Exhibit No:	
Issue:	**Replacement Programs, Worn Out or Deteriorated & Bare Steel Treated with Cathodic Protection**
Witness:	**Bob Robert R. Leonberger**
Type of Exhibit:	**Direct Testimony**
Sponsoring Party:	**Spire Missouri Inc.**
Case Nos.:	**GO-2019-0356, GO-2019-0357,**
Date Prepared:	**September 27, 2019**

SPIRE MISSOURI, INC.

File Nos. GO-2019-0356, GO-2019-0357

DIRECT TESTIMONY

OF

ROBERT R. LEONBERGER

SEPTEMBER 2019

TABLE OF CONTENTS

DIRECT TESTIMONY OF ROBERT R. LEONBERGER

Q. **PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

A. My name is Robert R. Leonberger and the business address for the consulting firm for whom I currently work (NatGas Consulting) is: One Westinghouse Plaza; Suite 36; Boston, Massachusetts 02136. However, I work from my residence at 1920 Sylvan Hills Road; Jefferson City, Missouri 65109.

Q. **WHAT IS YOUR PRESENT POSITION?**

A. I am presently employed as an Engineer/Natural Gas Expert for NatGas Consulting.

Q. PLEASE STATE HOW LONG YOU HAVE HELD YOUR POSITION AND BRIEFLY DESCRIBE YOUR RESPONSIBILITIES.

A. I have been employed with NatGas Consulting since April 2016. As an Engineer/Natural Gas Expert for NatGas Consulting, I investigate natural gas distribution system and natural gas transmission pipeline explosions and fires. I provide opinions regarding natural gas pipeline safety practices and procedures, operations and maintenance procedures, emergency response procedures and application of pipeline safety regulations. As an Engineer/Natural Gas Expert for NatGas Consulting I have been involved in natural gas distribution system explosion/fire investigations in California, Massachusetts, Indiana, Colorado, Illinois, Michigan, Missouri, Nebraska and Canada, as well as one natural gas transmission pipeline explosion/fire investigation in Illinois.

Q. WHAT WAS YOUR WORK EXPERIENCE PRIOR TO ASSUMING YOUR CURRENT POSITION?

A. I was employed by the Missouri Highway and Transportation Department in the Bridge Division from 1977-1982, as a Structural Design Engineer and later as a Senior Structural Design Engineer. While at the Highway Department I performed all facets of highway

bridge design work and checked bridge design plans prepared by others. During that time, I also spent one year as a steel fabrication inspector monitoring quality control/assurance of all phases of bridge steel fabrication and welding in steel fabrication plants.

Beginning in July 1, 1982, I joined the Pipeline Safety Engineering Staff of the Missouri Public Service Commission (Commission) as an Engineer III, was promoted to an Engineer IV and assumed the position of Pipeline Safety Program Manager in October of 1990. I held that position until retirement from the Commission in April 2016. I have successfully completed seven, week-long courses at the Training and Qualification facilities in Oklahoma City, OK, prescribed for all state and federal pipeline inspectors by the U.S. Department of Transportation - Pipeline and Hazardous Materials Safety Administration (DOT-PHMSA). These courses cover the application and enforcement of the federal safety standards for the transportation of natural and other gas by pipeline (49 CFR, Part 192). Included in this training were courses on the joining of pipeline materials, welding, corrosion control, regulator stations and relief devices, failure investigation, and code application and enforcement. I also completed a one-week long technical class on corrosion and corrosion control provided by the National Association of Corrosion Engineers (NACE) and the Appalachian Underground Corrosion Course. I have also taken an intensive week-long DOT-PHMSA sponsored course in root cause failure analysis. In addition, I have attended numerous other courses and seminars directly related to pipeline safety and incident investigation related subjects, as well as seminars on utility regulation.

Q. WHAT WERE YOUR DUTIES WHILE WORKING AT THE COMMISSION?

As the Pipeline Safety Program Manager in the Commission's Safety Engineering Unit, I managed all facets of the Commission's Pipeline Safety Program and supervised eight Safety Engineering Staff members. The Staff conducted on-site plant inspections, reviewed and analyzed utility records, investigated natural gas related incidents and assisted in the continued development of the Commission's pipeline safety rules. My responsibilities included monitoring all phases of natural gas utility plant design, installation, operation, and maintenance. It was also my responsibility to make recommendations to each utility's management and to the Commission, if necessary, following these evaluations and investigations. While at the Commission I personally investigated dozens of natural gas incidents and participated in writing dozens of technical incident reports filed with the Commission detailing the facts of Staff's investigation, as well as presenting analysis, conclusions and recommendations based on these investigations. I was also the manager directly supervising Staff conducting the investigations and writing of incident reports for dozens of other incident investigations from October 1990 to April 2016.

Q. HAVE YOU BEEN INVOLVED IN THE FORMULATION OF FEDERAL PIPELINE SAFETY REGULATIONS?

A. Yes, I was selected by DOT-PHMSA to participate with two other state program managers, pipeline operators, DOT-PHMSA personnel and other stakeholders to develop the federal operator qualification regulations through a negotiated rulemaking process. I also participated in a task group with state and federal pipeline safety personnel, pipeline operators and other stakeholders to develop the distribution integrity management regulation.

Q. HAVE YOU PARTICIPATED IN OTHER PROFESSIONAL ORGANIZATIONS THAT FOCUS ON NATURAL GAS SAFETY ISSUES?

A. Yes. I am a former member of the National Association of Corrosion Engineers (NACE) and former member of the American Society of Mechanical Engineers-Gas Piping and Technical Committee (ASME-GPTC). I represented the PSC on the ASME-GPTC from 1986-1989. I am a former member, past Central Region Chairman and past National Chairman of the National Association of Pipeline Safety Representatives (NAPSR). I have served on the NAPSR Legislative Committee, the Strategic Planning/Grant Allocation Committee, as well as several NAPSR task groups and subcommittees. I was awarded the NAPSR Chairman's Award for outstanding service to the organization and to pipeline safety. I was also awarded NAPSR's Lifetime Achievement Award for contributions to national pipeline safety advancements throughout my career. I am also a former member of the National Association of Regulatory Utility Commissioners (NARUC) Staff Subcommittee on Pipeline Safety and represented the Commission on this organization.

Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?

A. I studied Architectural/Structural Engineering at the University of Colorado in Boulder, Colorado from 1971 to 1977.

Q. HAVE YOU PREVIOUSLY FILED TESTIMONY BEFORE THIS COMMISSION?

A. Yes. I have presented testimony before the Commission in over a dozen cases, and have been deposed several times in association with these cases and incident investigations. I have also been called to testify in two court cases, one involving a Staff incident

investigation and the other the applicability of the Commission's Pipeline Safety Regulations.

I. PURPOSE OF DIRECT TESTIMONY

Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?

A. The purpose of my testimony is to address certain concerns that have been raised by the Office of the Public Counsel ("OPC") regarding the Company's replacement of steel mains that were initially installed without cathodic protection, but had cathodic protection added at a later date. I will also provide some background information on the Commission's pipeline safety replacement regulations.

II. HISTORY OF MISSOURI GAS PIPELINE REPLACEMENT PROGRAMS

Q. WERE YOU INVOLVED IN THE PROMULGATION OF THE COMMISSION'S SAFETY RULES AS THEY PERTAIN TO THE REPLACEMENT OF GAS PIPELINE FACILITIES?

A. Yes.

Q. PLEASE EXPLAIN YOUR INVOLVEMENT.

A. Along with other Commission Pipeline Safety Staff members, I was directly involved in the drafting of comprehensive revisions to the Commission's Pipeline Safety Regulations in the 1989 and 1990 timeframe. These revisions included new requirements for replacement programs of piping deemed by Staff to be in deteriorated condition and hazardous.

Q. PLEASE EXPLAIN WHY THESE RULES WERE DEVELOPED.

A. The revisions to the regulations during this time were extensive and covered changes to improve pipeline safety in numerous areas; however, I will limit my answer specifically to the replacement programs. During the winter of 1989/1990 there were several natural gas explosions in Missouri and Kansas caused by leakage from unprotected (non-cathodically protected) steel service lines due to corrosion. Several people were killed and several were injured. This drew the attention of the Governors and Commissions of both states, the Missouri Legislature, as well as national and state-wide media. The then Chairman of the Commission stated that in light of these terrible incidents, which involved the loss of life and serious injuries, it was obvious that the "minimum" Federal Pipeline Safety Regulations in effect at the time were not enough. The Commissioners of the Missouri Public Service Commission, wanted to address these pipeline safety issues and directed the Staff to draft comprehensive revisions to its Pipeline Safety Regulations. For the most part, the Missouri pipeline safety regulations in effect at the time simply duplicated the minimum safety requirements contained in the Federal Pipeline Safety Regulations contained in the Code of Federal Regulations.

Q. HOW DID THESE SAFETY RULES ADDRESS THE DETERIORATING CONDITION OF BARE STEEL AND CAST IRON PIPES?

A. The first issue was to address the materials and factors that caused the natural gas explosions that had recently occurred. Specifically, this meant addressing leakage due to corrosion of unprotected steel service and yard lines and to put in place requirements to replace such lines. However, it was equally important to address replacement of deteriorated unprotected steel mains and cast iron mains that also posed a

hazard to safety. The unprotected steel mains were in the same ground as the unprotected steel service lines and had been for decades, and were subject to the same kind of corrosion. The cast iron mains had also been in the ground for an even longer period of time, some now exceeding 100 years, and were susceptible to fracturing and other conditions that could result in catastrophic leaks.

Q. ARE YOU FAMILIAR WITH SPIRE MISSOURI'S ACCELERATED GAS PIPELINE REPLACEMENT PROGRAMS?

A. Yes. As stated previously, I was part of the Commission Staff that drafted the regulations requiring pipeline replacement programs and following that I was the Manager of the Commission's Pipeline Safety Staff from 1990 to 2016. In that capacity I monitored the progress of on-going replacement programs, as well as reviewed changes to those programs during that time.

Q. PLEASE EXPLAIN THE PURPOSE AND IMPACT OF THESE ACCELERATED REPLACEMENT PROGRAMS AS THEY PERTAIN TO SAFETY.

A. The purpose of the accelerated replacement programs was to eliminate piping materials that had been identified as deteriorated and presented a hazard to safety. The ultimate goal was to reduce the number of natural gas leaks and the number of natural gas explosions. The ISRS statute passed by the General Assembly in 2003, provided utility companies an incentive to accelerate the replacement of deteriorated infrastructure, such as the bare steel mains and other facilities with identified integrity risks. Or more exactly, it removed a disincentive by allowing utilities to begin recovering the costs for such investments once they were placed into service rather than making them absorb and permanently forego the depreciation, carrying costs and other expenses that were incurred between the time these

facilities went into service and a subsequent rate case was finalized. As a pipeline safety person in the Commission's Pipeline Safety Staff for over 20 years in 2003, I believed the ISRS statute appropriately encouraged utilities to accelerate replacements of these facilities. As a pipeline safety person, I wanted utilities to use these tools to expedite elimination of hazardous and deteriorated facilities as quickly as possible. I think the developments addressed by Spire Missouri witness Hoeferlin in his direct testimony, including the increased emphasis at the federal and state level on such accelerated replacements, underscores the wisdom of and need for the approach that has been taken by Spire Missouri.

III. CATHODIC PROTECTION OF BARE STEEL PIPES

Q. WHY WAS THE CATHODIC PROTECTION OF BARE STEEL PIPE AN OPTION FOR UTILITIES UNDER THE 1989 SAFETY RULES?

A. The regulations that were promulgated to address this issue can be found at 22 CSR 4240-40.030(15)(E) of the Commission's safety rules. Section (15)(E) contained several options for addressing unprotected steel mains, including the application of "cathodic protection" and the replacement of such facilities. While drafting the replacement requirements for bare steel mains, the Staff was uncomfortable with allowing "cathodic protection" of unprotected steel mains since these mains had not been protected from corrosion for that entire period of time and had been deteriorating since installation and had been deteriorating due to corrosion at the same rate as the steel service lines that had corroded and failed. As a result, neither the Staff nor the utility could not know the deteriorated condition of these unprotected bare steel mains. However, since there were approximately

100,000 unprotected steel service lines, the more immediate issue (that caused the recent explosions) was to eliminate those unprotected steel service lines. Given the huge replacement effort that would be required to eliminate these unprotected steel service lines, as well as address cast iron mains and the other pipeline safety initiatives, the final rule was promulgated allowing the cathodic protection of these unprotected steel mains as an interim measure to possibly slow deterioration while the other huge issues were addressed. In short, cathodic protection was a "stop gap measure" and not some kind of permanent fix to the problem.

Q. DID YOU CONSIDER THESE BARE STEEL FACILITIES THAT HAD BEEN PLACED UNDER SOME DEGREE OF CATHODIC PROTECTION TO STILL HAVE MANY OF THE SAME SAFETY-RELATED DEFICIENCIES ASSOCIATED WITH BARE STEEL?

A. Yes. I would like to point out a possible misunderstanding of the term "cathodically protected bare steel main". As noted above, the piping had already been in the ground corroding for 30 to 50 years and applying cathodic protection did not fix the deterioration that had already occurred. Using the term "cathodically protected bare steel main" might be misperceived as indicating that after the cathodic protection is applied, all deterioration of the main due to corrosion is now stopped. This is simply not the case. Spire Witness Hoeferlin page 21, lines 1-3, states that application of cathodic protection to these mains would not eliminate corrosion and would not repair corrosion that had occurred. I agree that applying cathodic protection to these bare steel mains did not eliminate any pre-existing corrosion or prevent significant additional corrosion in the future.

Q. TO YOUR KNOWLEDGE, WHAT WAS THE GENERAL AGE OF SPIRE MISSOURI'S BARE STEEL PIPE BEFORE IT RECEIVED CATHODIC PROTECTION?

A. Prior to my retirement from the Missouri Public Service Commission in April 2016, that information was readily available to me. However, since that time I do not have that information. However, Spire Witness Hoeferlin's has stated in his direct testimony that many of Spire West's steel mains had already been in the ground and operating for over 3 decades, with many more than 40 or 50 years old before cathodic protection was applied. From what I remember, the age for the bare steel mains sounds accurate.

Q. DO YOU KNOW WHY THE DECISION WAS INITIALLY MADE TO APPLY CATHODIC PROTECTION TO MGE'S BARE STEEL MAINS INSTEAD OF JUST REPLACING THEM OUTRIGHT?

A. As I previously indicated, Staff was not comfortable with the cathodic protection option and initially believed bare steel mains should be replaced. Logically, the unprotected bare steel mains were in the same corrosive environment as the unprotected steel service lines and were deteriorating at the same rate. The decision was nevertheless made almost 30 years ago to allow cathodic protection of unprotected steel mains due to the enormity of the problem posed by other facilities that needed to be replaced more immediately. Spire West had tens of thousands of unprotected steel service lines in operation at the time. Due to the numerous natural gas explosions, deaths and injuries during 1989/1990, eliminating those unprotected steel service lines was seen as the highest priority. The cost, planning, coordination of personnel and contractors, procurement of materials needed to replace the tens of thousands of unprotected steel service lines and cast iron mains (the highest

priorities), as well as compliance with other required new safety regulations was enormous. In the interim, a level of safety could be provided for unprotected steel main by monitoring them with accelerated leak survey frequency and applying cathodic protection. However, this was not proactive and did not fix the problem. At the same time, however, Staff was especially concerned about the sudden fractures of cast iron mains, especially small diameter cast iron mains. Conducting more frequent leak surveys over the cast iron mains was not effective in detecting when/if a failure/fracture will occur, so replacement was the only option for cast iron. In the end, the regulation for unprotected bare steel mains allowed for replacement of the main or cathodic protection being applied to the main as an interim solution. Of course, that interim solution was implemented nearly 30 years ago.

Q. WHY WOULD CATHODICALLY PROTECTING BARE STEEL PIPE THAT HAS BEEN BARE FOR DECADES NOT BE CONSIDERED A PERMANENT SOLUTION FOR RESOLVING THE DETERIORATED CONDITION OF ITS SUCH BARE STEEL PIPES?

A. As I noted previously, the bare steel mains had been deteriorating for 30 to 50 years before cathodic protection was applied. Now those same pipelines are 60 to 80 years old. In the last 30 years, even though cathodic protection was applied, such measure could not prevent 100% of future corrosion and deterioration has continued.

Q. AS A MATTER OF SAFETY, SHOULD BARE STEEL PIPE THAT HAD BEEN BARE FOR DECADES, BUT CATHODICALLY PROTECTED, BE REPLACED?

A. Yes. That was my opinion almost 30 years ago and is still my position. Accelerating the replacement of bare steel mains is also discussed in the 2011 Commission Pipeline Safety Report referenced by Spire Witness Hoeferlin.

Q. PLEASE EXPLAIN.

A. As stated previously, the unprotected pipelines corroded/deteriorated for a period of 30 to 50 years before cathodic protections was applied. When the regulations were drafted almost 30 years ago, the Staff believed the regulation should require replacement of the unprotected bare steel mains, similar to the replacement requirement for the bare steel service lines. Now almost 30 years later, even though cathodic protection was applied, corrosion/deterioration of the bare steel pipeline was not totally eliminated. Also, "replacement of high-risk infrastructure in pipeline systems" (such as bare steel) was also the position of U. S. Department of Transportation, which in 2011 urged the states to review programs for replacement of bare steel and cast iron for integrity of the pipeline system. Again, this is detailed in Spire Witness Hoeferlin's direct testimony (page 7, lines 4-23 through page 8, lines 1-5).

Q. DO YOU CONSIDER BARE STEEL PIPE THAT HAS BEEN BARE FOR DECADES, BUT CATHODICALLY PROTECTED, TO BE IN A WORN OUT OR DETERIORATED CONDITION?

A. Yes. Again, however, I hesitate to use the term "cathodically protected" bare steel because it is misleading and conveys an inaccurate assumption since cathodic protection was not applied to the bare steel pipelines for 30 to 50 years after they had been installed.

Q. IN YOUR OPINION, DOES MISSOURI'S RULE 4 CSR 240-40.030 15(E) ON REPLACEMENT OF BARE STEEL PIPE ALLOW FOR THE REPLACEMENT OF BARE STEEL THAT HAS BEEN CATHODICALLY PROTECTED?

A. Yes. Further, 22 CSR 4240-40.030(17) requires operators of natural gas facilities in Missouri to assess risks and failures and implement measures to reduce these risks.

Q. ARE YOU FAMILIAR WITH CASE NO. GO-2002-50?

A. Yes. I was the Pipeline Safety Program Manager at the Missouri Public Service Commission at the time.

Q. IN GO-2002-50 WAS MGE (NOW SPIRE WEST) REQUIRED TO REPLACE A MINIMUM AMOUNT OF ITS BARE STEEL PIPE THAT HAD RECEIVED CATHODIC PROTECTION?

A. Yes. The case set a minimum amount of "protected" bare steel main to be replaced. The Staff's rational for requiring replacement of those bare steel mains where cathodic protection had been subsequently applied is detailed in Spire Witness Hoeferlin's Testimony (page 21, lines 20-22 and page 22, lines 1-2).

Q. PLEASE EXPLAIN WHY THIS WAS REQUIRED IN THAT CASE.

A. The replacement of unprotected bare steel service lines had been on-going for approximately 10 years and tens of thousands of bare steel service lines had been eliminated. However, Staff still believed that replacement of bare steel mains had to be undertaken even if the initial minimum requirement was relatively modest.

Q. ARE YOU FAMILIAR WITH THE RATE AT WHICH SPIRE MISSOURI IS REPLACING ITS BARE STEEL MAINS THAT HAD BEEN CATHODICALLY PROTECTED?

A. Yes.

Q. IN YOUR OPINION, IS SPIRE MISSOURI REPLACING ITS BARE STEEL FACILITIES THAT HAVE BEEN CATHODICALLY PROTECTED AT THE APPROPRIATE RATE?

A. Yes. From the humble beginnings in 2002, Laclede/MGE (now Spire) have ramped up replacement of bare steel mains. At this point Spire Missouri is replacing approximately

80 miles of bare steel main annually. I would note that Spire Witness Hoeferlin (on page 9, line 6) references the Commission's 2011 Pipeline Safety Report and quotes a section from the Report (page 9, lines 8-28). I was the primary author of the Report and it discusses concerns of the 2011 rate of replacements and the reality in the future if the level of replacements were continued at the same level. The Report encourages increasing replacement rates for cast iron and "older steel pipelines". Specifically, pointing out that "older steel pipelines have been involved in the two recent incidents in Missouri" (Spire Witness Hoeferlin, page 9, lines 25-26).

Q. **DOES THIS COMPLETE YOUR DIRECT TESTIMONY?**

A. Yes.

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Spire Missouri Inc. to Change its Infrastructure System Replacement Surcharge in its Spire Missouri East Service Territory	))))	**File No. GO-2019-0356**
In the Matter of the Application of Spire Missouri Inc. to Change its Infrastructure System Replacement Surcharge in its Spire Missouri West Service Territory	))))	**File No. GO-2019-0357**

AFFIDAVIT

STATE OF MISSOURI)
) SS.
CITY OF ST. LOUIS)

Robert R. Leonberger, of lawful age, being first duly sworn, deposes and states:

1. My name is Robert R. Leonberger. I am an engineer and natural gas expert for Nat Gas Consulting. My business address is One Westinghouse Plaza, Suite 36, Boston Massachusetts, 02136.

2. Attached hereto and made a part hereof for all purposes is my direct testimony on behalf of Spire Missouri Inc.

3. I hereby swear and affirm that my answers contained in the attached testimony to the questions therein propounded are true and correct to the best of my knowledge and belief.

Robert R. Leonberger

Subscribed and sworn to before me this 27 day of September 2019.

TAYLER RIDENHOUR
Notary Public - Notary Seal
STATE OF MISSOURI
County of Maries
My Commission Expires 2/26/2021
Commission # 13453555

Tayler Ridenhour