BEFORE THE STATE CORPORATION COMMISSION OF THE STATE OF KANSAS

IN THE MATTER OF A GENERAL INVESTIGATION REGARDING THE ACCELERATION OF REPLACEMENT OF NATURAL GAS PIPELINES CONSTRUCTED OF OBSOLETE MATERIALS CONSIDERED TO BE A SAFETY RISK	)	**Docket No. 15-GIMG-343-GIG**

DIRECT TESTIMONY OF EDWARD A. McGEE
ON BEHALF OF THE
CITIZENS' UTILITY RATEPAYER BOARD

Dated: January 29, 2016

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DIRECT TESTIMONY OF
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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.

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 Citizens' Utility Ratepayer Board ("CURB") to provide an expert opinion to the State Corporation Commission of the State of Kansas ("Commission") on management and engineering issues associated with the plans of three Kansas utilities (Atmos

Energy, Black Hills, and KGS) to replace all obsolete piping materials in each of their systems. In particular, in order to evaluate the need for an accelerated replacement program, I was asked to review each Company's progress in managing leaks on their systems over a lengthy time period. I was also asked to take a broader look at safety trends for gas distribution utilities throughout the State of Kansas to evaluate their progress in reducing the frequency of reportable[1] incidents.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THIS COMMISSION?

A. No. However, I submitted direct testimony in the recent Docket No. 16-ATMG-079-RTS.

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

A. Yes. I have prepared eleven (11) schedules in support of my direct testimony that were prepared by me or under my direct supervision.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. In addition to this introductory section, my testimony is organized into the following sections:

- Section II. Summary of Findings and Conclusions
- Section III. Overview of Replacement of Obsolete Piping
- Section IV. Obsolete Materials in Each Company's Piping System
- Section V. Each Company's Operating History
- Section VI. History of Kansas Incidents
- Section VII. Findings and Conclusions

[1] Reportable incidents are defined in 49 CFR Part 191.3 as any of the following events: (1) An event that involves a release of gas from a pipeline, …, and that results in one or more of the following consequences: (i) A death, or personal injury necessitating in-patient hospitalization; (ii) Estimated property damage of $50,000 or more, including loss to the operator and others, or both, but excluding cost of gas lost.

II. Summary of Findings and Conclusions

Q. WOULD YOU PLEASE SUMMARIZE YOUR PRIMARY FINDINGS AND CONCLUSIONS REGARDING THE REPLACEMENT OF EACH COMPANY'S PIPING ASSETS?

A. Based on my analysis of each Company's filing and discovery responses, as well as publicly available information from the Department of Transportation (DOT) and other documentation in this case, my primary findings and conclusions are:

1) Safety risks, as measured by both leak rates and incident rates, have been successfully reduced over time under existing Commission replacement rules and rates.
2) Our review of each Company's leak rates over the last sixteen years indicates that leaks have generally been declining or level, meaning that each Company has managed leaks in its Kansas system very successfully to date under existing Commission replacement rules and rates.
3) Our review of incident rates in Kansas over the last forty-five years indicates that incidents generally have been declining, indicating that Kansas utilities as a whole have managed incidents in their systems very well to date under existing Commission replacement rules and rates.
4) Incidents caused by certain obsolete materials, such as those identified as "material failure" and "corrosion" causes, have been very low in recent years.

III. Overview of Replacement of Obsolete Piping

Q. CAN YOU DESCRIBE THE TYPES OF PIPING MATERIALS THAT EACH COMPANY CALLS OBSOLETE AND PROPOSES TO REPLACE MORE RAPIDLY?

A. Yes. The word obsolete means that the materials were state-of-the-art materials for gas piping at the time they were installed, and consist of various metals and plastics. However, over

the decades, new materials have been developed that have superior characteristics (e.g. longer life, less susceptible to corrosion). Today, when a gas company installs new piping, it uses only the newest types of materials. Older materials that are still a part of piping systems but are considered unsuitable for installation today are referred to as obsolete materials.

Q. DOES THE FACT THAT A COMPANY HAS OBSOLETE MATERIALS REMAINING IN ITS PIPING SYSTEM MEAN THAT THE SYSTEM IS UNSAFE?

A. No. The primary reason that a gas company would replace its obsolete piping is that newer materials would be less likely to leak. Leaks in turn could potentially lead to unsafe situations - such as reportable incidents - if they are not discovered and repaired in time; so upgrading materials through selective replacement is a common industry practice.

Obsolete metallic types of piping tend to leak or break after a period of time due to ground movement or corrosion from wet ground conditions. Steel piping tends to corrode over time. Some obsolete types of plastic piping tend to develop cracks over time, or crack spontaneously in reaction to earth movement, or separate at joints due to the deterioration of adhesion compounds, also leading to leaks or breaks. Cast iron can leak at the piping joints or through breaks in the piping walls. Gas companies spend considerable time and effort controlling leaks through leak detection, repair, and replacement activities as well as through damage prevention programs, so that the number of leaks does not increase substantially as the piping gets older.

Q. ARE THEIR OTHER REASONS THAT OBSOLETE MATERIALS IN PIPING SYSTEMS ARE REPLACED?

A. Yes. In recent years (starting about 2010), a relatively small number of serious piping accidents throughout the U.S. have been highly publicized. This has led to recommendations by federal authorities (the Pipeline Hazardous Materials and Safety Administration division of the

Department of Transportation, or "PHMSA") to accelerate the repair, rehabilitation, and/or replacement of certain obsolete piping materials. Of most concern are materials that can break catastrophically without prior warning, such as those involved in the highly-publicized incidents. Since 2011, these particular recommendations have been conveyed to the states, to regulators, and to gas companies, starting with a PHMSA "Call to Action" plea.

Also advisory notices warning of concerns on various materials have been issued to owners and operators of gas distribution systems over a longer period of time. These notices generally recommended that the operators should closely monitor these types of piping materials for leaks by analyzing their leak history, conducting more frequent leak surveys, and replacing the piping as necessary.

Q. IS THERE A GENERAL AGREEMENT AMONG ALL PARTIES IN THE GAS INDUSTRY CONCERNING OBSOLETE MATERIALS, THEIR SAFETY RISKS, AND THE NEED TO REPLACE THEM?

A. No. For instance, the American Gas Association ("AGA"), which is an organization of gas companies, has been quoted as follows:

> "There is no one-size-fits-all approach, according to AGA. The group questions drawing conclusions about the safety of a pipe based solely on what it's made out of, saying that even systems in big cities with high concentrations of cast-iron and bare-steel gas mains can be operated safely if the utility has in place aggressive inspection, monitoring and mitigation programs." [2]

[2] Source: http://www.usatoday.com/story/news/nation/2014/09/23/gas-pipes-cast-iron-deaths-explosions-investigation/15783697/

IV. Obsolete Materials in Each Company's Piping System

Q. WHICH TYPES OF OBSOLETE MATERIALS REMAIN IN EACH COMPANY'S KANSAS SYSTEM?

A. The obsolete materials in each Company's piping system can be sorted into two broad categories: 1) metallic materials and 2) vintage (obsolete) plastic materials.

Within these categories, the following individual materials would be included in the replacement plans of Atmos:

1) Metallic Piping Materials:
   a. Unprotected bare steel mains
   b. Protected[3] bare steel mains and service lines
2) Vintage Plastic Piping Materials:
   a. Aldyl-A/Century plastic mains and service lines
   b. PVC (polyvinyl chloride) mains

The following individual materials would be included in the replacement plans of Black Hills:

1) Metallic Piping Materials:
   a. Unprotected bare steel mains, transmission lines, service lines, and yard lines
   b. Protected bare steel mains, transmission lines, and service lines
2) Vintage Plastic Piping Materials:
   a. PVC mains, service lines, and yard lines
   b. Pre-1970 Aldyl-A mains and service lines

The following individual materials would be included in replacement plans of KGS:

1) Metallic Piping Materials:

[3] Protected indicates that electric protection has been applied to the piping to slow corrosion.

a. Cast/Ductile iron mains[4]

b. Unprotected bare steel mains and service lines[5]

c. Protected bare steel mains and service lines[6]

d. Coated steel unprotected mains and service lines

2) Vintage Plastic Piping Materials:

a. PVC mains

Q. PLEASE DESCRIBE THE AMOUNT OF OBSOLETE MAINS IN EACH COMPANY'S SYSTEM.

A. The types and amounts of piping material existing in the systems of all three Kansas utilities that are considered obsolete by that utility are shown in Schedule EM-01.

Currently, the Atmos Energy mains have relatively high amounts of materials that would not be installed in a modern-day system. Out of 3,628 miles of mains, the Company has 682 miles of metallic mains (18.8% of the system) and 815 miles of vintage plastic mains (22.5% of the system) that are considered to be obsolete. Thus, 41.3% of the miles of mains in the Kansas system are considered obsolete.

The KGS system has a total of 20.4% obsolete mains, which are mostly (19.1%) metallic; the remainder (1.3%) are PVC plastic.

The Black Hills mains have a smaller proportion (8.0%) of obsolete metallic materials in their distribution system than do the other two Kansas utilities. Black Hills also has a small amount of obsolete metallic transmission lines. However, the amount of obsolete plastic mains in the Black Hills system is quite large (607 miles out of their total system mileage of 2801, or 21.7%).

[4] KGS currently has an approved replacement program for cast iron mains.
[5] KGS currently has an approved replacement program for unprotected bare steel service lines.
[6] KGS currently has an approved replacement program for protected bare steel service lines.

The obsolete plastic mains are predominantly PVC (503 miles), and the remainder is Aldyl-A (104 miles).

Q. HOW DO THESE PERCENTAGES FOR OBSOLETE MAINS COMPARE TO THOSE OF OTHER GAS UTILITIES?

A. The amount of metallic mains piping in the systems of all U.S. utilities is reported in the DOT's Annual Distribution Reports. As shown in Schedule EM-02, KGS and Atmos rank 24th and 25th, respectively, in the proportion of their system composed of obsolete metallic mains as compared to other gas utilities in the U.S. This Schedule ranks all 176 gas utilities that have at least 1,000 miles of mains. The KGS system has 19.1% of its total miles of mains consisting of obsolete metallic materials, and Atmos has 18.8%. The Black Hills system has a much smaller percentage (8.8%, including transmission mains) of obsolete metallic materials, which places it in 60th place in the ranking of utilities.

Q. YOU'VE DESCRIBED THE AMOUNT OF METALLIC MAINS IN EACH KANSAS SYSTEM. HOW DO THE AMOUNTS OF OBSOLETE METALLIC SERVICE LINES IN EACH KANSAS SYSTEM COMPARE TO THOSE OF OTHER COMPANIES?

A. The Atmos system has a high percentage of metallic service lines. The current comparative condition of the Company's Kansas service lines is shown in Schedule EM-03. This indicates that out of 194 U.S. gas utilities having 25,000 or more service lines, Atmos Kansas ranks as the 21st highest in the percentage of obsolete metallic services (19.5% of its system).

The KGS system is shown in the same Schedule (EM-03) to rank 42nd with 11.8% of obsolete metallic services in its system.

Black Hills ranks lowest of the three Kansas utilities at 93rd, with only 2.5% of its system composed of obsolete metallic service lines.

Q. DO THE HIGH AMOUNTS OF OBSOLETE METALLIC PIPING FOR KANSAS UTILITIES, COMPARED TO OTHER U.S. GAS COMPANIES, INDICATE THAT SAFETY RISKS ARE ALSO HIGH?

A. No. As shown in both of the prior schedules, the obsolete metallic materials in the Kansas system differ markedly from the types of obsolete materials listed for most of the companies near the top of the rankings. Only one of the three Kansas utilities has any iron pipe and it is a relatively small amount (KGS has 70 miles of cast iron mains). Most of the obsolete metallic materials in the three Kansas systems are steel materials. Most other companies near the top of the ranking have high amounts of iron piping materials. Iron materials, especially cast iron, are susceptible to breakage of the pipe walls caused by ground movement because cast iron has very little flexibility. It cracks rather than bends under pressure from ground movement caused by frost or nearby construction activities. When stressed to the breaking point, cast iron tends to fail by breaking circumferentially—i.e., the pipe breaks completely in two all the way around—which results in a relatively large release of gas at the point of failure compared to the kinds of leaks that develop in steel materials.

Q. ARE EACH COMPANY'S MAINS COMPRISED OF HIGH PERCENTAGES OF OBSOLETE PLASTIC MATERIALS?

A. Measured in miles of mains, 22.5% of Atmos Kansas mains are obsolete types of plastic —primarily Aldyl-A or Century plastic. In the Black Hills system, 21.7% of their mains are obsolete plastic —primarily PVC. In the KGS system, only 1.3% of their mains are obsolete plastic, and they are entirely PVC plastic.

Q. ARE EACH COMPANY'S SERVICE LINES COMPRISED OF HIGH PERCENTAGES OF OBSOLETE PLASTIC MATERIALS?

A. Measured in number of service lines, 23.0% of Atmos Kansas service lines are obsolete types of plastic - Aldyl-A or Century plastic. In the Black Hills system, only 1.1% of their service lines (including yard lines) are obsolete plastic – primarily Aldyl-A. In the KGS system, there are no plastic services considered to be obsolete, even though there are a small number of PVC services.

Q. DO THE PERCENTAGES OF OBSOLETE METALLIC AND OBSOLETE PLASTIC MATERIALS INDICATE A DANGEROUS CONDITION IN THE PIPING SYSTEMS OF ANY OF THE THREE KANSAS COMPANIES?

A. No, not now. As will be shown in the following section covering each Company's operating history, the Companies are managing current piping problems well, as evidenced by generally declining leak rates. There are however, potential future risks that have been pointed out by the Pipeline Hazardous Materials and Safety Administration division of the Department of Transportation, based on experiences at other utilities. Accordingly, PHMSA has recommended accelerated proactive measures (such as repair, rehabilitation, or replacement) to help prevent future problems.

V. Each Company's Operating History

Q. IF OBSOLETE PIPING IS NOT REPLACED IMMEDIATELY, WHAT MEASURES CAN GAS COMPANIES TAKE TO MAINTAIN THE SAFETY OF THEIR SYSTEMS?

A. Prudent gas companies employ a variety of leak detection, leak repair, and damage prevention programs to assist in managing safety risks on their piping assets. The objective is to control leak and incident rates so they don't increase markedly and get out of hand.

Q. HOW CAN WE TELL IF EACH COMPANY HAS BEEN SUCCESSFULLY MANAGING THE SAFETY RISKS IN THEIR CURRENT INVENTORY OF PIPING?

A. The best way to assess the management of safety risks inherent in piping is to analyze leak rates and incident rates. If leak rates and incident rates are continually increasing, the Company is not managing its risks well. If leaks and incident rates are decreasing or staying level, the opposite is true.

Q. HAVE YOU PREPARED ANY ANALYSES OF LEAK HISTORY AND INCIDENT HISTORY?

A. Yes. I have prepared a series of exhibits that show the number of leaks over the past sixteen years for each of the three Kansas LDCs. I have also analyzed incidents that occurred in the state of Kansas over the past forty-five years and present these results in the next section of this testimony (Section VI. History of Kansas Incidents).

Q. WHAT IS THE SOURCE OF THE DATA YOU USED FOR YOUR ANALYSES?

A. For the leak rate analysis, I utilized data from the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration ("PHMSA"), Office of Pipeline Safety ("OPS," generally "OPS data"). The OPS collects a variety of information from pipeline operators

under its jurisdiction in accordance with federal pipeline safety regulations. This reporting of annual data is required by 49 CFR 191.11, which states that "…each operator of a distribution pipeline system shall submit an annual report for that system on Department of Transportation RSPA Form 7100.1-1. This report must be submitted each year, no later than March 15, for the preceding calendar year."[7] Some of the information submitted in this report is provided to the public, including the "Gas Distribution Annual Data" that was used in this analysis.

Q. HAVE YOU ANALYZED THE LEAK RATES ON THE PIPING OF EACH COMPANY TO SEE IF THEY ARE BEING MANAGED WELL OR ARE INCREASING?

A. Yes. Schedule EM-04 gives an overview of the leak rates for each of the three Kansas Utilities. This schedule presents total leaks detected by each Company each year for the past sixteen years. As shown, the general leak trends are all declining or flat over the time frame.

Q. HAVE YOU ALSO ANALYZED THE LEAK REPAIRS ON DIFFERENT TYPES OF PIPING ASSETS OF EACH COMPANY TO SEE IF THEY ARE BEING MANAGED WELL?

A. Yes. Schedules EM-05 and EM-06 show the number of annual leak repairs on the three piping systems since 1999. Schedule EM-05 shows leak repairs on the mains portion of each Company's piping system; Schedule EM-06 shows leak repairs on the services portion of each Company's system. On both schedules, the number of total leaks and the number of leaks caused by corrosion are shown separately.

Schedule EM-05 shows the total number of leak repairs on mains has been generally declining throughout the sixteen-year period for each of the three Kansas LDCs. This indicates that all three of the Companies have managed their leak repairs in an effective, responsible manner.

[7] 49 CFR 191.11.

The number of leaks on mains that have been caused by corrosion have also generally declined over the same time periods, but not as steeply as total leaks have decreased, indicating the rising importance of corrosion as a predominant cause of leaks on mains in the three systems. The increase in corrosion leaks as a percentage of total leaks reflects the gradual aging of the metallic assets.

Q. TO WHAT DO YOU ATTRIBUTE THE GENERAL DECREASES IN LEAKS ON MAINS SINCE 1999?

A. As shown in Schedule EM-05, the most likely causes of the drop in leaks on mains have been the Company's leak detection, leak repair, and pipe replacement activities, as well as other safety programs such as damage prevention.

Q. HAS CORROSION ALSO BEEN A MAJOR FACTOR IN THE CONDITION OF THE SERVICE LINES OF EACH UTILITY?

A. Yes. Schedule EM-06 indicates very similar patterns of leaks on services as shown for leaks on mains. Specifically, total service line leaks have generally fallen since 1999. Corrosion-caused leaks on services have also generally declined, but not as much as total leaks on services have declined. This indicates the growing importance of corrosion on service lines as well as on mains.

Q. TO WHAT DO YOU ATTRIBUTE THE DECREASE IN LEAKS ON SERVICE LINES SINCE 1999?

A. The most likely causes of the decreases in service line leaks have been cathodic protection of the services, replacement of leaking service lines, leak detection activities, as well as other safety programs such as damage prevention.

Q. AFTER VIEWING THE GENERAL DECLINES IN THE NUMBER OF LEAK REPAIRS ON BOTH MAINS AND SERVICE LINES, DO YOU CONCLUDE THAT EACH OF THE THREE COMPANIES HAS BEEN SUCCESSFULLY MANAGING LEAKS IN ITS SYSTEM?

A. Yes.

VI. History of Kansas Incidents

Q. HAVE YOU ANALYZED THE SAFETY-RELATED INCIDENTS THAT HAVE OCCURRED IN KANSAS?

A. Yes. I include in this section a quantitative analysis of several important factors related to incidents that have occurred in Kansas over a lengthy span of time.

Q. WHY IS IT IMPORTANT TO ANALYZE THE HISTORY OF INCIDENTS

A. In addition to the analyses of leaks presented earlier in my testimony, an analysis of incidents can reveal important insights into the changing nature of safety risks inherent in gas distribution within the state. All of these factors can be used not only to assess performance, but to yield more effective proactive directions for customized replacement plans.

Q. HOW COULD A GAS COMPANY STRENGTHEN A REPLACEMENT PROGRAM?

A. In my opinion, a prudent operator should understand the nature of the most serious problems (such as major incidents) that have occurred before taking any replacement actions, in order to insure the measures are appropriately directed at that company's particular problems. Such a plan would then be designed to minimize incidents as well as the minimization of leaks. No replacement program – especially an extensive replacement program such as the one proposed – should be implemented without first determining if a more effective replacement plan could be

formulated. This would assist in minimizing safety risks as well as in limiting the size and cost of any replacement plan. When considered in the development of a replacement plan, a review of past incidents can also assist in the prioritization of replacements.

Q. DOES THE GENERAL GAS UTILITY INDUSTRY AGREE WITH THIS APPROACH?

A. Yes. Lori Traweek, senior vice president of the American Gas Association, a trade group that represents gas utilities across the country, has said, "We have a strong safety record. We are not an industry that rests on its laurels …(e)very incident is one that you want to look closely at to see how it could have been prevented."[8]

Q. WHAT ARE THE BENEFITS OF A CUSTOMIZED PLAN?

A. A customized plan would first analyze which factors are more likely responsible for developing leaks or breaks that result in incidents, so an operator can focus its plan preferentially to minimize incidents. For instance, a customized plan might analyze the asset types (main or service or other), the piping materials, the causes, or other factors that have led to incidents in the past. Then a replacement plan can be developed and prioritized to minimize safety risks corresponding to these factors.

Q. HAVE YOU PREPARED ANALYSES OF INCIDENTS THAT HAVE OCCURRED IN KANSAS, THEIR FREQUENCY OF OCCURRENCE, AND THE TYPE OF PIPING THAT CAUSED THEM?

A. Yes. I have prepared a series of schedules (Schedule EM-07 to Schedule EM-11) that review the major incidents that have occurred in the state. These examine the frequency of

[8]Source: http://www.usatoday.com/story/news/nation/2014/09/23/gas-pipes-cast-iron-deaths-explosions-investigation/15783697/

occurrence of incidents, their severity (in terms of fatalities, serious injuries, and property damage), as well as the types of piping materials, the asset types (main or service), and the causes involved in past incidents.

Q. WHAT IS THE SOURCE OF THE DATA YOU USED FOR YOUR ANALYSIS?

A. I utilized data from the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration ("PHMSA"), Office of Pipeline Safety ("OPS," generally "OPS data"). The OPS collects a variety of information from pipeline operators under its jurisdiction in accordance with federal pipeline safety regulations. This annual data is required by 49 CFR 191.3, which states that "… each operator of a distribution pipeline system shall submit Department of Transportation Form RSPA F 7100.1 as soon as practicable but not more than 30 days after detection of an incident required to be reported …". Some of the information submitted in this report is provided to the public, including the incident data that were used in this analysis.

Q. WHAT TIME PERIOD DID YOU USE FOR YOUR ANALYSIS?

A. I used the time period spanning from 1970 through the year with the most recently available information (2014). This period of time (45 years) allows for an adequate comparison of incident trends, and covers the complete historical record of all Kansas incidents reported to PHMSA.

Q. CAN YOU GIVE AN OVERVIEW OF NATURAL GAS DISTRIBUTION INCIDENTS THAT HAVE OCCURRED IN THE STATE OF KANSAS?

A. Yes. There have been two hundred eighty-eight (288) reportable incidents by gas distribution utilities in the state of Kansas since 1970. These 288 incidents have resulted in a total of eight fatalities, seventy-nine injuries requiring hospitalization, and damages greater than $9 Million dollars.

Q. HAS THE NUMBER OF KANSAS INCIDENTS BEEN GENERALLY INCREASING OR DECREASING OVER TIME?

A. The number of reportable incidents in Kansas has been decreasing dramatically over time. As shown in Schedule EM-07, incidents have dropped from a high of 114 incidents in a five-year period (1980-1984) to the most recent level of 13 in the 2010-2014 five-year time period, a decrease of 88.6%. This is certainly a superior achievement, and has been accomplished under existing replacement rules and rates.

Q. HAVE MAJOR INJURIES AND FATALITIES ARISING FROM INCIDENTS ALSO DECREASED?

A. Major injuries (those requiring hospitalization) have also decreased significantly and fatalities have remained at a low level. These are shown in Schedule EM-08.

Q. WHAT DO THE TRENDS IN KANSAS INCIDENTS AND THEIR SEVERITY TELL US ABOUT THE OPERATIONS OF KANSAS UTILITIES?

A. The decreases are evidence that the major Kansas utilities have been successfully managing the safety of their systems. This indicates that leak repair and pipe replacement activities (as well as other Company safety programs such as damage prevention) at these utilities have been sufficient to markedly reduce the rate of incidents over the past forty-five years.

Q. ARE THERE ALSO ANY INDICATIONS THAT THE KEY FACTORS INVOLVED IN INCIDENTS ARE CHANGING AND THESE CHANGES SHOULD ALSO BE CONSIDERED IN A CUSTOMIZED REPLACEMENT PROGRAM?

A. Yes. There are indications that incidents for Kansas Utilities have changed radically over time and these changes need to be considered when a pipe replacement plan is being formulated:

A. Mains vs Services

As shown in Schedule EM-09 incidents on both mains and services have dropped considerably over the forty-five-year period shown. In recent years, incidents on mains are continuing to occur more often than incidents on services. Therefore, the replacement of mains should continue to be an important consideration when replacement plans are being formulated.

B. Piping Materials

As shown in Schedule EM-10, incidents on steel piping materials have dropped dramatically over the forty-five-year period shown, falling from a high of 80 incidents during the five-year period 1980-84 to the most recent level of 6 incidents during 2010-14, a decrease of 92.5%. This reflects the priorities given by Kansas utilities to safety activities such as cathodic protection, leak detection, leak repair, piping replacements, damage prevention, etc.

Similarly, cast iron or wrought iron incidents have dropped considerably as this material is being successfully phased out.

Incidents occurring on plastic decreased or were level for most of the forty-five-year time period, but have risen in the most recent time period. The five-year time periods from 2000 to 2004 and from 2005 to 2009 had only one incident in each time period attributable to plastic. The most recent five-year time period (2010 to 2014) however, has had six (6) incidents occurring on plastic materials. This is due, at least in part, to the substantial amounts of plastic that have been installed in recent years.

C. Causes of Incidents

Schedule EM-11 shows the number of incidents over the past forty-five years that have been attributed to two causes: corrosion and material failures. These are two types of incidents that potentially could have been prevented if modern materials had been available and used at the time

the incidents occurred. (Note that there are other incidents that potentially could have also been prevented with modern materials. For instance, certain cast iron incidents that occurred may have also been prevented with more flexible modern materials. However, these are not readily identifiable from the PHMSA report data, and the amount of cast iron in Kansas distribution systems is limited).

The graphs shown for incidents caused by both corrosion and material failures indicate these causes have declined significantly over the past forty-five years, and have been very low in recent years. In fact, there has been only 1 incident attributable to either of these two causes in the past 20 years. Thus out of the 39 Kansas incidents occurring in the past 20 years, these two causes represent only 3 % of them.

VII. Findings and Conclusions,

Q. WHAT ARE YOUR MAJOR FINDINGS AND CONCLUSIONS REGARDING THE CONDITION OF THE COMPANY'S PIPING ASSETS?

A. Based on my analysis of each Company's filing and discovery responses, as well as publicly available information from the DOT and other documentation in this case, my primary findings and conclusions are:

1) Safety risks, as measured by both leak rates and incident rates, have been successfully reduced over time under existing Commission replacement rules and rates.
2) Our review of each Company's leak rates over the last sixteen years indicates that leaks have generally been declining or level, meaning that each Company has managed leaks in its Kansas system very successfully to date under existing Commission replacement rules and rates.

3) Our review of incident rates in Kansas over the last forty-five years indicates that incidents have generally been declining, meaning that Kansas utilities as a whole have managed incidents in their systems very well to date under existing Commission replacement rules and rates.

4) Incidents caused by certain obsolete materials, such as those identified as "material failure" and "corrosion" causes, have been very low in recent years.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

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.

VERIFICATION

STATE OF FLORIDA)

COUNTY OF BREVARD) ss:

I, Edward A. McGee, of lawful age and being first duly sworn upon my oath, state that I am an engineering analyst for the Citizens' Utility Ratepayer Board; that I have read and am familiar with the above and foregoing document and attest that the statements therein are true and correct to the best of my knowledge, information, and belief.

Edward A. McGee

SUBSCRIBED AND SWORN to before me this 28th day of January, 2016.

Notary Public

My Commission expires: 4-22-2019.

Nora C. Bramlett
NOTARY PUBLIC
STATE OF FLORIDA
Comm# FF223419
Expires 4/22/2019

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.

APPENDIX B

Direct Testimony of Edward McGee
Supporting Schedules

Table of Schedules

Amount of "Obsolete" Materials in Distribution and Transmission Systems

Company/Main Details	"OBSOLETE" METALLIC MATERIALS					"OBSOLETE" PLASTIC MATERIALS			TOTAL	
	Cast Iron/ Ductile Iron	Bare Steel Unprotected	Bare Steel Protected	Coated Steel Unprotected	Sub-Total Metallic	PVC	Aldyl-A/ Century	Sub-Total Plastic	"Obsolete" Mains Materials	Mains Mileage
Atmos										
Miles	-	12.8	669.4	-	682.1	108.0	707.0	815.0	1,497.1	3,627.7
% of Total Distr. Mains		0.4%	18.5%		18.8%	3.0%	19.5%	22.5%	41.3%	
Black Hills										
Distribution Miles	-	88.0	137.0	-	225.0	503.0	104.0	607.0	832.0	2,801.0
% of Total Distr. Mains		3.1%	4.9%		8.0%	18.0%	3.7%	21.7%	29.7%	
Transmission Miles	-	19.0	1.0	-	20.0	-	-	-		
Distrib. + Transm. Miles	-	107.0	138.0	-	245.0	-	-	-	245.0	
KGS										
Miles	70.1	264.9	1,830.7	0.5	2,166.2	153.0	-	153.0	2,319.2	11,361.4
% of Total Distr. Mains	0.6%	2.3%	16.1%	0.0%	19.1%	1.3%		1.3%	20.4%	

Note: Some of KGS's materials are already being replaced under an existing approved plan.
Source: DOT Annual Distribution Reports; Direct Testimony of C. Paige, pp. 7-8; Direct Testimony of J. Watkins, pp. 3 and 7; Direct Testimony of R. Spector, p. 4.

Amount of "Obsolete" Materials in Distribution and Transmission Systems

Company/Services Details	"OBSOLETE" METALLIC MATERIALS					"OBSOLETE" PLASTIC MATERIALS			TOTAL	
	Cast Iron/ Ductile Iron	Bare Steel Unprotected	Bare Steel Protected	Coated Steel Unprotected	Sub-Total Metallic	PVC	Aldyl-A/ Century	Sub-Total Plastic	"Obsolete" Service Materials	Number of Services
Atmos										
Number of Services	-	-	28,149	-	28,149	-	33,171	33,171	61,320	144,368
% of Total Services			19.5%		19.5%		23.0%	23.0%	42.5%	
Black Hills										
Number of Services	-	2,050	399	-	2,449	-	900	900	3,349	99,570
% of Total Services		2.1%	0.4%		2.5%		0.9%	0.9%	3.4%	
Number of Yard Lines	-	27,184								
No. of Service + Yard Lines	-	29,234	399	-	29,633	184	900	1,084	30,717	
KGS										
Number of Services	-	60,365	8,504	5,428	74,297				74,297	629,825
% of Total Services		9.6%	1.4%	0.9%	11.8%				11.8%	

Note: Some of KGS's materials are already being replaced under an existing approved plan.
Source: DOT Annual Distribution Reports; Direct Testimony of C. Paige, pp. 7-8; Direct Testimony of J. Watkins, pp. 3 and 7; Direct Testimony of R. Spector, p. 4.

Ranking of U.S. Utilities by Percent Leak Prone Metallic Mains

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	3,023	491	1,605	2,096	69.3%
2	CONSOLIDATED EDISON CO OF NEW YORK	NY	4,283	1,065	1,147	2,212	51.6%
3	BOSTON GAS CO	MA	6,342	1,319	1,946	3,266	51.5%
4	KEYSPAN ENERGY DELIVERY - LONG ISLAND	NY	7,931	3,380	317	3,697	46.6%
5	KEYSPAN ENERGY DELIVERY - NY CITY	NY	4,134	314	1,586	1,900	46.0%
6	WASHINGTON GAS LIGHT CO	DC	1,212	88	415	503	41.5%
7	NIAGARA MOHAWK POWER CORP	RI	3,188	483	822	1,305	40.9%
8	PEOPLES GAS LIGHT & COKE CO	IL	4,327	0	1,595	1,595	36.9%
9	NSTAR GAS COMPANY	MA	3,231	734	380	1,114	34.5%
10	DOMINION HOPE	WV	3,146	1,073	-	1,073	34.1%
11	PENSACOLA, ENERGY SERVICES OF	FL	1,606	438	85	523	32.6%
12	SOUTHERN CONNECTICUT GAS CO	CT	2,358	93	663	756	32.1%
13	PEOPLES NATURAL GAS COMPANY LLC	PA	10,335	3,064	111	3,175	30.7%
14	MOUNTAINEER GAS CO	WV	5,760	1,759	-	1,759	30.5%
15	PEOPLES TWP LLC	PA	2,622	776	-	776	29.6%
16	PUBLIC SERVICE ELECTRIC & GAS CO	NJ	17,857	1,024	4,045	5,069	28.4%
17	DOMINION EAST OHIO	OH	19,632	5,458	70	5,528	28.2%
18	NATIONAL FUEL GAS DISTRIBUTION CORP	PA	4,831	1,046	167	1,213	25.1%
19	COLUMBIA GAS OF PENNSYLVANIA	PA	7,443	1,529	128	1,657	22.3%
20	ELIZABETHTOWN GAS CO	NJ	3,163	90	613	703	22.2%
21	NATIONAL FUEL GAS DISTRIBUTION CORP - NEW	NY	9,636	1,768	326	2,094	21.7%
22	DTE GAS COMPANY	MI	19,029	1,576	2,364	3,939	20.7%
23	OKALOOSA COUNTY GAS DISTRICT	FL	1,328	254	19	273	20.6%
24	KANSAS GAS SERVICE COMPANY, A DIVISION OF	KS	11,361	2,096	70	2,166	19.1%
25	**ATMOS ENERGY CORPORATION - CO/KS (KS ON**	**KS**	**3,628**	**682**	**-**	**682**	**18.8%**
26	BALTIMORE GAS & ELECTRIC CO	MD	7,173	35	1,278	1,313	18.3%
27	CENTRAL HUDSON GAS & ELECTRIC CORP	NY	1,229	140	85	225	18.3%
28	UGI CENTRAL PENN GAS, INC	PA	3,684	647	9	656	17.8%
29	CONNECTICUT NATURAL GAS CORP	CT	2,079	20	347	367	17.7%
30	COLUMBIA GAS OF MASSACHUSETTS	MA	4,945	319	554	872	17.6%
31	PECO ENERGY CO	PA	6,780	426	770	1,196	17.6%

[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.

Ranking of U.S. Utilities by Percent Leak Prone Metallic Mains

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
32	COLUMBIA GAS OF KENTUCKY INC	KY	2,570	414	16	429	16.7%
33	MISSOURI GAS ENERGY	MO	8,582	1,100	323	1,423	16.6%
34	UGI PENN NATURAL GAS	PA	2,515	306	106	412	16.4%
35	SOUTHERN CALIFORNIA GAS CO	CA	50,156	8,057	-	8,057	16.1%
36	METROPOLITAN UTILITIES DISTRICT	NE	2,790	20	427	447	16.0%
37	ALABAMA GAS CORPORATION	AL	11,017	986	768	1,754	15.9%
38	ARKANSAS OKLAHOMA GAS CORP	AR	1,634	247	-	247	15.1%
39	RICHMOND, CITY OF	VA	1,911	5	278	283	14.8%
40	COLUMBIA GAS OF OHIO INC	OH	19,881	2,745	194	2,939	14.8%
41	CENTERPOINT ENERGY RESOURCES CORP.	OK	2,735	398	-	398	14.6%
42	VECTREN ENERGY DELIVERY OF OHIO	OH	5,393	689	89	779	14.4%
43	YANKEE GAS SERVICES CO	CT	3,302	96	368	464	14.1%
44	ATMOS ENERGY CORPORATION - MID-TEX	TX	31,862	3,718	678	4,396	13.8%
45	UGI UTILITIES, INC	PA	5,525	471	279	750	13.6%
46	SOUTH JERSEY GAS CO	NJ	6,339	660	147	807	12.7%
47	SOUTHERN INDIANA GAS & ELECTRIC CO	IN	3,043	278	105	382	12.6%
48	AGRITEXGAS L P	TX	4,380	540	-	540	12.3%
49	CENTERPOINT ENERGY RESOURCES CORP.	LA	3,990	375	107	483	12.1%
50	COLONIAL GAS CO - LOWELL DIV	MA	1,396	67	99	166	11.9%
51	SOURCEGAS ARKANSAS INC.	AR	4,896	539	-	539	11.0%
52	ORANGE & ROCKLAND UTILITY INC	NY	1,849	173	15	188	10.2%
53	VIRGINIA NATURAL GAS	VA	5,338	498	43	541	10.1%
54	ENERGY NORTH NATURAL GAS INC	NH	1,354	26	105	131	9.7%
55	MIDWEST ENERGY INC	KS	3,060	286	-	286	9.3%
56	ENTERGY NEW ORLEANS, INC	LA	1,708	-	156	156	9.1%
57	NIAGARA MOHAWK POWER CORP	NY	8,643	231	523	754	8.7%
58	LACLEDE GAS CO	MO	8,608	26	704	730	8.5%
59	CENTERPOINT ENERGY RESOURCES CORPORA	MS	3,961	322	-	322	8.1%
60	BLACK HILLS ENERGY	KS	2,801	225	-	225	8.0%
…	…	…	…	…	…	…	…
176	MADISON GAS & ELECTRIC CO	WI	2,603	-	-	-	0.0%

[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.

Ranking of U.S. Utilities by Percent Leak Prone Metallic Service Lines

Rank	Operator Name	State	Total Number of Services	Number of Leak-Prone Steel Services[1]	Number of Leak-Prone Iron and Copper Services[2]	Total Number of Leak-Prone Metallic Services	Percent Leak-Prone Metallic Services
1	LIBERTY UTILITIES MASSACHUSETTS	MA	35,923	13,109	-	13,109	36.5%
2	PENSACOLA, ENERGY SERVICES OF	FL	57,877	16,040	-	16,040	27.7%
3	KEYSPAN ENERGY DELIVERY - NY CITY	NY	568,913	24,450	129,131	153,581	27.0%
4	NIAGARA MOHAWK POWER CORP	NY	555,686	129,432	19,687	149,119	26.8%
5	DTE GAS COMPANY	MI	1,197,585	189,571	131,711	321,282	26.8%
6	NIAGARA MOHAWK POWER CORP	RI	193,615	49,265	395	49,660	25.6%
7	PHILADELPHIA GAS WORKS	PA	471,945	118,478	15	118,493	25.1%
8	CENTRAL HUDSON GAS & ELECTRIC COI	NY	60,885	9,670	5,604	15,274	25.1%
9	BOSTON GAS CO	MA	495,167	110,226	10,644	120,870	24.4%
10	WASHINGTON GAS LIGHT CO	DC	123,925	18,999	11,073	30,072	24.3%
11	ENTERGY NEW ORLEANS, INC	LA	99,650	23,759	4	23,763	23.8%
12	CONSOLIDATED EDISON CO OF NEW YO	NY	369,339	68,834	17,492	86,326	23.4%
13	KEYSPAN ENERGY DELIVERY - LONG ISL	NY	535,580	116,951	5,308	122,259	22.8%
14	ALABAMA GAS CORPORATION	AL	549,002	121,506	1,119	122,625	22.3%
15	SOUTHERN CONNECTICUT GAS CO	CT	140,276	30,927	170	31,097	22.2%
16	KANSAS GAS SERVICE COMPANY, A DIVI	OK	34,911	7,446	-	7,446	21.3%
17	MOUNTAINEER GAS CO	WV	257,410	54,371	31	54,402	21.1%
18	HAWAI`IGAS	HI	34,692	6,991	30	7,021	20.2%
19	OKALOOSA COUNTY GAS DISTRICT	FL	49,678	9,797	-	9,797	19.7%
20	SOUTHERN CALIFORNIA GAS CO	CA	4,369,671	857,210	-	857,210	19.6%
21	**ATMOS ENERGY CORPORATION - CO/KS**	**KS**	**144,368**	**28,149**	**-**	**28,149**	**19.5%**
22	NSTAR GAS COMPANY	MA	198,775	37,801	763	38,564	19.4%
23	BERKSHIRE GAS CO	MA	31,775	5,820	289	6,109	19.2%
24	ARKANSAS OKLAHOMA GAS CORP	AR	55,274	10,575	-	10,575	19.1%
25	BALTIMORE GAS & ELECTRIC CO	MD	530,089	77,194	22,490	99,684	18.8%
26	ELIZABETHTOWN GAS CO	NJ	223,527	7,710	34,009	41,719	18.7%
27	PUBLIC SERVICE ELECTRIC & GAS CO	NJ	1,253,587	199,679	32,560	232,239	18.5%
28	COLUMBIA GAS OF MASSACHUSETTS	MA	263,029	45,303	542	45,845	17.4%
29	DOMINION HOPE	WV	112,495	19,126	-	19,126	17.0%
30	MARSHALL COUNTY GAS DISTRICT	AL	25,575	4,160	-	4,160	16.3%
31	PEOPLES TWP LLC	PA	58,666	9,423	-	9,423	16.1%
32	CENTERPOINT ENERGY RESOURCES CC	OK	122,405	19,309	-	19,309	15.8%
33	DELMARVA POWER & LIGHT COMPANY	DE	121,808	13,317	4,785	18,102	14.9%

[1] Includes the total number of unprotected bare steel, unprotected coated steel, and protected bare steel service lines.
[2] Includes the total number of cast iron, ductile iron, and copper service lines.
Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1.

Ranking of U.S. Utilities by Percent Leak Prone Metallic Service Lines

Rank	Operator Name	State	Total Number of Services	Number of Leak-Prone Steel Services[1]	Number of Leak-Prone Iron and Copper Services[2]	Total Number of Leak-Prone Metallic Services	Percent Leak-Prone Metallic Services
34	COLUMBIA GAS OF PENNSYLVANIA	PA	420,733	57,722	-	57,722	13.7%
35	CONSUMERS ENERGY CO	MI	1,551,307	35,746	165,680	201,426	13.0%
36	ENERGY NORTH NATURAL GAS INC	NH	66,823	8,255	273	8,528	12.8%
37	YANKEE GAS SERVICES CO	CT	156,757	19,046	513	19,559	12.5%
38	LIBERTY ENERGY (GEORGIA) CORP D/B/.	GA	68,649	8,432	-	8,432	12.3%
39	UGI PENN NATURAL GAS	PA	171,683	20,996	-	20,996	12.2%
40	NATIONAL FUEL GAS DISTRIBUTION COR	PA	193,550	23,426	-	23,426	12.1%
41	LACLEDE GAS CO	MO	617,385	6,121	67,233	73,354	11.9%
42	KANSAS GAS SERVICE COMPANY, A DIVI	KS	629,825	74,297	-	74,297	11.8%
43	NATIONAL FUEL GAS DISTRIBUTION COR	NY	453,903	51,813	-	51,813	11.4%
44	DUKE ENERGY OHIO	OH	404,188	3,862	42,120	45,982	11.4%
45	ESSEX COUNTY GAS CO	MA	43,215	4,830	6	4,836	11.2%
46	COLUMBIA GAS OF MARYLAND INC	MD	34,977	3,852	-	3,852	11.0%
47	CENTERPOINT ENERGY RESOURCES CC	LA	160,853	17,686	-	17,686	11.0%
48	ROCHESTER GAS & ELECTRIC CORP	NY	280,051	18,909	10,681	29,590	10.6%
49	PEOPLES NATURAL GAS COMPANY LLC	PA	613,036	56,154	8,084	64,238	10.5%
50	VECTREN ENERGY DELIVERY OF OHIO	OH	324,631	31,802	-	31,802	9.8%
51	WASHINGTON GAS LIGHT CO	MD	420,930	14,862	25,456	40,318	9.6%
52	PECO ENERGY CO	PA	444,762	39,244	2,366	41,610	9.4%
53	UGI UTILITIES, INC	PA	355,326	20,774	9,242	30,016	8.4%
54	HUNTSVILLE GAS SYSTEM	AL	50,605	4,217	-	4,217	8.3%
55	COLUMBIA GAS OF OHIO INC	OH	1,385,726	113,384	-	113,384	8.2%
56	CONNECTICUT NATURAL GAS CORP	CT	133,035	10,293	578	10,871	8.2%
57	NEW YORK STATE ELECTRIC & GAS COF	NY	235,710	19,085	-	19,085	8.1%
58	DUKE ENERGY KENTUCKY	KY	96,616	192	7,459	7,651	7.9%
59	COLUMBIA GAS OF KENTUCKY INC	KY	136,162	10,543	-	10,543	7.7%
60	RICHMOND, CITY OF	VA	96,212	3,671	3,601	7,272	7.6%
61	WASHINGTON GAS LIGHT CO	VA	448,667	10,548	22,197	32,745	7.3%
62	COLONIAL GAS CO - LOWELL DIV	MA	75,320	5,424	1	5,425	7.2%
63	MIDWEST ENERGY INC	KS	39,990	2,649	-	2,649	6.6%
64	FLORIDA PUBLIC UTILITIES CO	FL	69,710	4,543	-	4,543	6.5%
65	VIRGINIA NATURAL GAS	VA	319,959	19,588	507	20,095	6.3%
66	NATIONAL GAS & OIL CORP	OH	32,591	2,022	-	2,022	6.2%

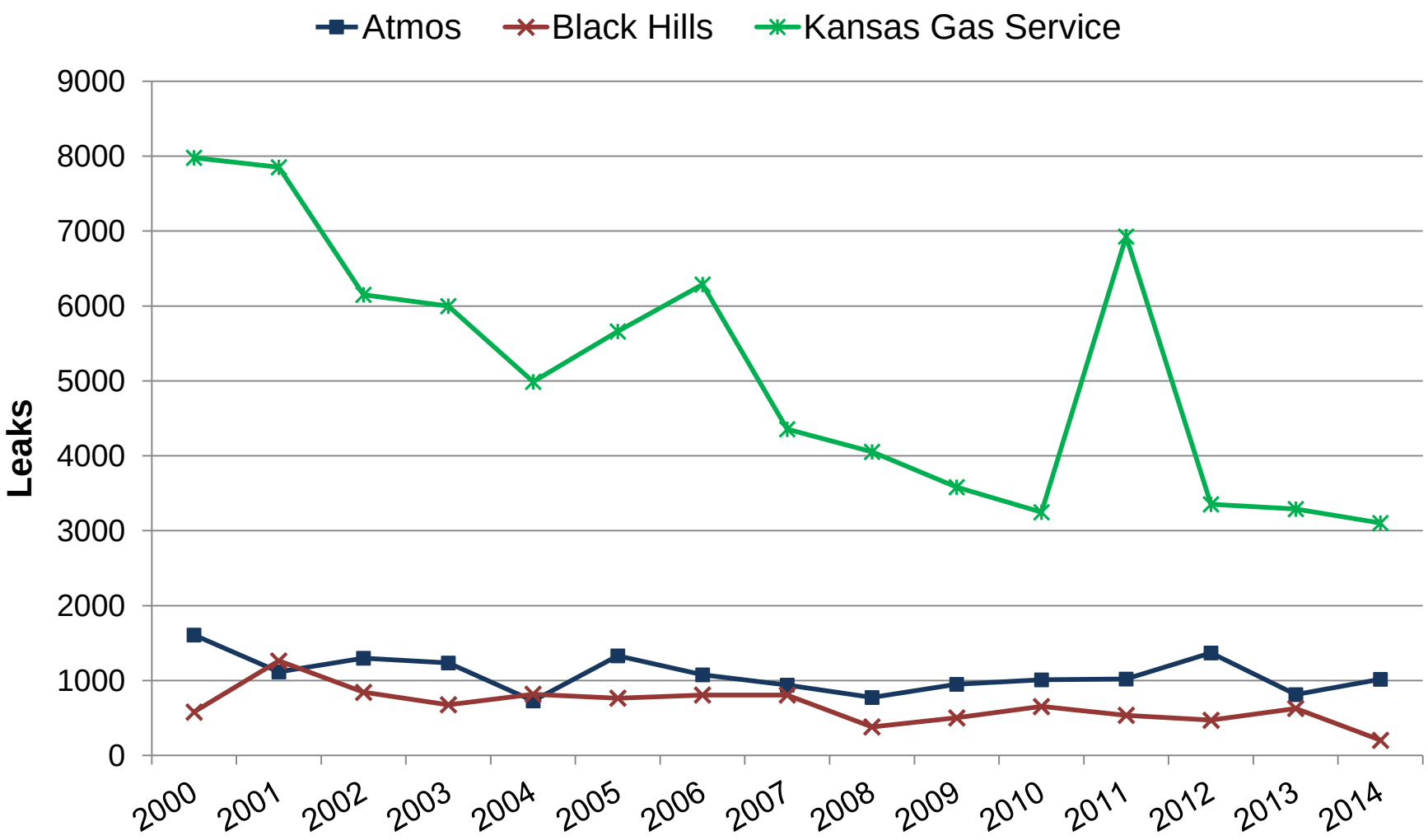
[1] Includes the total number of unprotected bare steel, unprotected coated steel, and protected bare steel service lines.
[2] Includes the total number of cast iron, ductile iron, and copper service lines.
Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1.

Ranking of U.S. Utilities by Percent Leak Prone Metallic Service Lines

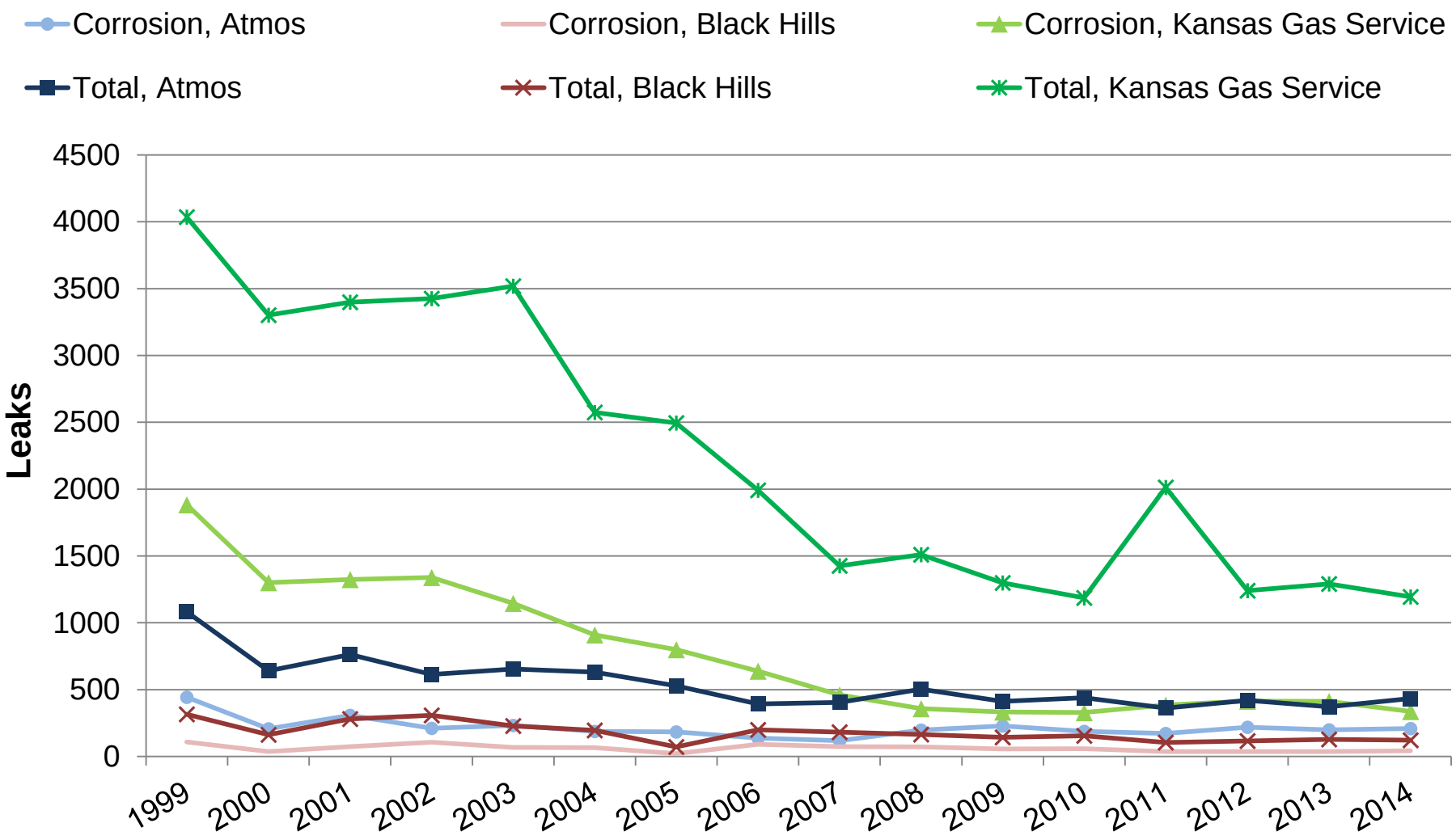
Rank	Operator Name	State	Total Number of Services	Number of Leak-Prone Steel Services[1]	Number of Leak-Prone Iron and Copper Services[2]	Total Number of Leak-Prone Metallic Services	Percent Leak-Prone Metallic Services
67	SOURCEGAS ARKANSAS INC.	AR	167,913	10,278	-	10,278	6.1%
68	NEW JERSEY NATURAL GAS CO	NJ	496,165	29,912	-	29,912	6.0%
69	CENTERPOINT ENERGY RESOURCES CC	AR	450,546	27,128	10	27,138	6.0%
70	ATMOS ENERGY CORPORATION - COLOF	CO	96,416	5,435	-	5,435	5.6%
71	ATMOS ENERGY CORPORATION - WEST	TX	376,834	20,226	-	20,226	5.4%
72	ROANOKE GAS CO	VA	59,185	3,150	-	3,150	5.3%
73	COLORADO SPRINGS, CITY OF	CO	157,814	8,178	-	8,178	5.2%
74	SOUTH JERSEY GAS CO	NJ	369,810	18,896	-	18,896	5.1%
75	ATMOS ENERGY CORPORATION - MID-TE	TX	1,402,610	70,979	-	70,979	5.1%
76	OHIO GAS CO	OH	49,353	2,497	-	2,497	5.1%
77	DOMINION EAST OHIO	OH	1,198,284	-	52,980	52,980	4.4%
78	ORANGE & ROCKLAND UTILITY INC	NY	104,093	4,602	-	4,602	4.4%
79	METROPOLITAN UTILITIES DISTRICT	NE	201,153	-	8,563	8,563	4.3%
80	OHIO VALLEY GAS CORP	IN	28,487	1,085	-	1,085	3.8%
81	PEOPLES GAS LIGHT & COKE CO	IL	515,719	5,404	13,575	18,979	3.7%
82	LIBERTY ENERGY (MID-STATES) CORP D	IL	25,732	946	-	946	3.7%
83	CAPE COD GAS CO (DIV OF COLONIAL G	MA	113,534	4,076	16	4,092	3.6%
84	SOURCEGAS LLC	WY	82,700	2,892	-	2,892	3.5%
85	ATMOS ENERGY CORPORATION - KY/MID	KY	178,480	6,105	-	6,105	3.4%
86	DELTA NATURAL GAS CO INC	KY	41,365	1,322	-	1,322	3.2%
87	TEXAS GAS SERVICE COMPANY, A DIVISI	TX	599,364	18,068	517	18,585	3.1%
88	CORPUS CHRISTI, CITY OF - GAS DIV	TX	60,068	-	1,801	1,801	3.0%
89	MIDAMERICAN ENERGY COMPANY	SD	81,375	2,333	44	2,377	2.9%
90	MIDAMERICAN ENERGY COMPANY	IA	509,758	14,849	7	14,856	2.9%
91	WISCONSIN GAS LLC DBA WE ENERGIES	WI	512,509	-	13,850	13,850	2.7%
92	NORTHERN ILLINOIS GAS CO	IL	2,034,204	17,900	32,192	50,092	2.5%
93	BLACK HILLS ENERGY	KS	99,570	2,449	-	2,449	2.5%
…	…	…	…	…	…	…	…
194	SPRINGFIELD, CITY UTILITIES OF	MO	77,385	-	-	-	0.0%

[1] Includes the total number of unprotected bare steel, unprotected coated steel, and protected bare steel service lines.
[2] Includes the total number of cast iron, ductile iron, and copper service lines.
Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1.

Total Detected Leaks Per Year

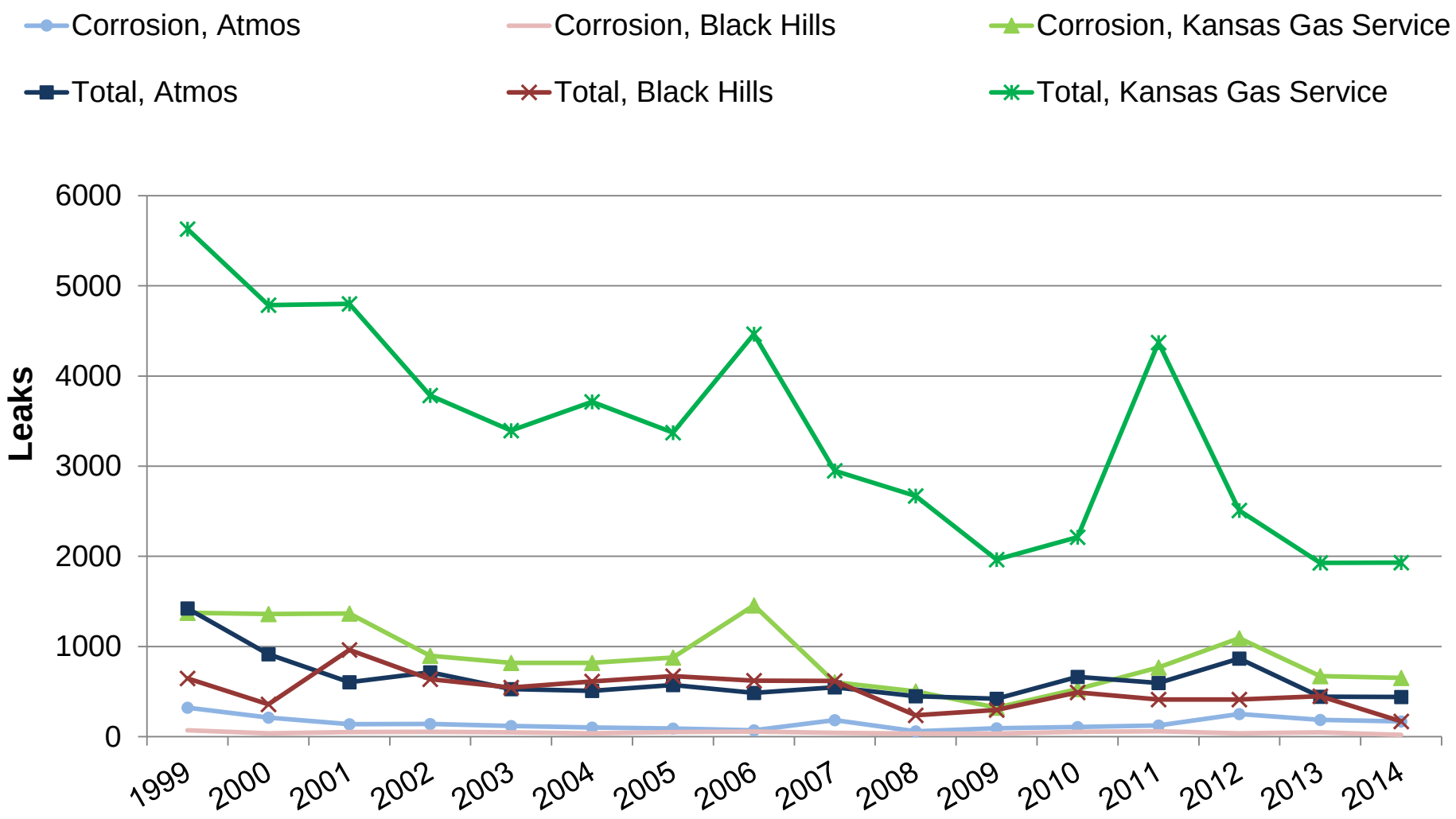


History of Leak Repairs on Mains for Atmos, Black Hills, and Kansas Gas Service



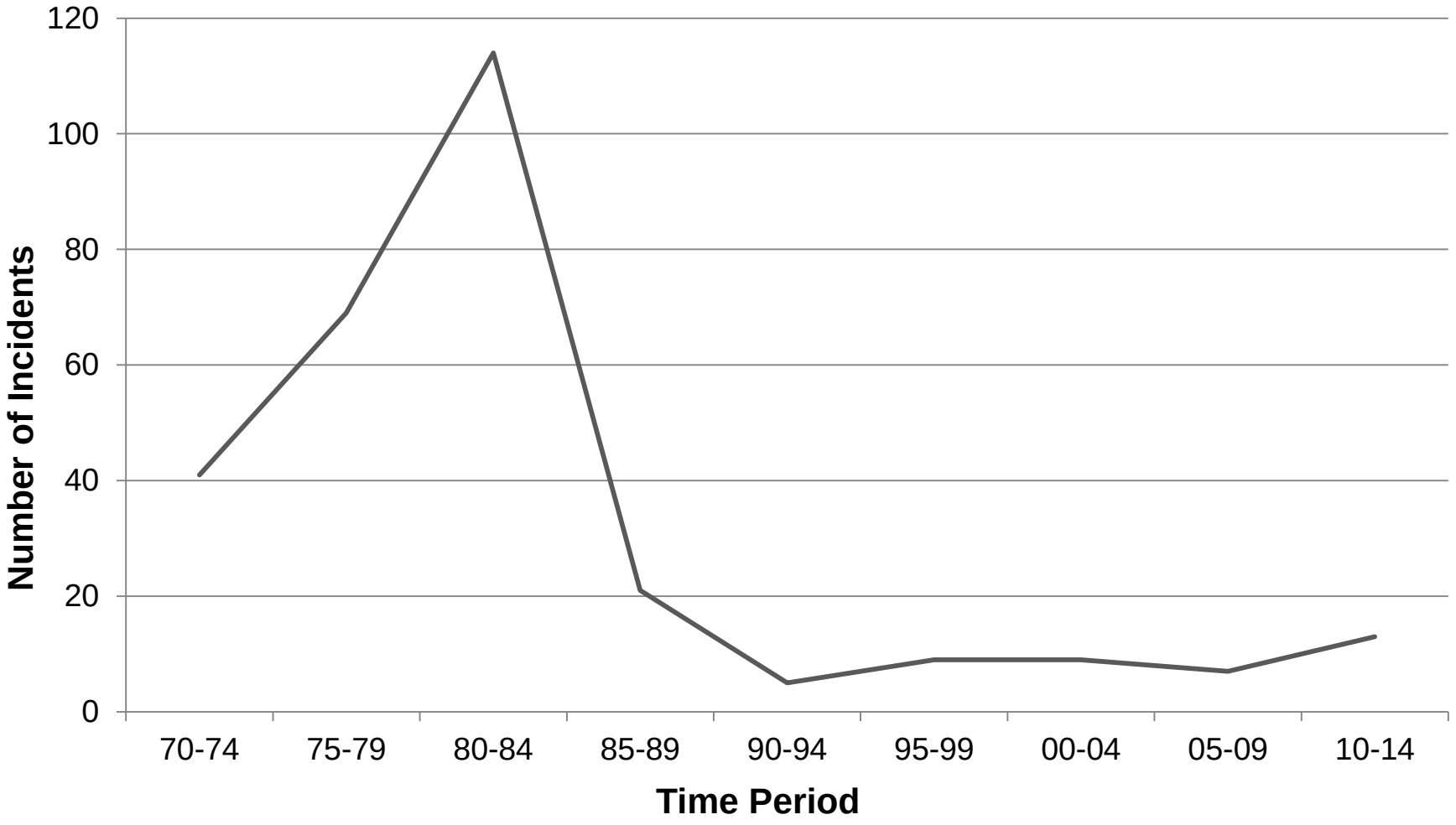
Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1.

History of Leak Repairs on Service Lines for Atmos Black Hills, and Kansas Gas Service

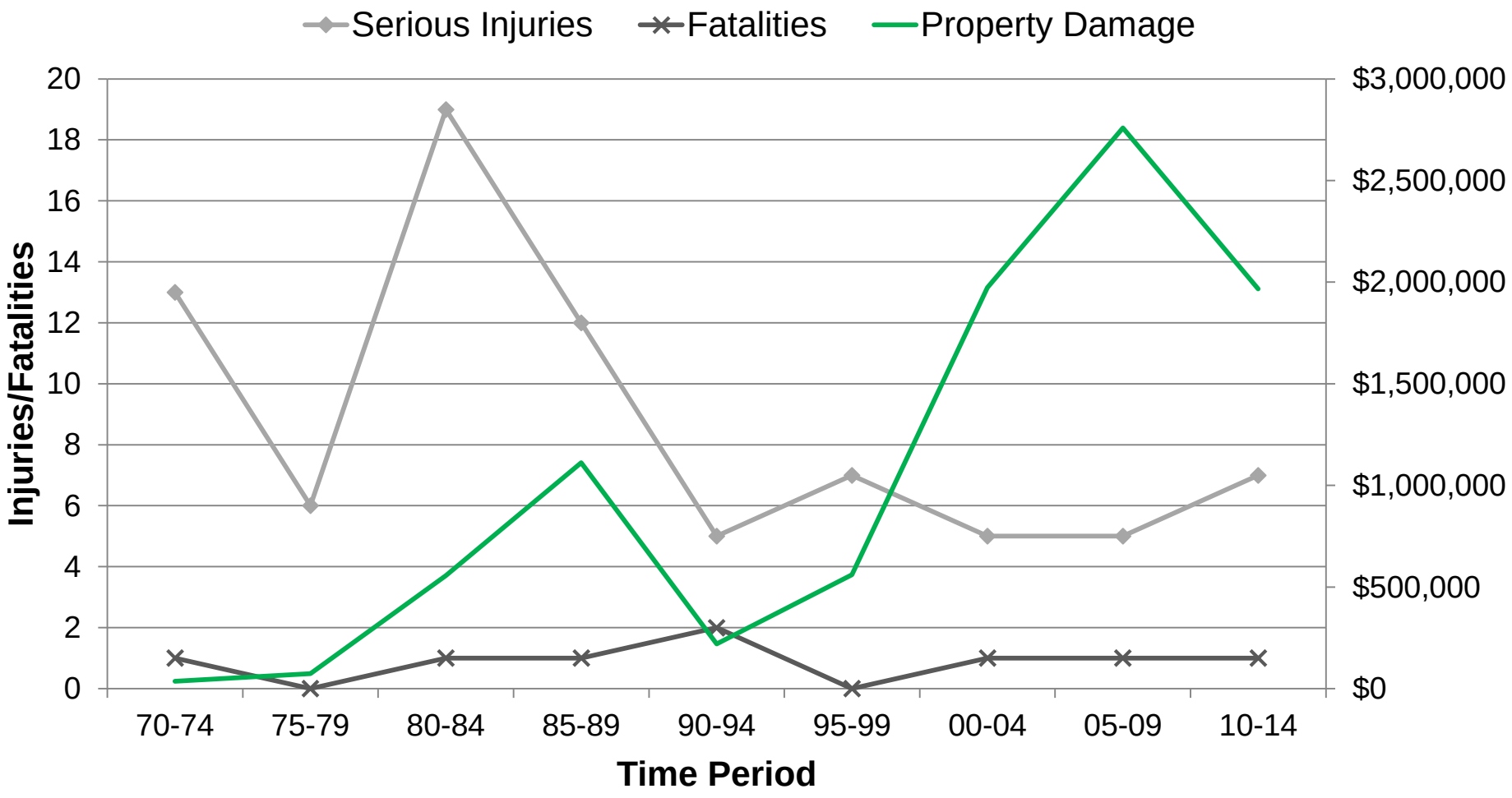


Source: Annual DOT Gas Distribution Reports, PHMSA Form 7100.1-1.

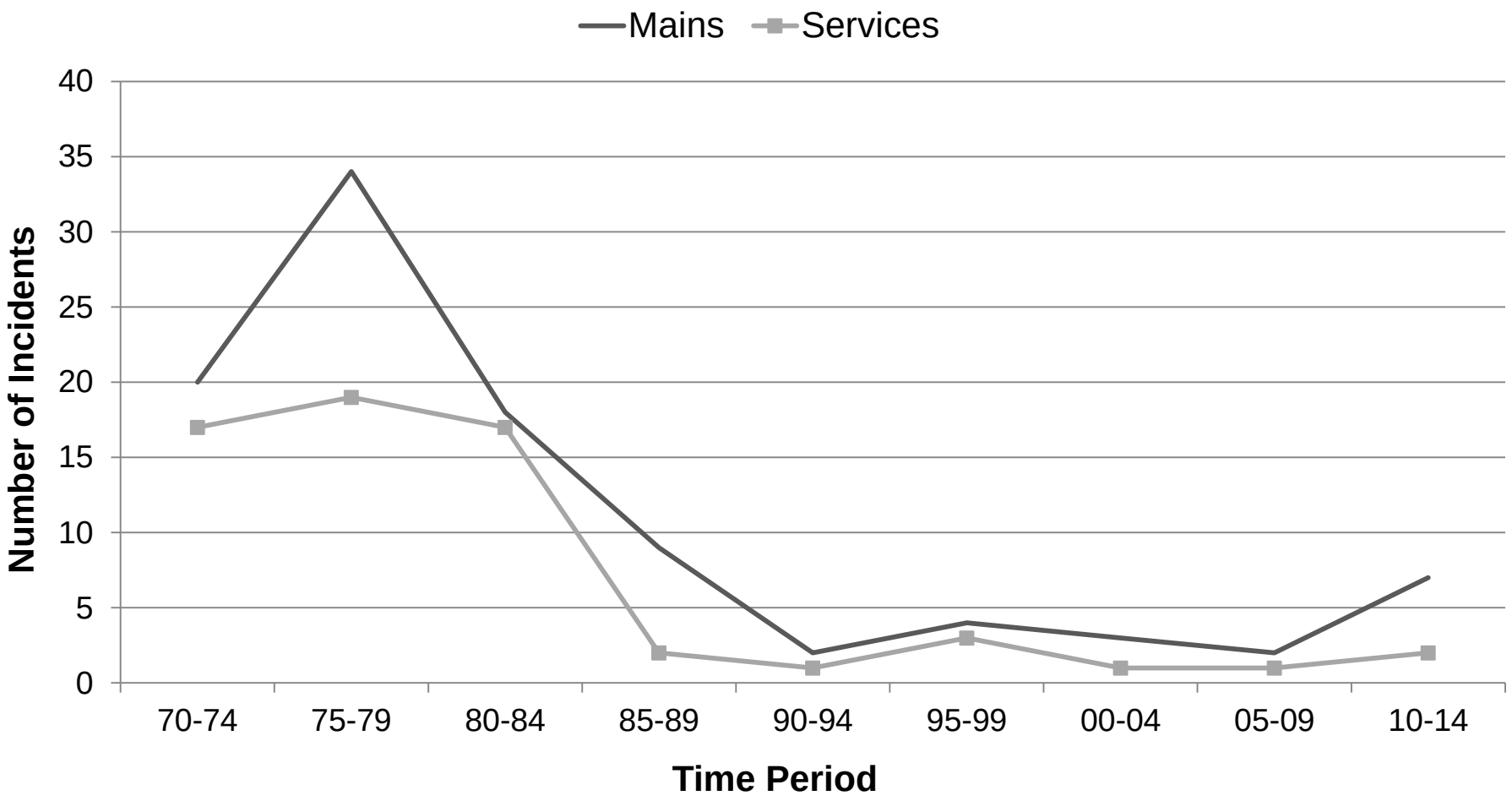
Frequency of Reportable Incidents in Kansas



Severity of Incidents in Kansas

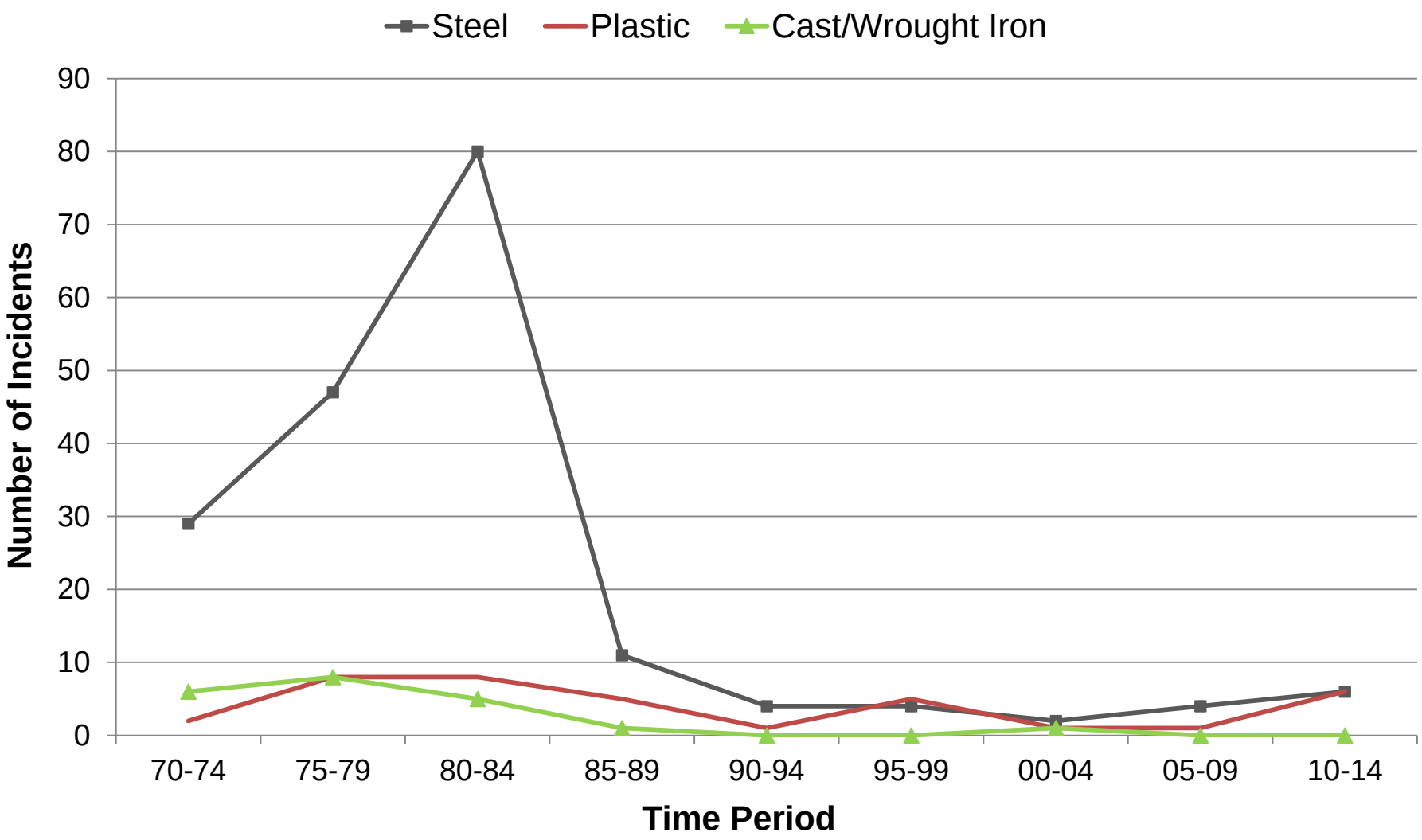


Piping Asset Involved in Kansas Incidents

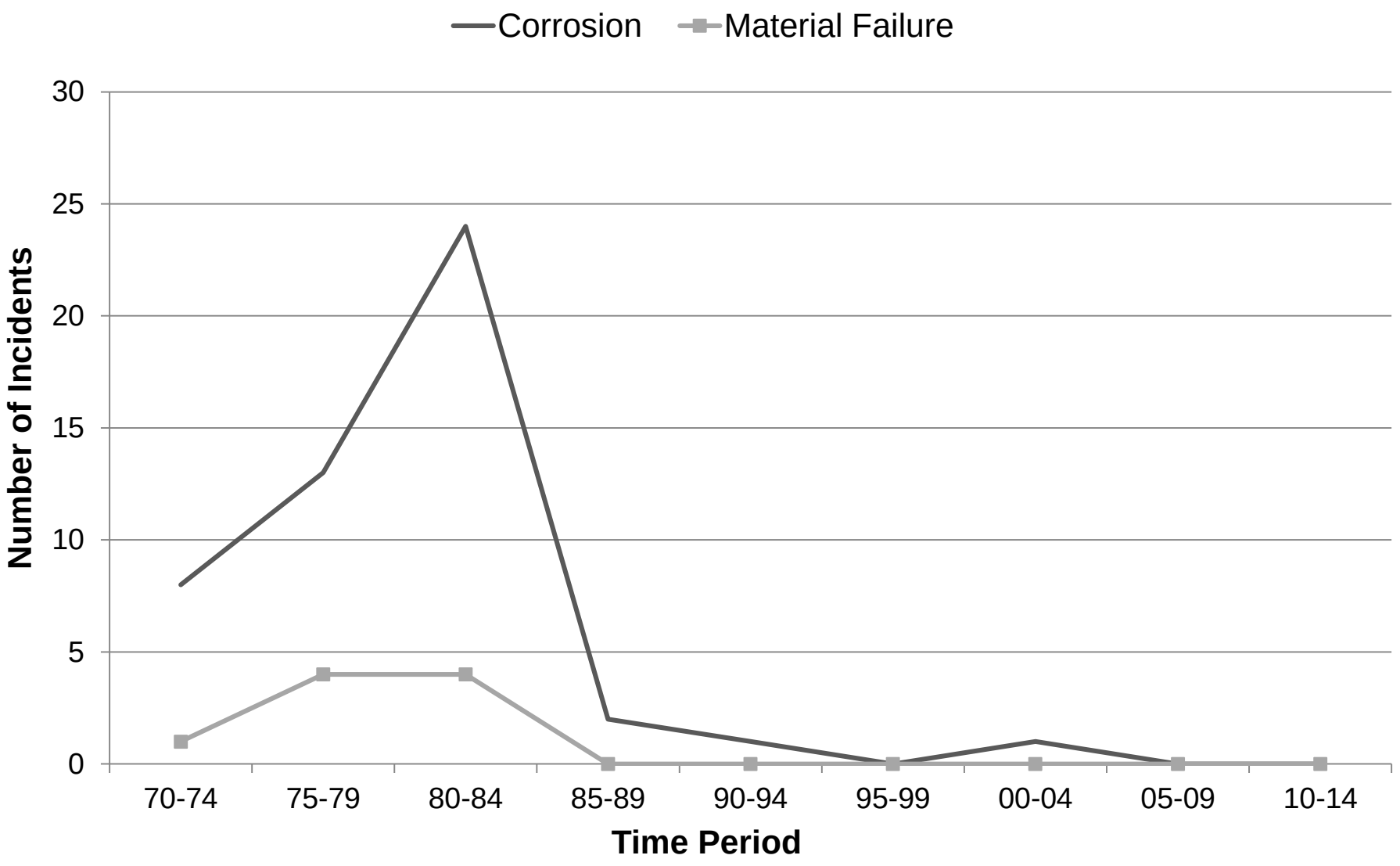


Note: For several years in the early 1980's (approx. Nov., 1982 to April, 1984) the PHMSA incident files do not indicate whether the incident occurred on a Main or Service Line. Therefore, the incidents shown occurring during the five-year time period 80-84 do not include all incidents.

Piping Material Involved in Kansas Incidents



Selected Causes Identified in Kansas Incidents



CERTIFICATE OF SERVICE

15-GIMG-343-GIG

I, the undersigned, hereby certify that a true and correct copy of the above and foregoing document was served by electronic service on this 29th day of January, 2016, to the following:

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