COMMONWEALTH OF KENTUCKY
BEFORE THE
KENTUCKY PUBLIC SERVICE COMMISSION

In the Matter of:

The Application of Duke Energy Kentucky, Inc., for a Certificate of Public Convenience and Necessity Authorizing the Implementation of an Accelerated Service Line Replacement Program, Approval of Ownership of Service Lines, and a Gas Pipeline Replacement Surcharge	)	Case No. 2015-00210

DIRECT TESTIMONY OF

JOHN A. HILL JR.

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

July 6, 2015

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ATTACHMENT

I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is John A. Hill Jr., and my business address is 139 East Fourth Street, Cincinnati, Ohio 45202.

Q. BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?

A. I am employed by the Duke Energy Business Services LLC (DEBS) as Director, Gas Engineering for Duke Energy Kentucky, Inc., (Duke Energy Kentucky or Company) and Duke Energy Ohio, Inc. (Duke Energy Ohio). DEBS provides various administrative and other services to Duke Energy Kentucky and other affiliated companies of Duke Energy Corporation (Duke Energy).

Q. PLEASE BRIEFLY SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I graduated from the University of Cincinnati with a Bachelor of Science in Civil & Environmental Engineering and later obtained an MBA from the University of Kentucky. In 1996, I obtained my license as a Professional Engineer in the Commonwealth of Kentucky and, by reciprocity, later in the State of Ohio. I started my career as an engineering consultant focused mainly on completing geotechnical and environmental projects for various companies and public agencies. I then worked for an investor-owned water utility, overseeing new development and pipeline extension projects as well as asset mapping/records. I joined Cinergy Corp. in 2001 and held various management/leadership positions in Generation and Environmental, Health & Safety and, in 2010, joined the Gas Engineering Department as Director of Engineering.

Q. PLEASE SUMMARIZE YOUR RESPONSIBILITIES AS DIRECTOR, GAS ENGINEERING.

A. As Director, Gas Engineering, I oversee multiple engineering disciplines (Civil, Mechanical, Electrical/Controls, and Corrosion) and technical functions responsible for gas pipeline activities such as design, system monitoring, system design, meter/regulator design, integrity management and corrosion services. I also provide planning and oversight for the Gas Operations capital budget. In addition, I represent Gas Operations on Corporate and Industry initiatives/committees. Importantly, I provide subject matter expertise for Duke Energy Kentucky and Duke Energy Ohio's integrity management programs.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE KENTUCKY PUBLIC SERVICE COMMISSION?

A. No.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to discuss Duke Energy Kentucky's natural gas distribution integrity management program (DIMP) and the federal and state regulations that drive the Company's mission to provide safe, reliable, and affordable natural gas distribution service to its customers. I will also provide an overview of Duke Energy Kentucky's annual capital expenditures for current gas system integrity, safety, and reliability projects and how the associated capital expenditures are categorized and prioritized. I then discuss how Duke Energy

Kentucky's proposed Accelerated Service Line Replacement Program (ASRP) is necessary to fulfill that mission and to comply with state and federal regulations.

II. DISTRIBUTION INTEGRITY MANAGEMENT PROGRAMS

Q. PLEASE EXPLAIN WHO REGULATES DISTRIBUTION INTEGRITY MANAGEMENT FOR NATURAL GAS UTILITIES.

A. The DIMP is part of the Pipeline Safety Regulations, CFR Part 192, administered by the Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA).

Q. PLEASE IDENTIFY THE REGULATIONS THAT DRIVE DUKE ENERGY KENTUCKY'S DISTRIBUTION INTEGRITY MANAGEMENT INITIATIVES.

A. CFR 192 Subpart P – Gas Distribution Pipeline Integrity Management defines the required Integrity Management Program as "an overall approach by an operator to ensure the integrity of its gas distribution system.

Q. WHY IS DISTRIBUTION INTEGRITY MANAGEMENT IMPORTANT?

A. As stated previously, distribution integrity management is an overall approach to ensure the integrity (*i.e.* safety) of the gas distribution system. These regulations impose upon the Company an obligation to continuously evaluate the reliability of its distribution system and to maintain and improve its safety and performance.

Q. PLEASE DESCRIBE DUKE ENERGY KENTUCKY'S CURRENT DIMP.

A. Duke Energy Kentucky's DIMP is summarized in a written document that meets all the requirements of CFR 192 Subpart P – Gas Distribution Pipeline Integrity Management and follows the following seven elements outlined in the regulation:

1) Knowledge of the gas distribution system;

2) Identify threats;

3) Evaluate and rank risk;

4) Identify and implement measures to address risks;

5) Measure performance, monitor results, and evaluate effectiveness;

6) Periodic evaluation and improvement; and

7) Report results.

These elements support the basis of the DIMP and provide direction in evaluating initiatives to reduce risks in the distribution system.

Q. PLEASE EXPLAIN HOW DUKE ENERGY KENTUCKY IDENTIFIES, DESIGNS, PRIORITIZES, AND IMPLEMENTS PROJECTS BASED ON ITS DIMP.

A. Duke Energy Kentucky identifies, evaluates, and ranks risks in its distribution system and prioritizes measures to address these risks based on a relative risk model that takes into consideration threats to the system as defined in CFR 192.1007, which include corrosion, natural forces, excavation damage, material, weld or joint failure, incorrect operation, and other concerns that would threaten the integrity of the pipeline. The method used to determine the risk in Duke Energy Kentucky's distribution system is based on the relative risk associated with repaired leaks. This risk is then aggregated for the entire system. The model is configured to utilize consequence values and a probability of one for each individual leak repair. Risk is calculated for each repair along with the inclusion of facility and location data. Individual leak risk is then summed up to develop

risk scores at a system level. Threats with the highest total risk scores are then reviewed to determine appropriate measures to reduce and/or eliminate the risk.

Attachment JH-1 is a true and accurate copy of a summary of how the relative risk is developed under the DIMP.

Q. HAS DUKE ENERGY KENTUCKY IMPLEMENTED ANY OTHER PROGRAMS DESIGNED TO IMPROVE SAFETY AND RELIABILITY?

A. Yes.

Q. PLEASE DESCRIBE THE COMPANY'S OTHER PROGRAMS THAT ADDRESS DISTRIBUTION SYSTEM RELIABILITY.

A. Duke Energy Kentucky has implemented several programs over time to improve the safety and reliability of our distribution system. The most noteworthy of these programs was its accelerated main replacement program (AMRP). The AMRP began in 2001, when Duke Energy Kentucky, with the approval of the Kentucky Public Service Commission, implemented a ten-year replacement program for certain of its gas mains that were considered high risk for leak or failure (cast iron and bare steel). The AMRP initiative also included certain leak -prone service lines that were attached to the gas mains targeted for replacement. The AMRP however, did not include replacement of all leak-prone service lines. Only those service lines that were directly attached to mains targeted for replacement under the AMRP were replaced.

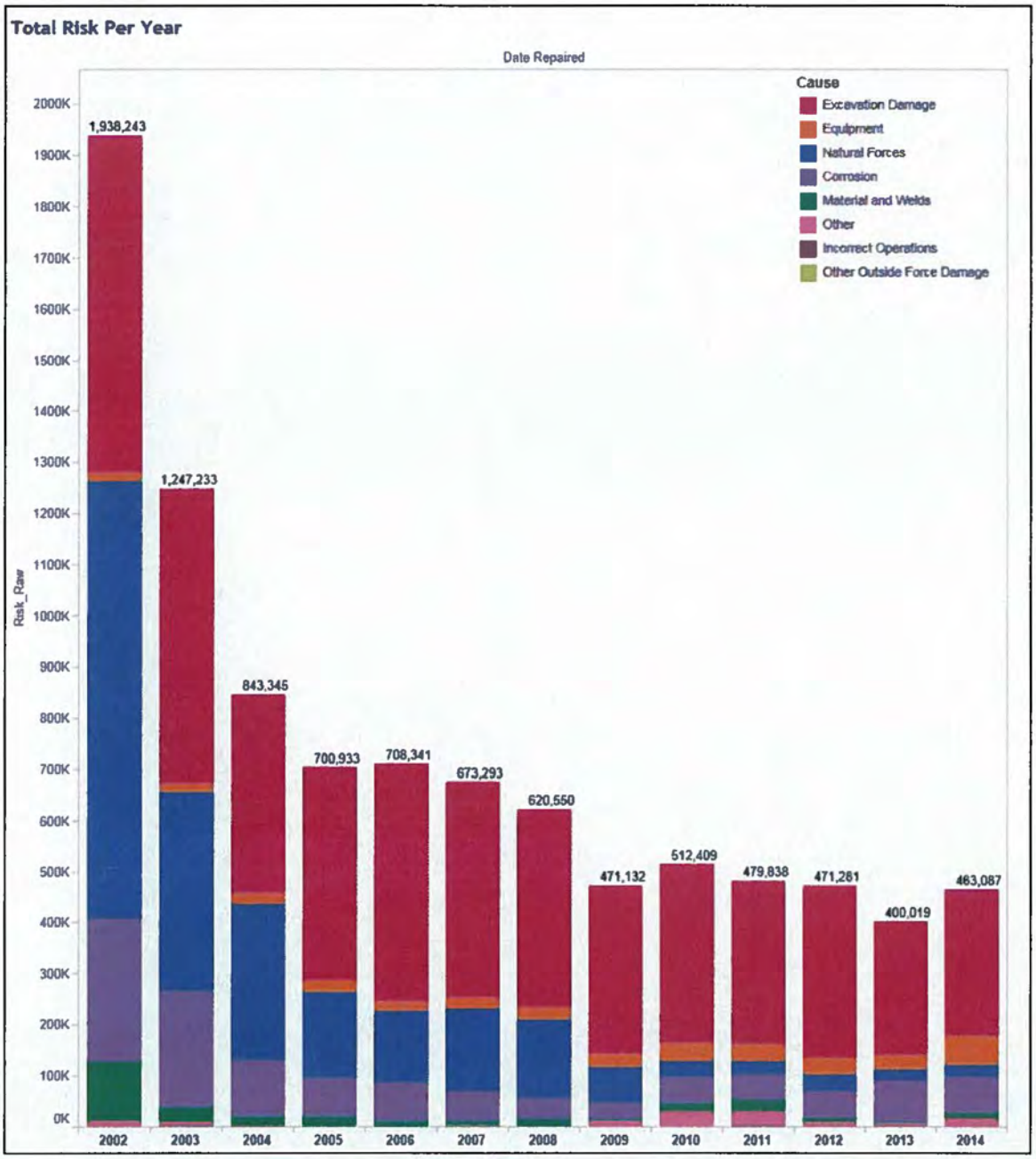
The Company has also implemented a riser replacement program to replace service head adapters that had a high likelihood of leakage. Additionally, the Company has several other initiatives to enhance the safety of its delivery

system, as well as public education campaigns to increase customer awareness of natural gas safety.

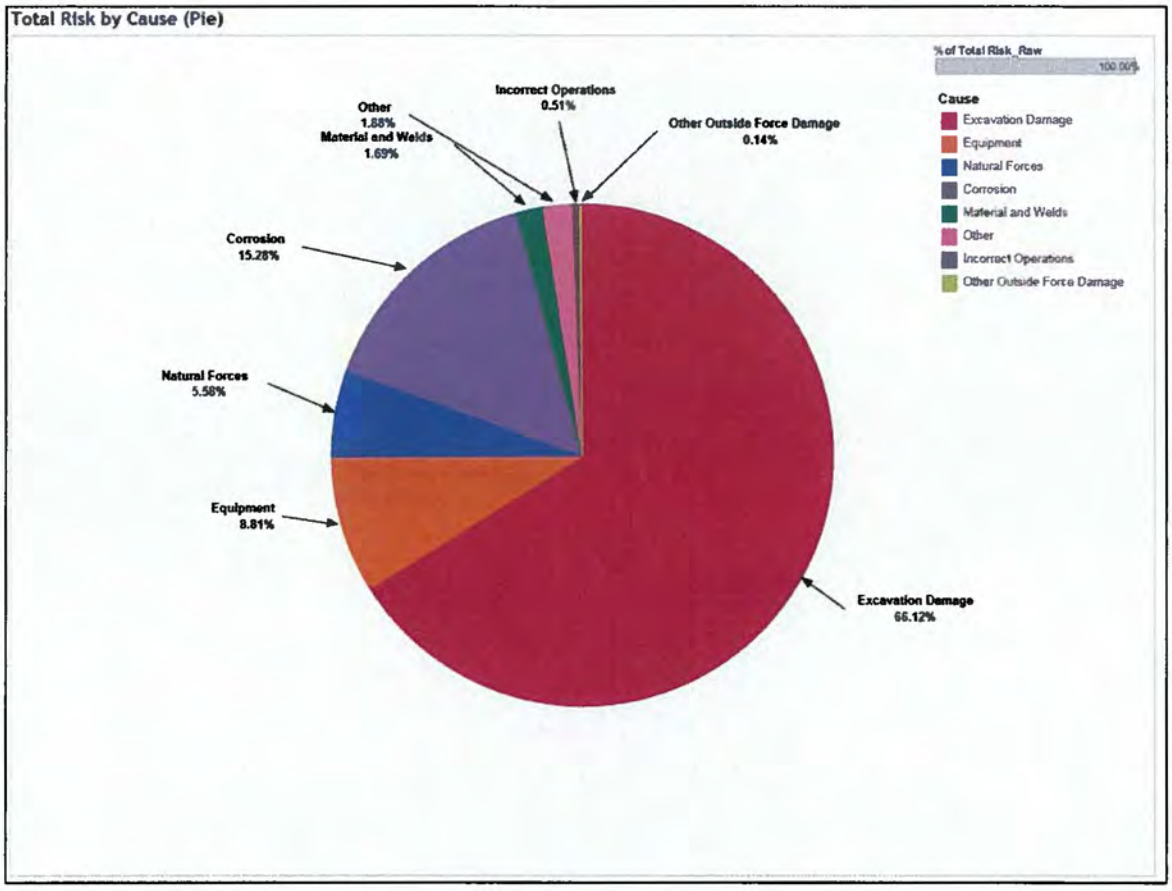
Q. PLEASE QUANTIFY THE IMPACT DUKE ENERGY KENTUCKY'S DISTRIBUTION INTEGRITY MANAGEMENT PROGRAMS, AND ITS PREVIOUS AMRP INITIATIVE, HAVE HAD UPON THE COMPANY'S SAFETY AND RELIABILITY.

A. In 2010, Duke Energy Kentucky completed its AMRP as predicted, on time and on budget. As expected, as a direct result of the AMRP, Duke Energy Kentucky experienced a decrease in the number of leaks on its gas mains. However, the Company did not see a similar decrease in the number of leaks in either the main-to-curb or curb-to-meter distribution service lines.

As described previously, the risk model for the distribution integrity program provides a relative basis to compare risk in the distribution system. These system risks over time are quantified in the table following:



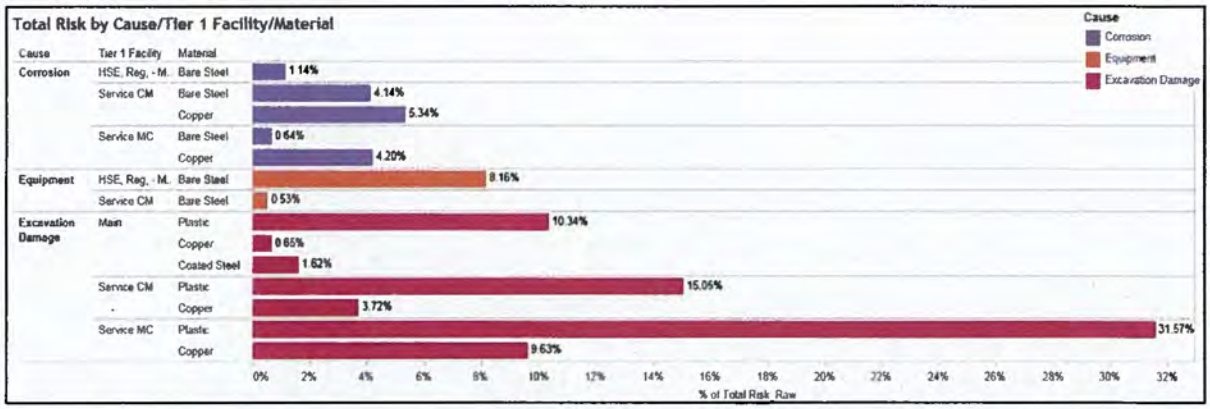
Although the total risk score for the Duke Energy Kentucky system has dropped significantly since 2002, mainly due to the reduction of leaks associated with cast iron and bare steel that was replaced as part of AMRP, the continued leaks related to corrosion (mainly copper services) place it as the second highest threat behind excavation damage as shown in the following table:



The need to address this issue from a safety, reliability, and overall integrity management perspective is the driver of the Company's application in this proceeding.

Q. ARE THERE RISKS ASSOCIATED WITH A SERVICE LINE LEAK?

A. Yes. As described previously, Duke Energy Kentucky uses a risk model to determine the relative risk and rank of each threat. Using this process as outlined in the Company's Distribution Integrity Plan, the threat of corrosion related leaks on services ranks in the top three categories of system risks along with excavation damage and leaks on equipment.



Based on this information and as required by DIMP regulations, Duke Energy Kentucky has already begun a program to replace these leak-prone service lines.

Anytime there is a natural gas leak, there is a potential hazardous condition. Service lines operate at the same pressure as gas mains and are generally physically located closer in proximity to a customer premises. Although actual incidents of a catastrophic failure attributed to a service line may be fewer than those associated with a natural gas main, the possibility of damage and risk to life and property in the event of a catastrophic failure is the same. In Duke Energy Kentucky's opinion, just because statistics may show that on a national level, the number of catastrophic events attributed to a service line failure is less than that of a gas main, one should not diminish or disregard the prudency of taking immediate action for the elimination or mitigation of these risks or any such risk. Duke Energy Kentucky values its customers and its goal is to take necessary steps to provide safe natural gas service in all facets of its operations.

III. DUKE ENERGY KENTUCKY'S CAPITAL BUDGETING AND EXPENDITURES

Q. HOW DOES THE GAS OPERATIONS GROUP DETERMINE WHAT CAPITAL EXPENDITURES WILL BE MADE IN ANY GIVEN YEAR?

A. Duke Energy Kentucky prepares a range of budget forecasts as part of the overall capital planning process. The projects are prioritized by year based on input from sources across Gas Operations, including Project Sponsors, Field & System Operations and Integrity Management. The capital planning process is updated annually and approved by executive management.

Q. ONCE DUKE ENERGY KENTUCKY HAS DECIDED ON A BUDGET FOR CAPITAL EXPENDITURES, HOW ARE THOSE EXPENDITURES CATEGORIZED?

A. The capital budget is generally categorized into four main groups: 1) Expansion, 2) Maintenance, 3) Recoverables, and 4) Major Projects. The general definitions are as follows:

1) Expansion: Generally includes projects with Allowance of Funds Used During Construction (AFUDC) that are not included in 'Recoverable' and have limited regulatory lag or deferral opportunities. Includes projects adding Mega Watts, revenue producing projects, and acquisitions.

2) Maintenance: Includes all non-Recoverable, non-Expansion, and non-Major Projects capital. Maintenance would generally include minimal to no AFUDC and carries regulatory lag implications.

3) Recoverables: Defined as items that are recovered outside of normal base rates that (a) have a specific clause/rider/tracker or (b) are deemed

probable for future regulatory treatment that would result in a clause/rider/tracker where there is often no or limited regulatory lag.

4) Major Projects: Includes large projects (greater than $25 Million) that are garnering AFUDC that are not in Recoverable or Expansion.

Q. EXPLAIN HOW THE COMPANY PLANS AND PRIORITIZES ITS CAPITAL PROJECTS.

A. Projects are prioritized based upon the Company's risk assessment and in consideration of the category or nature of projects such as safety and system integrity, customer request and general maintenance.

Q. PLEASE SUMMARIZE THE COMPANY'S RECENT ANNUAL BUDGETS FOR CAPITAL PROJECTS.

A. The Company's recent budgets for capital projects are summarized in the following table:

Kentucky Capital			
	Actual	Budget	Variance
Recoverable	-	-	-
Expansion	1,870,878.80	4,151,714.00	2,280,835.20
Maintenance	11,357,890.20	8,553,982.00	(2,803,908.20)
Investment	-	-	-
2011 Total	**13,228,769.00**	**12,705,696.00**	**(523,073.00)**
Recoverable	-	-	-
Expansion	2,082,739.80	3,187,942.00	1,105,202.20
Maintenance	11,862,080.20	9,811,759.00	(2,050,321.20)
Investment	-	-	-
2012 Total	**13,944,820.00**	**12,999,701.00**	**(945,119.00)**
Recoverable	-	-	-
Expansion	2,219,494.38	3,502,602.19	1,283,107.81
Maintenance	8,550,709.41	6,265,910.68	(2,284,798.73)
Investment	-	-	-
2013 Total	**10,770,203.79**	**9,768,512.87**	**(1,001,690.92)**
Recoverable	-	-	-
Expansion	2,589,341.39	3,275,111.12	685,769.73
Maintenance	5,768,082.20	10,943,239.27	5,175,157.07
Investment	-	-	-
2014 Total	**8,357,423.59**	**14,218,350.39**	**5,860,926.80**
Recoverable	-	-	-
Expansion	866,045.51	865,303.68	(741.83)
Maintenance	1,263,427.81	2,764,723.23	1,501,295.42
Investment	-	-	-
April 2015 YTD	**2,129,473.32**	**3,630,026.91**	**1,500,553.59**

Q. HAVE DUKE ENERGY KENTUCKY'S ACTUAL CAPITAL EXPENDITURES BEEN CONSISTENT WITH THE COMPANY'S BUDGETS?

A. Yes.

Q. PLEASE EXPLAIN.

A. Duke Energy Kentucky's annual budgeted versus actual expenditures have been consistent and within 10% each year except 2014, when several large projects were delayed, cancelled, or rebudgeted to be Duke Energy Ohio only projects.

IV. ASRP

Q. PLEASE PROVIDE A BRIEF OVERVIEW OF THE COMPANY'S ASRP PROPOSAL.

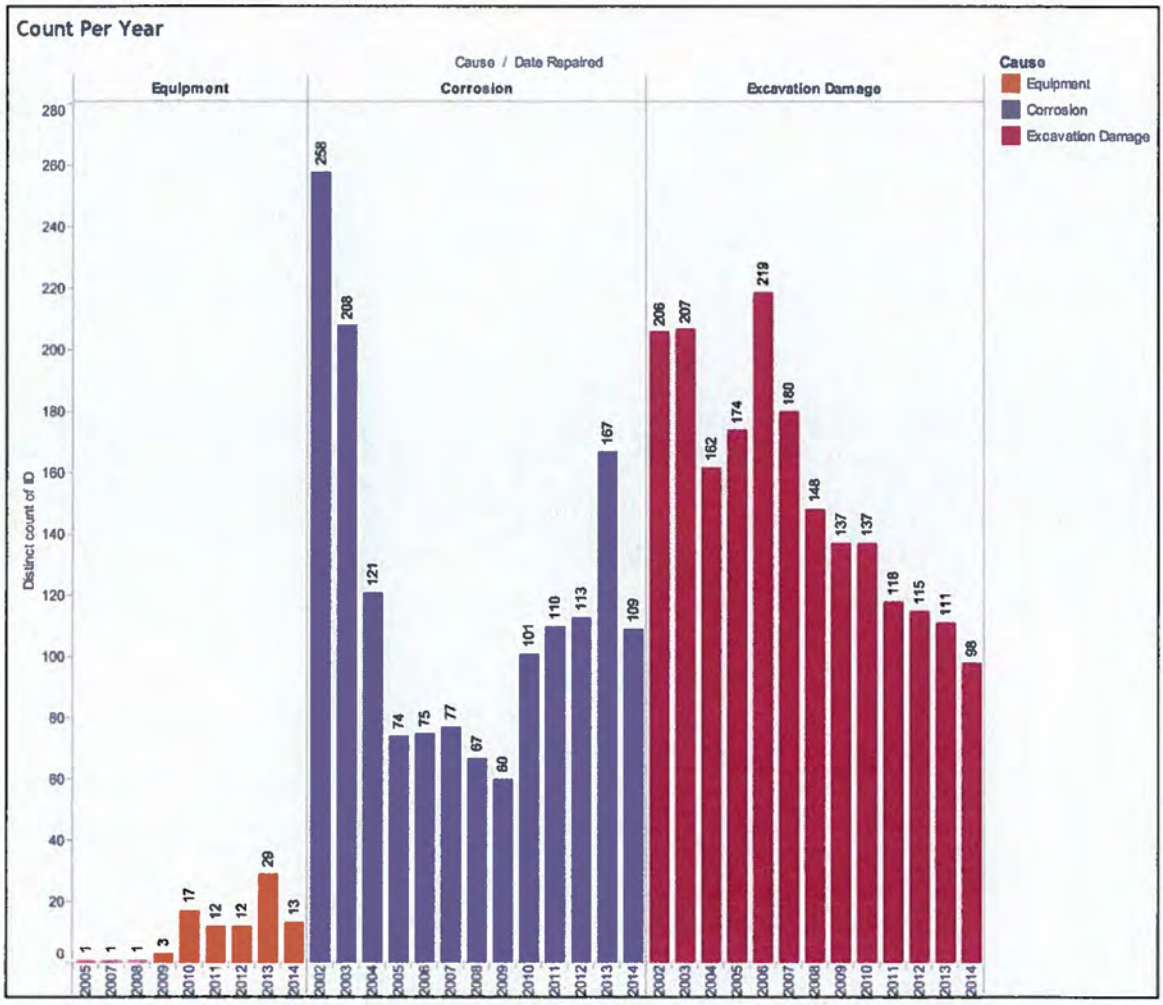
A. Based upon the risks I previously discussed and in recognition of federal integrity management requirements for natural gas distribution systems, most notably rules promulgated by PHMSA, Duke Energy Kentucky is proposing to implement a five-year ASRP initiative to immediately and expeditiously address a safety risk identified in the DIMP. As discussed previously, the second highest relative risk is associated with corrosion leaks (2012 - 2014) with a majority occurring on service lines. The Company proposes to address this risk through a targeted and deliberate replacement of these at-risk facilities for the benefit of all customers and the public.

Q. IF THE ASRP IS THE SECOND HIGHEST RELATIVE RISK IDENTIFIED IN THE DIMP, WHAT WAS THE FIRST, AND IS THE COMPANY CURRENTLY ADDRESSING THAT RISK?

A. The highest relative risk to the Company's gas delivery system that was identified through the DIMP are leaks associated with damage done to the gas delivery system due to third-party excavations. Duke Energy Kentucky is, in fact, already taking steps to proactively address this risk and appreciates the attention the Commission has given this issue through public service announcements and other outreach efforts over the years. For each excavation incident, Duke Energy Kentucky has an investigator who arrives at the incident site to determine fault and provide education on how to prevent reoccurrence. The Company has

increased its public awareness program outreach to include education on excavation laws and regulations such as "Call Before You Dig." Duke Energy Kentucky also reaches out to individual contractors and provides specific education related to excavations near gas facilities. Duke Energy Kentucky meets monthly with its locating company and contractors to discuss their at-fault damages and locate issues to avoid repeat occurrences. Duke Energy Kentucky responds to untoneable services/mains to work toward making them toneable and has an Inspector on site when an excavator is digging within 25 feet of a transmission line. Duke Energy Kentucky also promotes April as national Safe Digging Month by setting up a display table in front of our office to provide education. The Company participates in excavator seminars and emergency responder seminars throughout the year to provide education on natural gas mains and services and safe work practices.

These efforts have been fruitful as the number of incidents or leaks due to a third-party excavation have declined over the last few years. This decrease can be seen in the graph following which depicts the events per year on M-C and C-M service piping in each category:



However, the Company can only do so much in this regard. Local law enforcement authorities must also be willing to enforce the laws and regulations of the Commonwealth, which include any penalties associated with these third-party excavators failing to follow the rules and causing hazardous situations when they damage the gas facilities.

While the incidents due to third-party excavation are declining; the leaks related to corrosion continue. These metallic type pipe materials will continue to corrode overtime unless replaced.

Q. PLEASE EXPLAIN THE NEED FOR THE ASRP FROM A SAFETY AND RELIABILITY PERSPECTIVE.

A. The ASRP is the proposed measure to address risks to the natural gas delivery system identified in the Company's DIMP. As required in the regulations, once a risk is identified, the Company must respond to and address the risk. The ASRP is the Company's preferred method to address the risk to the delivery system created by these leak-prone services. Replacing these services in an accelerated and targeted manner will reduce the number of incidents by eliminating the root cause of the leaks and reduce the exposure to increased failures as these services continue to age. An accelerated approach allows the Company to manage costs in a way to perform the work over the next few years, rather than decades, and in an efficient manner by targeting an entire area at once, as opposed to a more expensive reactive approach.

Q. IS THE ASRP ACTUALLY REQUIRED UNDER BY PHMSA OR UNDER ITS DIMP REGULATIONS?

A. PHMSA does not mandate any specific remedial actions. PHMSA is the federal agency that, among other things, oversees transportation of natural gas through pipelines. To do this, PHMSA establishes national policy, sets and enforces standards, educates, and conducts research to prevent incidents. The DIMP procedural regulation is the tool used by PHMSA to require utilities to develop, maintain, and follow an integrity management program to maintain the safety and integrity of their gas delivery systems. The DIMP regulation essentially requires utilities to continually evaluate their delivery systems for risks and to develop

immediate strategies to address those risks. The evaluation is done in accordance with the seven factors I previously discussed. So, while neither DIMP nor PHMSA require any specific type of action or replacement activity, nonetheless, under DIMP, once a utility identifies a risk using the DIMP evaluation or "elements," it must then manage its system accordingly, which includes addressing and correcting the identified risk(s). Therefore, now that the Company has identified the risks associated with these service lines, the Company must address these risks under DIMP. The ASRP is the safest and most cost-effective way to respond to these identified risks and protect customers by methodically replacing these services and taking ownership as soon as possible.

Q. IN YOUR OPINION, DOES REPLACING THESE AT RISK SERVICE LINES UNDER THE CURRENT TIME LINE ADEQUATELY RESPOND TO THE IDENTIFIED RISK UNDER DIMP?

A. No. These services are already identified as a system risk as the leaks identified are increasing. Under DIMP, the Company must now take action. However, it cannot do so on a widespread basis without Commission approval. The identified pattern of service line leaks will only increase as time goes on and these systems continue to age and are exposed to corrosive forces. Replacing these services under the current schedule of approximately 200 per year is, and will continue to be, inadequate to respond to this growing level of risk. At that rate, it would take approximately 50 years for the Company to replace these services. As a Kentucky resident, and Duke Energy Kentucky customer, I want my utility to be proactive

to address potential weaknesses on its system before a hazardous situation develops.

Q. PLEASE EXPLAIN HOW THE ASRP IS CONSISTENT WITH INDUSTRY INITIATIVES AND BEST PRACTICES.

A. The 2012 report by the American Gas Foundation titled "Gas Distribution Infrastructure: Pipeline Replacements and Upgrades" describes then United States Secretary of Transportation Ray LaHood's "Pipeline Safety Action Plan" calling for pipeline operators, including local natural gas distribution companies, to accelerate their efforts to replace pipeline facilities and take other actions that will enhance the integrity of network facilities This ASRP aligns with the "Call to Action" for the industry, as well as similar programs undertaken by other natural gas local distribution companies.

Q. IS THERE ANY QUANTATIVE ANALYSIS THAT SUPPORTS THE NEED FOR THE COMPANY'S ASRP INITIATIVE?

A. Yes. Duke Energy Kentucky performed a detailed review of its own operation and maintenance practices, including the leak rates for the different types of service materials. Duke Energy Kentucky has also retained Lummus Consultants (Lummus) to independently review the background, operation, and maintenance of the Company's proposed ASRP program. As explained in the Lummus Study (Application, Exhibit 4) and Direct Testimony of Edward A. McGee, Duke Energy Kentucky has seen an increase in the number of leaks along its natural gas delivery system associated with service lines. This increase in service leaks and decrease in main leaks attributable to the successful implementation of the

AMRP, is highlighted in successive DIMP risk assessment results. In other words, service leak rates are increasing and must be addressed as required by the DIMP.

The Lummus Study shows that, upon completion of the Company's AMRP in 2010, the Company did experience a reduction in the number of leaks along its gas mains. However, the Company is now seeing an increase in the number of leaks along its distribution system that are located within the curb-to-main and main-to-curb service lines.

Q. PLEASE EXPLAIN HOW THE ASRP IS BOTH CONSISTENT AND IN COMPLIANCE WITH THE REGULATIONS YOU PREVIOUSLY DISCUSSED.

A. As stated earlier, the Company's DIMP is consistent with CFR 192 Subpart P – Gas Distribution Pipeline Integrity Management, that defines the required Integrity Management Program as "an overall approach by an operator to ensure the integrity of its gas distribution system." Leak rates on non-protected metallic services have been identified as a risk in the Company's distribution system and the ASRP is the proposed measure to address this risk as required in the regulations.

Q. WHAT IS THE ESTIMATED COST OF CONSTRUCTION FOR THE ASRP PER YEAR AND IN TOTAL?

A. The current estimated cost of construction is $50M broken down as follows: 2016 ($5M), 2017 ($12M), 2018 ($13M), 2019 ($13M), and 2020 ($7M).

Q. WHAT IS THE ESTIMATED COST OF OPERATION OF THE NEW SERVICES ONCE THE PROGRAM IS COMPLETED?

A. In terms of Operations and Maintenance expense, there are no incremental operating costs associated with ASRP once the program is completed. Once installed, these new service lines will constitute new plant in service and eventually will be rolled into base rates at the time of the Company's next base natural gas rate case.

Q. HOW WERE THESE ESTIMATES DERIVED?

A. Duke Energy Kentucky has estimated that approximately 10,000 service lines will need to be replaced during the five-year ASRP. The approximate cost per service replacement is, on average, $5,000 over the five year program. The number of services is based upon Company records and is depicted in the Lummus Study. Estimated costs for replacing services are based upon current actual costs for similar replacements completed as part of AMRP in Ohio and current service replacement programs in Ohio and Kentucky.

Q. HOW DOES THE COMPANY PROPOSE TO MANAGE THE COSTS OF THE PROGRAM?

A. Work will be performed by both internal and external resources. The external work will be competitively bid in packages (by communities) to pre-qualified contractors. The bids are reviewed against historical costs and other factors by Duke Energy Kentucky's sourcing department, the Project Manager, and the Manager of Contractor Construction, with a final approval from me as the

Director of Engineering. The costs are then tracked on a monthly basis to ensure actual expenditures are in line with budgets.

V. FILING REQUIREMENT SPONSORED BY WITNESS

Q. PLEASE DESCRIBE THE FILING REQUIREMENTS CONTAINED IN THE COMPANY'S APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY THAT YOU ARE SPONSORING AND SUPPORTING.

A. I sponsor the need for the program in response to 807 KAR 5:001, Section 15(2)(a) and the estimated annual cost of the operation upon completion of construction.

VI. CONCLUSION

Q. DO YOU HAVE AN OPINION AS TO WHETHER THE ASRP IS REASONABLE AND NECESSARY FROM A DISTRIBUTION INTEGRITY MANAGEMENT STANDPOINT?

A. Yes, as stated previously, the DIMP regulations require natural gas operators such as Duke Energy Kentucky to implement the seven required program elements, which include among other tasks, evaluating/ranking risks and then implementing measures to address these risks. The ASRP will significantly reduce the risk of corrosion leaks which has been identified as the second highest relative risk in the DIMP based on a three-year (2012-2014) review of leak data.

Q. WAS ATTACHMENT JH-1 PREPARED BY YOU OR UNDER YOUR DIRECTION AND CONTROL?

A. Yes.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes.

VERIFICATION

STATE OF OHIO)
) SS:
COUNTY OF HAMILTON)

The undersigned, John A. Hill Jr., in his capacity as Director of Engineering, Gas Operations for Duke Energy Kentucky, Inc., being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

John A. Hill, Jr., P.E. Affiant
Director of Engineering
Gas Operations
for Duke Energy Kentucky, Inc.

Subscribed and sworn to before me by John Hill on this 30 day of June 2015.

NOTARY PUBLIC

My Commission Expires:

NOTARIAL SEAL
STATE OF OHIO

ROCCO O. D'ASCENZO
ATTORNEY AT LAW
Notary Public, State of Ohio
My Commission Has No Expiration
Section 147.03 R.C.

APPENDIX A – RISK MODEL CONFIGURATION

Risk Model

A. The method used to determine the risk in Duke Energy's distribution system is based on the relative risk associated with repaired leaks. This risk is then aggregated for the entire system. The model is configured to utilize the consequence values detailed below and a probability of one for each individual leak repair. Risk is calculated for each repair along with the inclusion of facility and location data. As an example: if a leak occurred on an intermediate pressure main that was a grade 1 leak, then the risk associated with the pressure would be 40 and the grade would be 10. Individual leak risk is then summed up to develop risk scores at a system level.

B. The total risk associated with a specific leak is calculated using the equation below. The weight factors in the risk model are assigned by SME's to give the more hazardous items greater influence on the final score.

C. Risk Formula

Duke Energy risk model is based on the following risk formula:

$$R_T = 1 + \sum_{i=0}^{n} \left(R_{(i)}\right)$$

$R_{(i)} = P_{(i)} * C_{(i)}$ where,

R_T = Risk score per threat
$R_{(i)}$ = Risk score per event
n = Number of events per threat for the reporting year
$P_{(i)}$ = Probability of the event
$C_{(i)}$ = Consequence of the event

```
Risk_Raw=([C_EventMetric])*([P_Material])*(((([C_Pressure]+[C_Grade]+[C_Dia
meter]) * [C_Proximity] ) *[C_InjuryFatalityRatio])/ 1000
```

D. Weight Factors for Threat Probability

The Pipeline Integrity DIMP database contains the count and cause of events experienced by Duke Energy. The weight factors assigned to each cause are determined by SME's based on the likelihood of the cause to result in a serious incident (injury or fatality) per national averages as provided by the Pipeline Hazardous Materials Safety Administration (PHMSA). Additionally, a second probability factor has been established based on material type with values assigned by SME's based upon operating experience. These relative weights were assigned based on the potential for a material to play a significant role in the occurrence of an event.

```
WHEN [Cause] = 'Excavation Damage' THEN 70
WHEN [Cause] = 'Other' THEN 60
WHEN [Cause] = 'Other Outside Force Damage' THEN 20
WHEN [Cause] = 'Natural Forces' THEN 20
WHEN [Cause] = 'Incorrect Operations' THEN 30
WHEN [Cause] = 'Material and Welds' THEN 20
```

```
WHEN [Cause] = 'Equipment' THEN 20
WHEN [Cause] = 'Corrosion' THEN 20
WHEN [Cause] = 'Company or Agent Excavation' THEN 70
ELSE 70 END)

WHEN [Material] = 'Bare Steel' THEN 70
WHEN [Material] = 'Cast Iron' THEN 90
WHEN [Material] = 'Coated Steel' THEN 15
WHEN [Material] = 'Copper' THEN 40
WHEN [Material] = 'Copper Tubing' THEN 40
WHEN [Material] = 'Ductile Iron' THEN 70
WHEN [Material] = 'Plastic' THEN 20
WHEN [Material] = 'Steel' THEN 70
WHEN [Material] = 'Steel Tubing' THEN 15
WHEN [Material] = 'Unknown' THEN 90
ELSE 90 END)
```

E. Weight Factors for Consequence

The factors selected to represent the relative consequence of an event are based on Duke Energy and Industry experience. The master dataset generated in System Knowledge includes a number of attributes associated with each hazardous and non-hazardous leak. Selected attributes have been utilized to derive the consequence associated with the threat determined to be the root cause. The following attributes and incident results were utilized in the determination of consequence.

F. **Fatality/Injury ($F_{I/F}$):** Fatalities and injury data provide a relative representation as to the potential consequence associated with the various cause. National data as provided by PHMSA will be utilized as a means of weighting the potential consequence associated with each cause.

```
WHEN [Cause] = 'Other' THEN 0.25
WHEN [Cause] = 'Other Outside Force Damage' THEN 0.28
WHEN [Cause] = 'Excavation Damage' THEN 0.22
WHEN [Cause] = 'Material and Welds' THEN 0.09
WHEN [Cause] = 'Natural Forces' THEN 0.23
WHEN [Cause] = 'Corrosion' THEN 0.15
WHEN [Cause] = 'Equipment' THEN 0.09
WHEN [Cause] = 'Incorrect Operations' THEN 0.06
WHEN [Cause] = 'Company or Agent Excavation' THEN 0.22
ELSE 0.35 END)
```

G. **Code Factor (F_c):** This factor is used to consider the leak grade in terms of the higher grade leaks releasing more gas to the environment. Grade 1 leaks with pipe wall breaks will be given the highest weight value.

```
WHEN [Class] = 'Grade 1' AND [Pipe Wall Break?]= 'Yes' THEN 75
WHEN [Class] = 'Grade 1' THEN 25
```

```
WHEN [Class] = 'Grade 2' THEN 10
ELSE 75 END)
```

H. **Proximity Factor (F_{PR}):** This factor is used to consider the proximity of the gas facility to structures where migration from a leak could result in the collection of gas in an enclosed space at explosive concentrations. Mains were considered to be the highest risk due to potential migration under paving and into sewers, service main to curbs were considered to have some of this risk as well. A meter and regulator set, although located in closer proximity to structures than a service, was assigned a lower weight factor as they are generally located above ground which allows any leaks to immediately vent to atmosphere.

```
WHEN [Tier 1 Facility] = 'MAIN' THEN 75
WHEN [Tier 1 Facility] = 'SERVICE CM' THEN 50
WHEN [Tier 1 Facility] = 'SERVICE MC' THEN 60
WHEN [Tier 1 Facility] = 'AGF' THEN 5
WHEN [Tier 1 Facility] = 'Other' THEN 75
ELSE 75 END)
```

I. **Pressure Factor (F_p):** This factor is considered as having a direct effect on the consequences associated with any threat based on the operating pressure.

```
WHEN [Pressure] ='Feeder' THEN 60
WHEN [Pressure] = 'HP' THEN 40
WHEN [Pressure] = 'MP' THEN 20
WHEN [Pressure] = 'SP' THEN 5
WHEN [Pressure] = 'IP' THEN 40
ELSE 60 END)
```

J. **Diameter Factor (FD):** The factor is used to consider the pipe diameter in terms of the larger diameters releasing a larger volume of gas to the environment. The weight factors will be scaled by diameter from smallest to largest.

```
WHEN [Diameter] ='0.25' THEN 10
WHEN [Diameter] = '0.375' THEN 10
WHEN [Diameter] = '0.5' THEN 10
WHEN [Diameter] = '0.75' THEN 10
WHEN [Diameter] = '1' THEN 20
WHEN [Diameter] = '1.25' THEN 20
WHEN [Diameter] = '1.5' THEN 20
WHEN [Diameter] = '1.75' THEN 20
WHEN [Diameter] = '2' THEN 30
WHEN [Diameter] = '2.5' THEN 30
WHEN [Diameter] = '3' THEN 40
WHEN [Diameter] = '4' THEN 50
WHEN [Diameter] = '5' THEN 60
WHEN [Diameter] = '6' THEN 70
WHEN [Diameter] = '8' THEN 80
```

```
WHEN [Diameter] = '10' THEN 90
WHEN [Diameter] = '12' THEN 100
WHEN [Diameter] = '16' THEN 110
WHEN [Diameter] = '20' THEN 120
WHEN [Diameter] = '24' THEN 130
WHEN [Diameter] = '30' THEN 140
ELSE 140 END)
```

COMMONWEALTH OF KENTUCKY
BEFORE THE
KENTUCKY PUBLIC SERVICE COMMISSION

In the Matter of:

The Application of Duke Energy Kentucky, Inc., for a Certificate of Public Convenience and Necessity Authorizing the Implementation of an Accelerated Service Line Replacement Program, Approval of Ownership of Service Lines, and a Gas Pipeline Replacement Surcharge	)))))))	Case No. 2015-00210

DIRECT TESTIMONY OF

EDWARD A. McGEE

ON BEHALF OF

DUKE ENERGY KENTUCKY, INC.

July 6, 2015

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LIST OF FIGURES

ATTACHMENTS

I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR FULL NAME, ADDRESS, AND OCCUPATION.

A. My name is Edward A. McGee. My business address is P.O. Box 1659, Bethany Beach, Delaware. I am a Principal Consultant of McGee Consulting, LLC, and I am currently working as a Gas Utility Consultant with Lummus Consultants International, Inc. (Lummus).

Q. COULD YOU PLEASE DESCRIBE LUMMUS?

A. Lummus is an independent company in Chicago Bridge & Iron's (CB&I) Lummus Technology operating group. Predecessor companies absorbed into the present-day Lummus include Stone & Webster Management Consultants, Inc., and Shaw Consultants International, Inc., both with extensive experience in the utility consulting industry.

Q. DO YOU HOLD ANY ACADEMIC DEGREES?

A. Yes. I graduated from the University of Notre Dame with Bachelor and Master Degrees in Chemical Engineering. I also graduated from the University of Chicago with a Master's Degree in Business Administration (MBA). Attachment EAM-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 SCOPE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. Duke Energy Kentucky, Inc., (Duke Energy Kentucky or the Company) requested that I provide an expert opinion to the Kentucky Public Service Commission (Commission) on the current condition of the Company's service lines following

an analysis of the service lines conducted by Lummus. I was also asked to render an opinion on whether a portion of the service lines should be replaced, and if so, whether they would qualify for an Accelerated Service Replacement Program (ASRP) where these services are replaced in a more rapid fashion, and whether the selected service lines are consistent with the examples, recommendations, and rules provided by the Department of Transportation (DOT) for expeditious replacement.

Q. WAS THE LUMMUS STUDY OF THE CURRENT CONDITION OF THE COMPANY'S SERVICE LINES CONDUCTED BY YOU?

A. Yes. I directly participated in the Lummus study, called Condition Analysis of Kentucky Service Lines (Lummus Study), along with the assistance of others under my direct supervision. A true and accurate copy of the Lummus Study is included as Exhibit 4 to Duke Energy Kentucky's Application in this proceeding.

Q. HOW IS THE REMAINDER OF YOUR TESTIMONY ORGANIZED?

A. Following the above Introduction, my testimony is organized into the following sections:

- Section II: Summary of Findings and Conclusions
- Section III: Overview of the Service Condition Study
- Section IV: Composition of Duke Energy Kentucky's Service Lines
- Section V: Analysis of Condition of Service Lines
- Section VI: Comparison of Number of Risk Factors on Services Against Number of Risk Factors on Mains

- Section VII: Analysis of Pipeline and Hazardous Materials Safety Administration (PHMSA) Recommendations for Pipe Replacement
- Section VIII: Findings and Conclusions

II. SUMMARY OF FINDINGS AND CONCLUSIONS

Q. PLEASE SUMMARIZE YOUR FINDINGS AND CONCLUSIONS REGARDING THE COMPANY'S SERVICE LINES.

A. The primary conclusion contained in the Lummus Study is that a small portion (10,027 services or 10.4% of the total 96,746 services) of the Company's service lines require replacement, which consists of services that are the metallic types of pipe materials. Additionally, services without adequate records of their type of material should also be replaced. This amounts to an additional 689 services, or 0.7% of the total Kentucky service lines.

Q. CAN YOU STATE THE PRIMARY REASONS WHY THESE SERVICES REQUIRE REPLACEMENT?

A. A key finding by Lummus was that the number of service line leaks has far exceeded the number of leaks on mains in recent years. Also, service leaks caused by factors such as corrosion or materials and welds have not necessarily been declining as expected, following the accelerated main replacement program (AMRP). These factors directly relate to metallic types of pipe materials that continue to corrode over time. The corrosion can result in pinhole leaks on the wall of the service line, as well as joint leaks where sections of the service line are fastened together. For safety reasons, services whose material type cannot be ascertained require replacement.

Q. ARE THERE OTHER REASONS WHY THESE SERVICES REQUIRE REPLACEMENT?

A. Yes. The proportion of "hazardous"[1] leaks is increasing on service lines, especially on the portion of the service lines that is closest to buildings. Accordingly, we conclude that Duke Energy Kentucky has service-line safety risks that need to be addressed.

Q. HOW ARE RISKS DEFINED?

A. Safety risks include risks to the general public, Company employees, and first responders. Risks to the general public arise primarily through risks to building occupants.

Q. CAN THE RISK FACTORS ON SERVICE LINES IN DUKE ENERGY KENTUCKY'S SYSTEM BE COMPARED TO THE RISK FACTORS ON MAINS?

A. Yes. Overall, the Lummus analysis found the number of factors that contribute to risks on service lines to be:

- Greater than the number of risk factors on mains in five areas since service lines have thinner pipe walls, higher frequencies of leaks, higher frequency of hazardous leaks, closeness to buildings and their occupants, and incomplete records of age and material types;
- Less in one area since mains have larger pipe sizes, which contain more gas; and

[1] Hazardous leaks are classified Grade 1 leaks, which represents an indication of leakage presenting an existing or probable hazard to persons or property, and requires immediate repair or continuous action until the conditions are no longer hazardous.

- About equal in three areas since mileage, age, and pressure levels are nearly the same for both services and mains.

Q. DID THE LUMMUS STUDY CONTAIN ANY FINDINGS REGARDING THE APPLICABILITY OF AN ACCELERATED SERVICE REPLACEMENT PROGRAM?

A. Yes. We compared the six characteristics of pipes that the Department of Transportation (DOT) recommends for accelerated replacement programs against the composition of Duke Energy Kentucky's service lines. Duke Energy Kentucky's current service lines, particularly their metallic service lines, contain five of the six characteristics that would suggest that these service lines should be replaced on a rapid basis.

III. OVERVIEW OF SERVICE CONDITION STUDY

Q. CAN YOU DESCRIBE LUMMUS' OBJECTIVES FOR THE SERVICE LINE STUDY?

A. Yes. Lummus was retained by Duke Energy Kentucky to analyze the current inventory and leak history of service lines in the Company's service territory in order to develop an independent opinion regarding:

- Whether Duke Energy Kentucky is having integrity issues with its service lines;
- The cause of any identified service line issues;
- The extent of the identified service line issues especially whether safety is a concern; and
- The need for an ASRP.

Q. HOW WAS THE LUMMUS STUDY CONDUCTED?

A. Primarily the study encompassed a detailed analysis of leak repairs contained in Duke Energy Kentucky's Enterprise Geographical Information System (EGIS) data base. Leak repairs were categorized by year and by type of material composing the pipe; cause of each leak requiring repair; portion of the service line where the leak occurred; and age and pressure of the pipes upon which the leaks occurred. Additionally, Lummus reviewed Duke Energy Kentucky's Distribution Integrity Management Plan (DIMP) and the data base of annual gas distribution reports maintained by the DOT from reports submitted by all gas distribution utilities, including Duke Energy Kentucky. Lummus also analyzed the recommendations of the DOT for the development of ASRPs in order to determine whether the materials that we specified for replacement, were included in DOT's list of materials to be replaced under accelerated programs.

IV. COMPOSITION OF DUKE ENERGY KENTUCKY'S SERVICE LINES

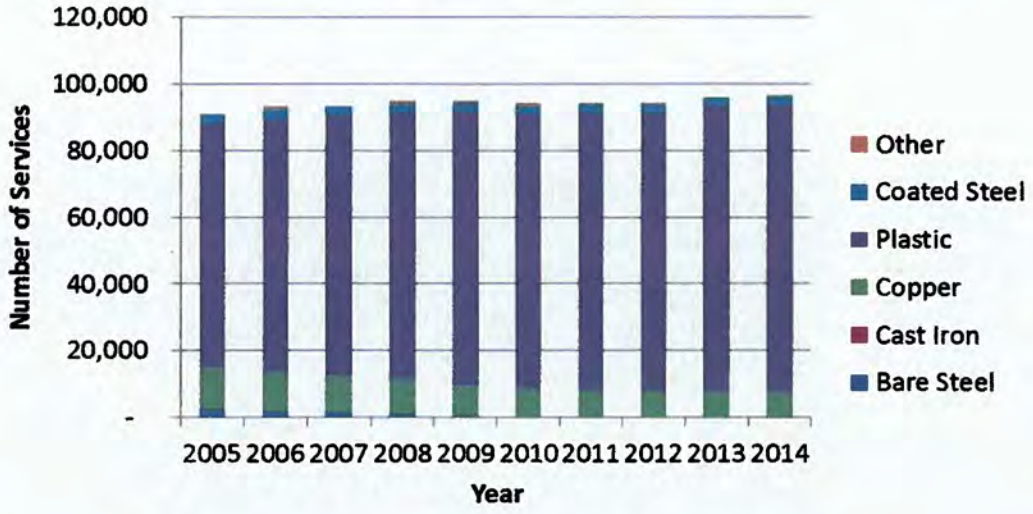
Q. HOW MANY SERVICE LINES ARE IN DUKE ENERGY KENTUCKY'S SERVICE TERRITORY?

A. Duke Energy Kentucky currently operates just over 96,000 service lines in the Commonwealth of Kentucky. The vast majority of these lines (over 80,000) are composed of plastic (polyethylene), many of which were installed during Duke Energy Kentucky's ten-year AMRP program, which ended in 2010.

Q. HAS THE COMPOSITION OF MATERIALS USED FOR SERVICE LINES CHANGED IN RECENT YEARS?

A. Yes. Many of Duke Energy Kentucky's metallic service lines were removed from its system in the ten-year period ending in 2010. This was accomplished primarily through replacement of service lines that were attached to mains that were replaced under Duke Energy Kentucky's AMRP. A smaller number of services have also been removed under Duke Energy Kentucky's annual replacement policy based on their condition and judged level of obsolescence. However, a number of service lines (just over 10,000) composed of metallic materials remain since these were not associated with the replaced mains. The change in composition in the past ten years is pictured in Figure EAM-1 shown below:

EAM-1: Number of Services by Material Type for Duke Energy Kentucky (2005-2014)

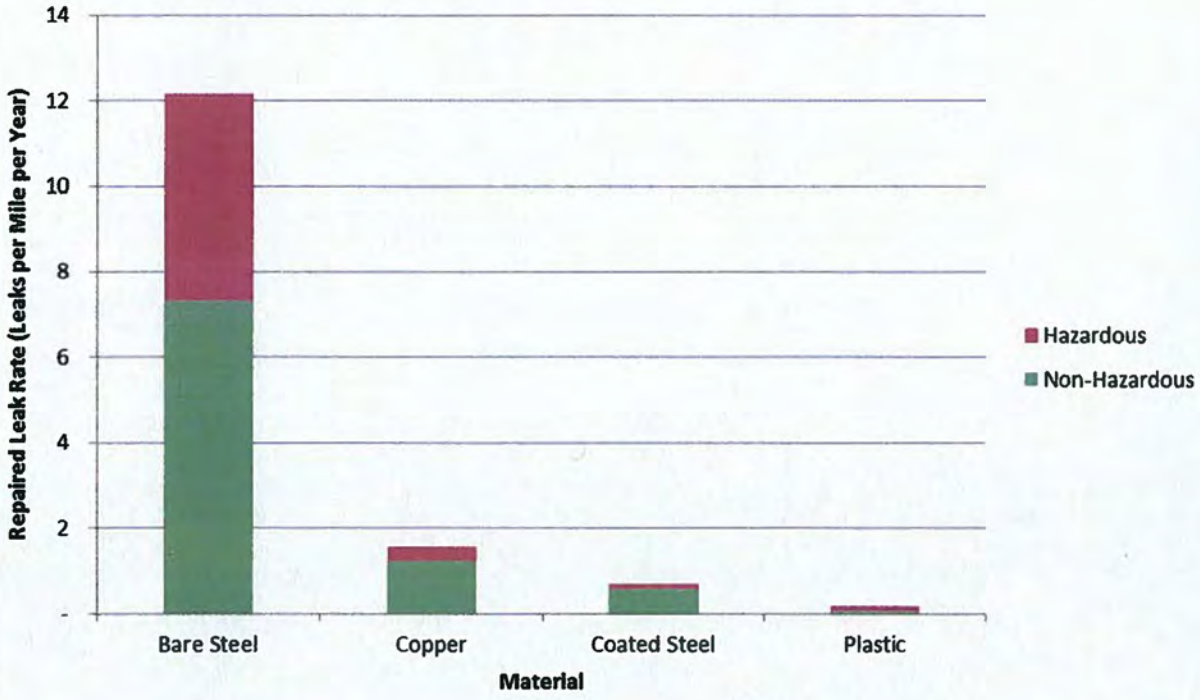


Data Source: Annual DOT Reports, PHMSA Form 7100.1-1

Q. DOES EACH MATERIAL TYPE EXHIBIT SIMILAR NUMBERS OF LEAKS?

A. No. Each material has exhibited a separate leak rate. For instance plastic, which is the predominant service-line material installed by Duke Energy Kentucky in recent years, has the lowest leak rate and bare steel has the highest leak rate. A comparison of leak rates over the past five years for each material is shown below in Figure EAM-2:

EAM-2: Duke Energy Kentucky's Leak Rates for Services by Material Type (2010-2014)
(Leaks per Mile per Year)



Data Source: EGIS Leak Repairs-Grade-State-Suburb-Collection.xlsx

Note: The relative order of leak rates by material type shown above is in good agreement with Federal EPA Greenhouse Gas Emissions data for methane releases from all U.S. gas distribution service lines.[2]

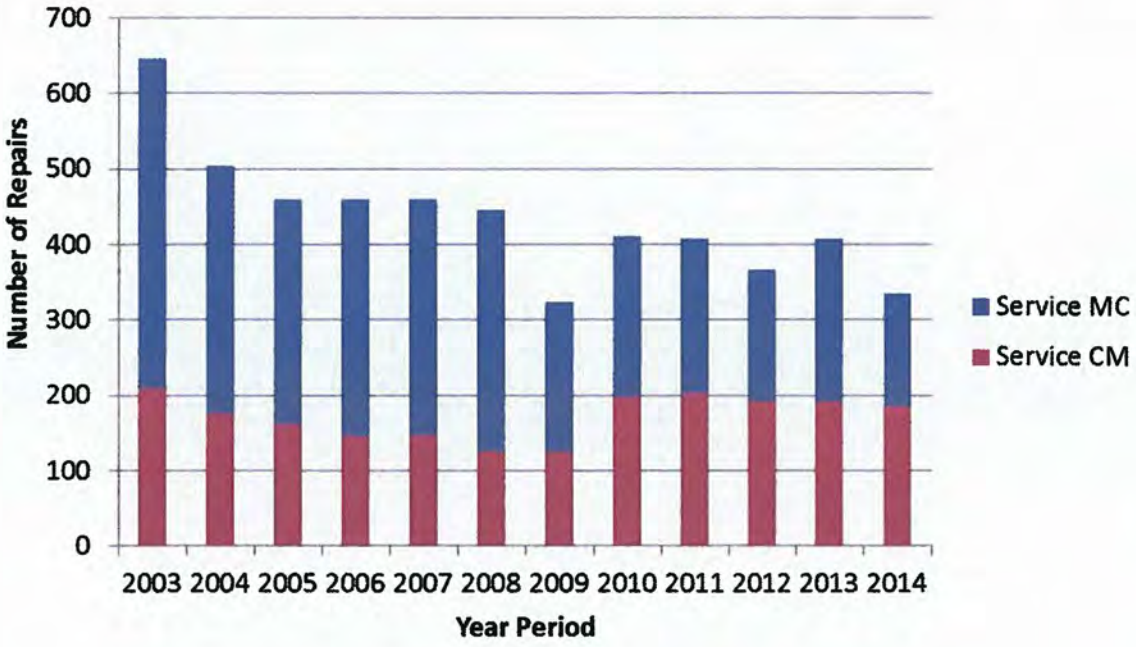
V. ANALYSIS OF CONDITION OF SERVICE LINES

Q. HAS THE NUMBER OF LEAKS ON THE COMPANY'S SERVICE LINES DECREASED SIGNIFICANTLY FOLLOWING DUKE ENERGY KENTUCKY'S AMRP PROGRAM?

A. No. Leaks on service lines have not shown the significant decrease that has been accomplished for mains leaks (Please refer to Tables 8 and 9 in the Lummus Study). Figure EAM-3 shows the history of leaks repaired between 2003 and 2014 on the underground portions of the service lines. Leaks are identified separately as M-C (leaks that developed on the underground portion of the service line stretching from the main to the curb box) and C-M (leaks that developed on the underground portion of the service line leading from the curb box toward the meter).

[2] Reference: http://www.ecfr.gov/cgi-bin/text-idx?SID=265f0267789d99416d22a4085fdbdc9a%20&node=ap40.21.98_1238.10&rgn=div9

EAM-3: Duke Energy Kentucky's Repaired Leaks on Services (Repairs per Year)



Data Source: EGIS Leak Repairs-Grade-State-Suburb-Collection.xlsx

Q. DOES FIGURE EAM-3 INDICATE ANY OTHER LEAK TRENDS?

A. Yes. Figure EAM-3 also demonstrates that in particular the number of leaks on the C-M portion of service lines, which is closest to buildings and their occupants, has grown in proportion to the number of leaks on the M-C portion of service lines, which is furthest from the buildings.

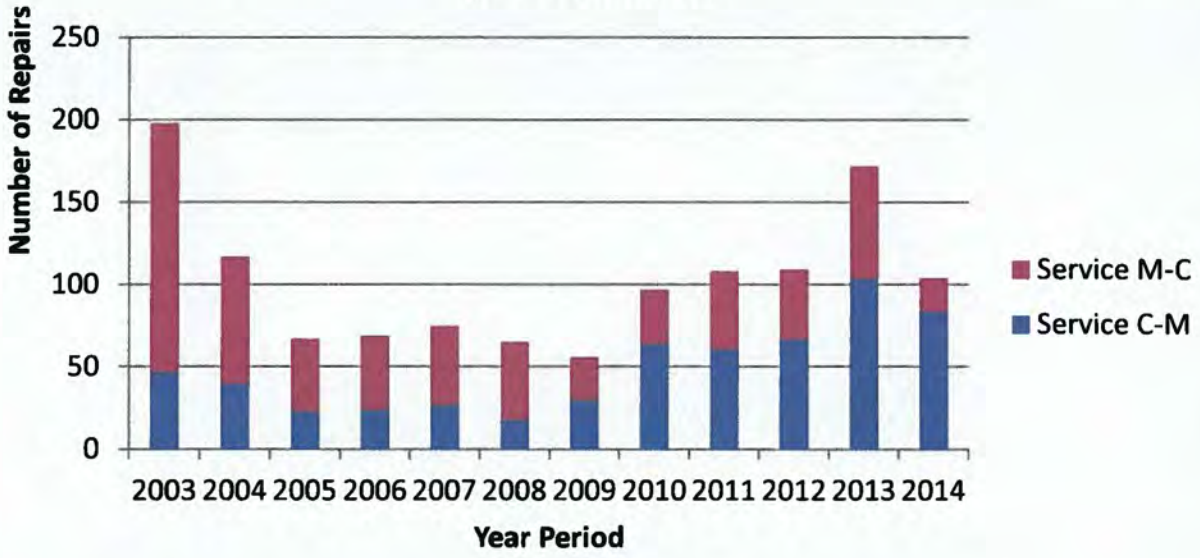
Q. ARE THERE ANY FACTORS CAUSING THE CONTINUING OCCURRENCE OF LEAKS ON SERVICE LINES?

A. Yes. The results indicated that there are two causes of continuing leaks: 1) leaks due to corrosion and 2) leaks due to materials & welds. Both of these causes may be related to metallic pipes.

Q. CAN YOU SHOW THE CORROSION TRENDS?

A. Yes. The latest ten-year trend of corrosion-caused leaks is shown in Figure EAM-4. In this figure, leaks seem to be increasing in recent years particularly on the C-M portion of the service-line, which is closest to buildings and their occupants.

EAM-4: Duke Energy Kentucky's Repaired Leaks on Services (due to Corrosion)

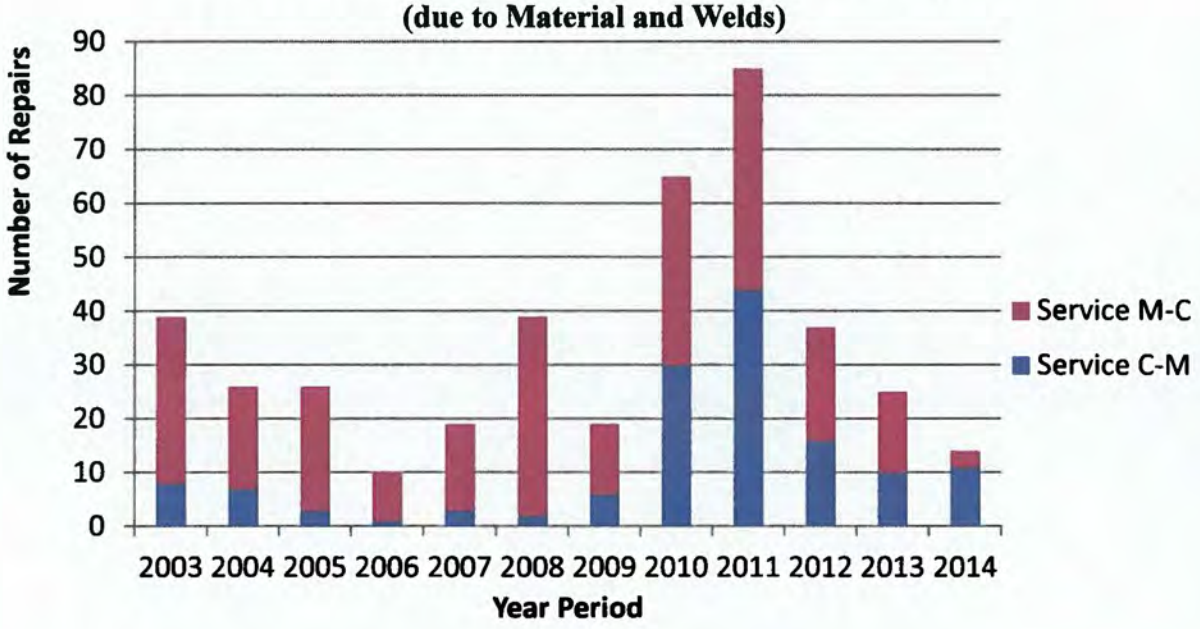


Data Source: EGIS Leak Repairs-Grade-State-Suburb-Collection.xlsx

Q. CAN YOU ALSO SHOW THE TRENDS FOR MATERIALS & WELDS?

A. Yes. The latest ten-year trend of material & welds-caused leaks is shown in Figure EAM-5. This figure shows an unstable pattern of leaks over the ten-year period shown. The number of leaks from this cause of leak did not decline during the period the AMRP program was undertaken. In the latest two or three years, leaks from this cause may be starting to decline, but a longer time period may be required to be certain, due to the unstable patterns exhibited in earlier years.

EAM-5: Duke Energy Kentucky Repaired Leaks on Services (due to Material and Welds)



Data Source: EGIS Leak Repairs-Grade-State-Suburb-Collection.xlsx

VI. COMPARISON OF SAFETY RISK FACTORS ON SERVICE LINES AGAINST RISK FACTORS ON MAINS

Q. CAN THE NUMBER OF RISK FACTORS ON SERVICE LINES IN DUKE ENERGY KENTUCKY'S SYSTEM BE COMPARED AGAINST THE NUMBER OF RISK FACTORS ON MAINS?

A. Yes. Overall, the Lummus analysis found the number of risk factors on service lines to be greater than the number of risk factors on mains in five areas. The number of risk factors on mains was higher in one area. And the number of risk factors was about equal in three areas. These risk factors are discussed in the next four questions.

Q. PLEASE IDENTIFY THE FIVE FACTORS FOUND TO CONTRIBUTE TO A GREATER NUMBER OF RISKS ON SERVICES.

A. Service line risks were found to be greater due to:

1. Pipe walls are thinner on service lines;
2. Annual number of leaks is higher on service lines;
3. Annual number of hazardous leaks is higher on service lines;
4. Service line piping is closer to buildings than mains piping; and
5. There are a number of services having unknown ages and unknown material types.

Q. PLEASE ELABORATE ON THE SIGNIFICANCE OF LUMMUS'S FINDING THAT THERE ARE SEVERAL FACTORS THAT INDICATE SERVICES POSE A GREATER RISK THAN THAT OF GAS MAINS.

A. While all of the aforementioned factors are significant, the location of services to that of an actual building structure is perhaps the most noteworthy insofar as potential impact to the general public. These services are attached directly to homes and businesses such as hospitals, nursing homes, or movie theaters and therefore, in my mind, pose an even greater potential for harm if a catastrophic failure occurs. The risk posed by the failure of these services not only affects Company employees working on the system, but also first responders (fire/police departments), families, and the unsuspecting public.

Q. PLEASE IDENTIFY THE ONE FACTOR FOUND TO CONTRIBUTE TO GREATER RISKS ON MAINS.

A. Risks on mains were found to be greater due to the greater size (diameter) of the mains, allowing more gas to be released from a leak in a given amount of time.

Q. PLEASE ALSO IDENTIFY THE THREE FACTORS FOUND TO CONTRIBUTE NEARLY EQUAL RISKS ON BOTH SERVICES AND MAINS.

A. Risks were found to be comparable on both mains and services due to:

1. Pipe mileage for service lines is comparable to mileage of mains;
2. Age of service lines is comparable to age of mains; and
3. Pressure levels are identical on mains and on service lines that are connected to them.

Q. PLEASE EXPLAIN WHY THIS COMPARISON OF SERVICE LINE RISK FACTORS TO GAS MAIN RISKS FACTORS IS SIGNIFICANT IN YOUR OPINION.

A. This comparison is significant since it helps explain why the majority of leaks (and the majority of hazardous leaks) are occurring on services as opposed to mains. Therefore, it is important to not overlook services when replacement programs are being considered or implemented.

Q. ARE YOU AWARE OF ANY REPORTED INCIDENTS THAT ILLUSTRATE SAFETY PROBLEMS THAT OCCURED WHEN OLDER METALLIC SERVICES WERE NOT REPLACED?

A. Yes. There have been several reported incidents involving hazardous accidents that occurred on steel service lines. Most noteworthy are recent events in the greater Dallas/Fort Worth area over a period of several years.[3] These accidents, all attributed to corrosion on the couplings used in older installations of steel service lines, reportedly occurred in Wylie, Texas in 2006, in Cleburne, Texas in 2007, in Mesquite, Texas in 2009, in Irving, Texas in May 2009, in again in Irving in August, 2010. Two building occupants reportedly died in the Wylie incident, two more in the Cleburne incident, and two residents were hospitalized with extensive burns in the most recent Irving explosion. These incidents prompted response by both the state legislature and regulatory authorities.[4] In fact, the Texas Railroad Commission, recognizing the risks associated with the failure of natural gas service lines, adopted a new pipeline safety rule applicable to all regulated natural gas utilities in the state. The new rule directly addresses the potential risks associated with service lines and is even more stringent than the federal government's Gas Distribution Integrity Management rule (49 CFR Subpart P) in that it mandates the replacement of pipelines or facilities that pose the greatest potential threats for failure.[5]

Q. FROM A STATISTICAL STANDPOINT, ARE THE NUMBER OF HAZARDOUS LEAKS ATTRIBUTED TO SERVICE LINE FAILURES ON DUKE ENERGY KENTUCKY'S SYSTEM SIGNIFICANT?

A. Yes. Figure 10 in the Lummus Study depicts this.

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[3] Source: http://www.wfaa.com/story/news/local/investigates/2014/08/06/13490520/

[4] *Id.*

[5] http://www.rrc.state.tx.us/all-news/022511c/

Q. DO YOU BELIEVE THE LIKELY GAINS IN TERMS OF SAFETY, RELIABILITY AND OVERALL REDUCTION OF NUMBER OF LEAKS ACHIEVABLE THROUGH A FIVE-YEAR REPLACEMENT PROGRAM IS CONSISTENT WITH DOT AND PHMSA RECOMMENDATIONS?

A. Yes. From a risk perspective, considering that the proportion of hazardous leaks occurring on services is growing and is moving toward the buildings, the sooner the Company replaces these services, the better. From a pure timing perspective, a five-year replacement period seems reasonable and within the spirit of DOT and PHMSA regulations and guidance and is consistent with the Company's prior capabilities. The services that have been identified and are now targeted for replacement, would likely be similar in material and age to those replaced as part of the Company's previous ten-year accelerated main replacement program. The number of services identified and targeted for replacement currently (approx. 10,000) are less than half of the number of services that were replaced under the AMRP (approx. 25,000), so a comparable reduction in time would be consistent.

VII. ANALYSIS OF PHMSA RECOMMENDATIONS FOR PIPE REPLACEMENT

Q. DID THE LUMMUS STUDY CONTAIN ANY FINDINGS REGARDING THE APPLICABILITY OF AN ACCELERATED SERVICE REPLACEMENT PROGRAM?

A. Yes. We compared the six characteristics of pipes that the DOT recommends for accelerated replacement programs against the composition of the service lines we recommend for replacement by Duke Energy Kentucky. Duke Energy

Kentucky's service lines that are proposed for replacement contain five of the six characteristics recommended for expeditious replacement by the DOT.

Q. WHAT IS PHMSA's POSITION ON PIPE REPLACEMENT?

A. PHMSA has stated: "We believe that the timely repair, rehabilitation, and replacement of high-risk gas pipeline infrastructure are critical to ensuring public safety."[6]

Q. DOES PHMSA APPLY THIS POSITION ON PIPE REPLACEMENT TO INCLUDE SERVICE LINES?

A. Yes. PHMSA specifically uses the word "infrastructure" – rather than mains or any other subcategory of infrastructure.

Q. DOES PHMSA ONLY CONSIDER PIPELINE INFRASTRUCTURE THAT HAS ACTUALLY EXPERIENCED SOME SORT OF LEAK TO CONSTITUTE A HIGH RISK PIPELINE INFRASTRUCTURE THAT SHOULD BE REPLACED?

A. No. In general, PHMSA's recommendations and regulations are designed to identify gas integrity risks and address them before a catastrophic event occurs. Key to that evaluation is consideration of all aspects of the risks, including, but not limited to, history of integrity of the system. A thorough review of the history of piping failures helps guide the response.

Q. HOW DOES PHMSA DEFINE THE TERM "HIGH-RISK GAS PIPELINE INFRASTRUCTURE" THAT SHOULD BE REPLACED?

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[6] http://opsweb.phmsa.dot.gov/pipelineforum/docs/PHMSA%20111011-002%20NARUC.pdf

A. PHMSA has stated: "High-risk pipeline infrastructure is piping or equipment that is no longer fit for service. As discussed below, that lack of fitness can be the product of a variety of factors.

1. Cast iron gas mains and service lines can be prone to failure as a result of graphitization or brittleness.
2. Certain vintages of plastic pipe are susceptible to premature failures as a result of brittle-like cracking.
3. Mechanical coupling installations are devices that are used for the joining and pressure sealing of two pieces of pipe. These devices are prone to failure under certain conditions.
4. Pipelines lacking adequate construction records or assessment results to verify their integrity.
5. Other kinds of pipe installations, including bare steel pipe without adequate corrosion control (*i.e.*, cathodic protection or coating) and copper piping, are also more susceptible to failure.
6. Age of pipe should be considered in determining whether pipeline infrastructure is vulnerable to failure from time-dependent forces, like corrosion, stress corrosion cracking, settlement, embrittlement, or cyclic fatigue."[7]

These factors are key to evaluating not only the integrity risk itself, but also the urgency of the need for replacement.

[7] Ibid 2.

Q. WHICH OF PHMSA'S SIX CRITERIA FOR REPLACEMENT APPLY TO DUKE ENERGY KENTUCKY'S SERVICE LINES?

A. Our analysis found that the following five of PHMSA's criteria for replacement apply to Duke Energy Kentucky's service lines:

1. Cast iron service lines (Duke Energy has one in Kentucky);
2. Mechanical coupling installations;
3. Pipelines lacking adequate construction records;
4. Bare steel pipe without adequate corrosion control (*i.e.*, cathodic protection or coating) and copper piping; and
5. Age of pipe.

VIII. FINDINGS AND CONCLUSIONS

Q. PLEASE STATE YOUR OVERALL FINDINGS AND CONCLUSIONS.

A. The primary conclusion is that a small portion (10,027 services or 10.4% of the total 96,746 services) of the Company's service lines require replacement. The services that require replacement are comprised of the metallic types of pipe materials. Additionally, services without adequate records of their type of material should be replaced. This amounts to an additional 689 services, or 0.7% of the total Kentucky service lines.

Q. CAN YOU STATE THE PRIMARY REASONS WHY THESE SERVICES REQUIRE REPLACEMENT?

A. A key finding by Lummus was that the number of service line leaks has far exceeded the number of leaks on mains in recent years. Also, service leaks caused by factors such as corrosion or materials and welds, have not necessarily

been declining as expected, following the AMRP. These factors directly relate to metallic types of pipe materials that continue to corrode over time. The corrosion can result in pinhole leaks on the wall of the service line, as well as joint leaks where sections of the service line are fastened together. For safety reasons, services whose material type cannot be ascertained also require replacement.

Q. ARE THERE OTHER REASONS WHY THESE SERVICES REQUIRE REPLACEMENT?

A. Yes. We compared the number of safety risk factors for services against the number for mains and determined that the number of risk factors on services is greater than the number on mains. Specifically, risks were greater for services in five safety areas:

1. Pipe walls are thinner on service lines;
2. Annual number of leaks is higher on service lines;
3. Annual number of hazardous leaks is higher on service lines;
4. Service line piping is closer to buildings than mains piping; and
5. There are a number of services having unknown ages and unknown material types.

These five factors compare against only one risk factor that is greater for mains due to the larger main pipe sizes; and three risk factors that are about equal for services and mains for mileage, age, and pressure levels.

Q. IN YOUR OPINION WOULD DUKE ENERGY KENTUCKY'S PROPOSED REPLACEMENT PROGRAM FOR KENTUCKY SERVICE LINES BE CONSISTENT WITH PHMSA'S RECOMMENDATIONS?

A. Yes. Lummus Consultants found that the following five PHMSA criteria for replacement would apply to Duke Energy Kentucky's proposed service line replacement program:

1. Cast iron service lines (Duke Energy has one in Kentucky);
2. Mechanical coupling installations;
3. Pipelines lacking adequate construction records;
4. Bare steel pipe without adequate corrosion control (i.e., cathodic protection or coating) and copper piping; and
5. Age of pipe.

Additionally, considering that hazardous leaks are increasing on the portion of services nearest a building and its occupants, the sooner these service lines are replaced, the better. Given these factors and for the reasons articulated throughout the Lummus Study, a customized response, where these services are replaced in an expeditious manner is appropriate, warranted and supportable under federal regulations and guidance in the interests of safety and from an overall integrity management perspective.

Q. WAS ATTACHMENT EAM-1 AND THE LUMMUS STUDY CONTAINED IN EXHIBIT 4 TO THE COMPANY'S APPLICATION PREPARED BY YOU OR UNDER YOUR DIRECTION AND CONTROL?

A. Yes.

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes.

VERIFICATION

STATE OF DELAWARE)
) SS:
COUNTY OF SUSSEX)

The undersigned, Edward A. McGee, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing testimony, and that the answers contained therein are true and correct to the best of his knowledge, information and belief.

Edward A. McGee, Affiant

Subscribed and sworn to before me by Edward A. McGee on this 26TH day of June 2015.

NOTARY PUBLIC

My Commission Expires:

JOHN A. BARRETT
Notary Public
State of Delaware
My Commission Expires on Oct. 31, 2017

PROFESSIONAL CAREER

2012 - present **Lummus Consulting International, Inc.**
Gas Utility Consultant

As a Gas Utility Consultant for Lummus Consulting, I am responsible for assisting in studies performed in the gas utility and other energy areas.

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 in the utility field.

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 - State of Indiana (Expired)
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.