing activity".[18] I believe that the proper ground for inclusion of a sub-program under accelerated rate treatment would be that it is safety-related and high-risk.

EPCI replacements are not part of the map-grid mains selection process. They are targeted for replacement segment-by-segment anywhere in the entire system, and thus do not result in the contractor economies of scale that UPCI map-grid replacements produce. Also EPCI mains are generally larger diameter mains with thicker walls that don't break as easily.

Polyethylene plastic and protected steel mains are the current materials of choice for gas companies to install. As such, they have very low safety risks and have not been included in PHMSA's list of suggested materials to be replaced under accelerated rate treatment.

The impetus for the proposal to include EPCI joint reinforcement in GSMP II appears to be the need to comply with the Board's performance metric for the maximum number of leaks-

[18] Discovery response RCR-POL-0085.

per-mile permissible on EPCI. Leaks on large-diameter cast iron primarily come from joints of the piping. The number of leaks tends to rise in harsh winters when freeze-thaw cycles heave the ground and disturb the piping joints. [redacted]

D. New Open-Leak Performance Metric

Q. HAS THE COMPANY OFFERED A PERFORMANCE METRIC REGARDING LEAK PERFORMANCE?

A. Yes. As in past replacement projects such as GSMP I, the Company commits to reducing the open leak inventory by 80% over the five years following the date of Board approval and a minimum of 20% each year in the first two years except if extraordinary circumstances such as extreme weather, acts of war or terrorism, or other *force majeure* extraordinary circumstances prevent the achievement of the annual reduction.

Q. IN YOUR OPINION HAS THIS PERFORMANCE MEASURE REGARDING LEAK REDUCTIONS BEEN EFFECTIVE?

A. No. It has not been as effective as it could be. A major difficulty is that the commitment does not include incremental, new, post-approval leaks which are not counted in this metric. The metric only applies to open leaks existing at the end of one year (the year following the date of Board approval).

Q. HOW COULD THE LEAK PERFORMANCE METRIC BE REVISED TO APPLY TO A REDUCTION OF OPEN LEAK INVENTORIES IN ALL YEARS?

A. I believe the leak performance metric should be changed such that all open leaks are included, and the total open leaks are capped for every year of the replacement program.

Q. HOW WOULD THE OPEN LEAK CAP BE SET?

A. I propose that the cap for the first year following the date of Board approval be set at the average number of open leaks the Company has experienced over the past five years. For years following the first year the cap should be reduced by one (1) percent each year for the duration of the GSMP II program.

Q. WHAT IS THE PURPOSE OF USING THE AVERAGE NUMBER OF OPEN LEAKS THE COMPANY HAS EXPERIENCED AT THE END OF THE PREVIOUS FIVE YEARS FOR THE CAP IN THE FIRST YEAR?

A. The average is proposed to allow for variations in the number of open leaks from year to year in past years.

Q. WHAT IS THE RATIONALE FOR REDUCING THE CAP FOR THE SUCCEEDING YEARS OF THE GSMP II PROGRAM?

A. Pipe replacement programs such as the proposed GSMP II should result in significant decreases in the total number of leaks occurring each year as older pipes are replaced by newer pipe materials that exhibit markedly lower leak rates. There are also increases in leaks that occur due to the addition of piping to accommodate new customers, however these are minor and the net effect would still be expected to be a net decrease in total leaks. Open leak inventories should also decline in amounts similar to the decline in total leaks.

The Company annually sets a reduction plan for open leaks for future years. As part of its current plan, the total number of open leaks is projected to decrease by one (1) percent each year.[19] I suggest using the same reduction percentage for each year of the GSMP II program.

Q. CAN YOU ILLUSTRATE WHAT THE CAPS ON THE NUMBER OF OPEN LEAKS WOULD BE FOR EACH YEAR OF THE GSMP II PROGRAM?

A. Yes. If the program were to have started in 2017, the average open leak inventory for years 2012 through 2016 is 1,911. This would be the cap on the permissible number of open leaks for the first year (2017). Succeeding year caps would be 1,892 for 2018, 1,873 for 2019, etc.

Q. HAS THE COMPANY OFFERED TO ACCEPT ANY PENALTIES FOR FAILURE TO MEET OPEN-LEAK PERFORMANCE METRICS?

A. No, the Company has not proposed any penalties for failure to meet its proposed open-leak performance metrics.

Q. HOW SHOULD A PENALTY BE FORMULATED FOR FAILURE TO MEET OPEN-LEAK PERFORMANCE METRICS?

A. If the Company exceeds the open-leak performance cap in the first two years of the program, the Company will notify the Board and Rate Counsel and schedule a conference to discuss the failure to meet its agreed-upon cap for open leaks. If the cap is still exceeded for the third year, then the Company would reduce its return on equity ("ROE") by 50 basis points until it is able to achieve the leak reduction target.

V. Key Findings and Recommendations

[19] Company Response to RCR-POL-0004.

Q. WOULD YOU PLEASE SUMMARIZE YOUR MAJOR FINDINGS REGARDING THE PROPOSED SECOND PHASE OF THE GAS SYSTEM MODERNIZATION PROGRAM (GSMP II)?

A. My primary findings are that:

1) A twenty-year timeframe to replace/address all remaining cast iron and unprotected steel, as proposed by the Company, requires a mains replacement rate of approximately 250 miles per year. This would be a major increase over replacement rates in past programs such as both gas Capital Infrastructure Programs CIP-I and CIP-II (below 100 miles per year), Energy Strong (below 150 miles in any year), and even in the first phase of this program (limited to an average 133 miles per year).

2) The specific replacement programs proposed for the second phase of GSMP (GSMP II) deviate from the replacement programs approved in the settlement of GSMP I in eight of its essential operating components.

3) The proposed inclusion of service-line leaks in the calculation of Hazard Indices for prioritization of utilization-pressure replacements, tends to move the proposed GSMP II program away from a mains replacement program and towards a service-line replacement program, which would be a major change from the settled first phase of the GSMP and would not necessarily directly target the high-risk mains cited by PHMSA in its Call to Action.

4) The current leak performance metric is insufficient since it applies only to open leaks that exist prior to the program, rather than to open leaks in existence each year of the GSMP II program.

Q. WOULD YOU PLEASE SUMMARIZE YOUR RECOMMENDATIONS REGARDING THE SECOND PHASE OF THE GAS SYSTEM MODERNIZATION PROGRAM (GSMP II)?

A. Yes, a summary of my recommendations is as follows:

1) If the Board decides to approve some portion of the proposed GSMP II program, I recommend that the approved replacement activities and prioritization techniques be limited to those approved for GSMP I, in order to focus resources on the primary task of replacing the most-risky assets, namely Utilization Pressure Cast Iron.
2) The timeframe for addressing all of the Company's cast iron and unprotected steel should remain at thirty (30) years as it was in GSMP I.
3) All mains replacements should be selected through map-grid techniques in order to take advantage of contractor economies of scale.
4) All mains replacements should be prioritized (by map-grids) through use of the original Hazard Index which was based on cast iron breakage rates.
5) Costs for district regulator replacement, uprating of the UP portions of the system that are being replaced, and the installation of Excess Flow Valves on replaced service-lines, where appropriate, should also be approved.
6) Service-line leaks should be excluded from the prioritization of UPCI and steel piping replacements.
7) The open-leak performance measure should be changed to one that recognizes all open leaks. Specifically, a cap should be placed on the total number of open leaks. The cap should be set at the average of open leaks for the past five years, and

should be reduced by 1% per year for each succeeding year of the program. A penalty should also be imposed for exceeding these caps.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY FILED ON JANUARY 19, 2018?

A. Yes, it does. However, I reserve the right to supplement my testimony if any updated or additional information becomes available during the course of this proceeding.

CREDENTIALS OF EDWARD A. McGEE

PROFESSIONAL CAREER

2012 – present **Acadian Consulting Group**
Engineering Associate

As Engineering Associate for Acadian Consulting Group, I am responsible for assisting in studies performed for Public Utility Commissions.

1999 – present **McGee Consulting**
Principal Consultant and Engineer – Energy Industry

As Principal Consultant and Engineer, I am responsible for assisting larger consulting firms in their studies performed for utility companies and Public Utility Commissions.

1985 - 1999 **Stone & Webster Management Consultants, Inc.**
Vice President/Director

As Vice President of Stone & Webster Management Consultants, I was responsible for consulting studies in the Gas Practice area, where I performed consulting analyses in the gas planning and gas operations areas for gas utility companies and public utility commissions.

1982 - 1985 **Stone & Webster Engineering Corporation**
Business Development Manager

As Business Development Manager at Stone & Webster Engineering Corp., I was responsible for the construction of investment models for feasibility studies on large-scale chemical and refining complexes.

1982 & earlier **W. R. Grace & Co.**
Director of Energy Resources
Manager of Chemical Development

As Director of Energy Resources for W. R. Grace, I advised the Chief Operating Officer on corporate energy consumption and production. I also assisted operating divisions in securing long-term energy resources.

As Manager of Chemical Development at W. R. Grace, I analyzed potential acquisition targets in specialty chemical and high technology fields, developing corporate strategies for selected expansions.

AMOCO Oil
Supervisor of Technical Computer Programming
Internal Operations Research Consultant

In a variety of engineering and computer modeling capacities at AMOCO Oil directed a staff of professionals in the development of technical programs in the refining, distribution and marketing areas.

EDUCATION

University of Chicago, Master of Business Administration, Quantitative Analysis and Computers

University of Notre Dame, Master of Science in Chemical Engineering

University of Notre Dame, Bachelor of Science in Chemical Engineering

LICENSES & CERTIFICATES

Licensed Professional Engineer (License Currently Retired) -- State of Indiana
U.S. Patent Holder -- Refinery Treating Process

PROFESSIONAL AFFILIATIONS

American Institute of Chemical Engineers
The Institute of Management Sciences

SAMPLE PUBLICATIONS AND PAPERS

"Using a Personal Computer as a Gas Supply Planning Tool." Gas Industries lead article.

"Personal Computers and the Natural Gas Industry." Public Utilities Fortnightly.

"Personal Computer-Based Long-Range Planning for Natural Gas Development and Supply Management." Presented at the International Gas Union's 18th World Gas Conference, Berlin, Germany.

"Role of Optimization Models in Dispatching Gas Supplies." Presented at AGA Distribution/Transmission Conference, Toronto, Canada.

"Experience With Gas Supply Optimization Models at Inland Natural Gas." Presented at IGT symposium on Personal Computers in the Gas Industry, Chicago, Illinois.

Table of Exhibits

Title	Exhibit
Ranking of U.S. Gas Utilities by Highest Precent of Leak Prone Metallic Mains, 2016	Exhibit EAM-1
Years to Replace Obsolete Mains for Top 15 Utilities with Highest Percent of Leak Prone Metallic Mains	Exhibit EAM-2
PSE&G GSMP II Elevated Pressure Cast Iron Leaks per Mile (2007-2016) - **CONFIDENTIAL**	Exhibit EAM-3

Ranking of U.S. Gas Utilities by Highest Percent of Leak Prone Metallic Mains, 2016

Rank	Operator Name	State	Total Miles of Mains	Miles of Leak-Prone Steel Mains[1]	Miles of Leak-Prone Iron and Copper Mains[2]	Total Miles of Leak-Prone Metallic Mains	Percent Leak-Prone Metallic Mains
1	PHILADELPHIA GAS WORKS	PA	3,031	484	1,538	2,022	66.72%
2	BOSTON GAS CO	MA	6,360	1,270	1,834	3,104	48.81%
3	CONSOLIDATED EDISON CO OF NEW YORK	NY	4,329	996	1,072	2,068	47.77%
4	KEYSPAN ENERGY DELIVERY - NY CITY	NY	4,118	318	1,413	1,731	42.03%
5	KEYSPAN ENERGY DELIVERY - LONG ISLAND	NY	8,113	3,132	276	3,408	42.01%
6	WASHINGTON GAS LIGHT CO	DC	1,216	83	411	493	40.58%
7	NIAGARA MOHAWK POWER CORP	RI	3,193	416	770	1,186	37.14%
8	PEOPLES GAS LIGHT & COKE CO	IL	4,351	1	1,460	1,461	33.57%
9	DOMINION HOPE	WV	3,218	1,080	-	1,080	33.56%
10	NSTAR GAS COMPANY	MA	3,265	691	351	1,042	31.91%
11	PENSACOLA, ENERGY SERVICES OF	FL	1,627	412	82	494	30.37%
12	SOUTHERN CONNECTICUT GAS CO	CT	2,406	90	638	727	30.23%
13	MOUNTAINEER GAS CO	WV	5,855	1,749	-	1,749	29.87%
14	PEOPLES NATURAL GAS COMPANY LLC	PA	10,369	2,962	98	3,061	29.52%
15	PEOPLES TWP LLC	PA	2,646	744	-	744	28.12%
16	PUBLIC SERVICE ELECTRIC & GAS CO	NJ	17,863	995	3,790	4,785	26.78%
17	ATMOS ENERGY CORPORATION - MID-TEX	TX	31,853	7,735	567	8,302	26.06%
18	DOMINION EAST OHIO	OH	19,720	4,942	36	4,979	25.25%
19	NATIONAL FUEL GAS DISTRIBUTION CORP	PA	4,830	988	156	1,145	23.70%
20	OKALOOSA COUNTY GAS DISTRICT	FL	1,359	252	16	268	19.72%
21	DTE GAS COMPANY	MI	19,368	1,528	2,272	3,799	19.62%
22	COLUMBIA GAS OF PENNSYLVANIA	PA	7,501	1,350	108	1,458	19.43%
23	ELIZABETHTOWN GAS CO	NJ	3,190	86	531	618	19.36%
24	NATIONAL FUEL GAS DISTRIBUTION CORP - NEW YORK	NY	9,699	1,592	284	1,876	19.35%
25	KANSAS GAS SERVICE COMPANY, A DIVISION OF ONE GAS, INC.	KS	11,412	2,051	36	2,087	18.29%
26	ATMOS ENERGY CORPORATION - COLORADO/KANSAS	KS	3,647	647	-	647	17.74%
27	BALTIMORE GAS & ELECTRIC CO	MD	7,306	22	1,216	1,238	16.94%
28	UGI CENTRAL PENN GAS, INC	PA	3,725	613	6	619	16.62%
29	PECO ENERGY CO	PA	6,853	401	712	1,113	16.24%
30	SOUTHERN CALIFORNIA GAS CO	CA	50,356	7,954	-	7,954	15.80%

[1] Includes unprotected bare steel, unprotected coated steel, and protected bare steel mains mileage.
[2] Includes cast iron, ductile iron, and copper mains mileage.
Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1.

Years to Replace Obsolete Mains for Top 15 Utilities with Highest Percent of Leak Prone Metallic Mains

Rank	Operator Name	State	Percent Leak-Prone Metallic Mains	Number of Years Estimated to Completely Replace Obsolete Metallic Mains
1	PHILADELPHIA GAS WORKS	PA	66.72%	48
2	BOSTON GAS CO	MA	48.81%	20
3	CONSOLIDATED EDISON CO OF NEW YORK	NY	47.77%	20
4	KEYSPAN ENERGY DELIVERY - NY CITY	NY	42.03%	N/A
5	KEYSPAN ENERGY DELIVERY - LONG ISLAND	NY	42.01%	N/A
6	WASHINGTON GAS LIGHT CO	DC	40.58%	40
7	NIAGARA MOHAWK POWER CORP	RI	37.14%	13
8	PEOPLES GAS LIGHT & COKE CO	IL	33.57%	40[1]
9	DOMINION HOPE	WV	33.56%	50
10	NSTAR GAS COMPANY	MA	31.91%	25
11	PENSACOLA, ENERGY SERVICES OF	FL	30.37%	10[2]
12	SOUTHERN CONNECTICUT GAS CO	CT	30.23%	20
13	MOUNTAINEER GAS CO	WV	29.87%	N/A
14	PEOPLES NATURAL GAS COMPANY LLC	PA	29.52%	20
15	PEOPLES TWP LLC	PA	28.12%	20
16	PUBLIC SERVICE ELECTRIC & GAS CO - GSMP I	NJ	26.78%	30
17	PUBLIC SERVICE ELECTRIC & GAS CO - GSMP II	NJ	26.78%	20
Average Number of Years to Replace Mains[3]				**27.2**

[1] Peoples Gas Light & Coke Co. expect half of its system to be replaced within 20 years, therefore years to complete set at 40 years.
[2] Pensacola Energy voluntarily established a pipeline replacement program, and so may not technically be under Commission mandated 10-year goal.
[3]The average includes the 12 utilities in which replacement years were publicly available and excludes both PSE&G entries.
Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1; and Commission Orders.

PSE&G GSMP II Elevated Pressure Cast Iron Leaks per Mile (2007-2016)

Source: PSE&G DIMP.