

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

Spire Exhibit No. 6
Date 10-2-19 Reporter TR
File No. GO-2019-0354
GO-2019-0357

TABLE OF CONTENTS

- I. PURPOSE OF DIRECT TESTIMONY*
- II. HISTORY OF MISSOURI GAS PIPELINE REPLACEMENT PROGRAMS*
- III. CATHODIC PROTECTION OF BARE STEEL PIPES*

DIRECT TESTIMONY OF ROBERT R. LEONBERGER

1 Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

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

6 Q. WHAT IS YOUR PRESENT POSITION?

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

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

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

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

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

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

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

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

22

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

15
16 **Q. HAVE YOU BEEN INVOLVED IN THE FORMULATION OF FEDERAL**
17 **PIPELINE SAFETY REGULATIONS?**

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

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

3 A. Yes. I am a former member of the National Association of Corrosion Engineers (NACE)
4 and former member of the American Society of Mechanical Engineers-Gas Piping and
5 Technical Committee (ASME-GPTC). I represented the PSC on the ASME-GPTC from
6 1986-1989. I am a former member, past Central Region Chairman and past National
7 Chairman of the National Association of Pipeline Safety Representatives (NAPSR). I have
8 served on the NAPSR Legislative Committee, the Strategic Planning/Grant Allocation
9 Committee, as well as several NAPSR task groups and subcommittees. I was awarded the
10 NAPSR Chairman's Award for outstanding service to the organization and to pipeline
11 safety. I was also awarded NAPSR's Lifetime Achievement Award for contributions to
12 national pipeline safety advancements throughout my career. I am also a former member
13 of the National Association of Regulatory Utility Commissioners (NARUC) Staff
14 Subcommittee on Pipeline Safety and represented the Commission on this organization.

15 **Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?**

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

18 **Q. HAVE YOU PREVIOUSLY FILED TESTIMONY BEFORE THIS**
19 **COMMISSION?**

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

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

3 **I. PURPOSE OF DIRECT TESTIMONY**

4 **Q. WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

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

10

11 **II. HISTORY OF MISSOURI GAS PIPELINE REPLACEMENT PROGRAMS**

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

15 A. Yes.

16 **Q. PLEASE EXPLAIN YOUR INVOLVEMENT.**

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

22 **Q. PLEASE EXPLAIN WHY THESE RULES WERE DEVELOPED.**

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

16

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

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

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

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

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

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

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

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

10 **III. CATHODIC PROTECTION OF BARE STEEL PIPES**

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

13 **A.** The regulations that were promulgated to address this issue can be found at 22 CSR 4240-
14 40.030(15)(E) of the Commission's safety rules. Section (15)(E) contained several options
15 for addressing unprotected steel mains, including the application of "cathodic protection"
16 and the replacement of such facilities. While drafting the replacement requirements for
17 bare steel mains, the Staff was uncomfortable with allowing "cathodic protection" of
18 unprotected steel mains since these mains had not been protected from corrosion for that
19 entire period of time and had been deteriorating since installation and had been
20 deteriorating due to corrosion at the same rate as the steel service lines that had corroded
21 and failed. As a result, neither the Staff nor the utility could not know the deteriorated
22 condition of these unprotected bare steel mains. However, since there were approximately
23

1 100,000 unprotected steel service lines, the more immediate issue (that caused the recent
2 explosions) was to eliminate those unprotected steel service lines. Given the huge
3 replacement effort that would be required to eliminate these unprotected steel service lines,
4 as well as address cast iron mains and the other pipeline safety initiatives, the final rule was
5 promulgated allowing the cathodic protection of these unprotected steel mains as an interim
6 measure to possibly slow deterioration while the other huge issues were addressed. In
7 short, cathodic protection was a “stop gap measure” and not some kind of permanent fix to
8 the problem.

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

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

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

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

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

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

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

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

15 A. As I noted previously, the bare steel mains had been deteriorating for 30 to 50 years before
16 cathodic protection was applied. Now those same pipelines are 60 to 80 years old. In the
17 last 30 years, even though cathodic protection was applied, such measure could not prevent
18 100% of future corrosion and deterioration has continued.

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

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

1 **Q. PLEASE EXPLAIN.**

2 A. As stated previously, the unprotected pipelines corroded/deteriorated for a period of 30 to
3 50 years before cathodic protection was applied. When the regulations were drafted
4 almost 30 years ago, the Staff believed the regulation should require replacement of the
5 unprotected bare steel mains, similar to the replacement requirement for the bare steel
6 service lines. Now almost 30 years later, even though cathodic protection was applied,
7 corrosion/deterioration of the bare steel pipeline was not totally eliminated. Also,
8 “replacement of high-risk infrastructure in pipeline systems” (such as bare steel) was also
9 the position of U. S. Department of Transportation, which in 2011 urged the states to review
10 programs for replacement of bare steel and cast iron for integrity of the pipeline system.
11 Again, this is detailed in Spire Witness Hoeflerlin’s direct testimony (page 7, lines 4-23
12 through page 8, lines 1-5).

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

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

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

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

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

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

4 Q. IN GO-2002-50 WAS MGE (NOW SPIRE WEST) REQUIRED TO REPLACE A
5 MINIMUM AMOUNT OF ITS BARE STEEL PIPE THAT HAD RECEIVED
6 CATHODIC PROTECTION?
7

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

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

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

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

20 A. Yes.

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

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

1 80 miles of bare steel main annually. I would note that Spire Witness Hoferlin (on page
2 9, line 6) references the Commission’s 2011 Pipeline Safety Report and quotes a section
3 from the Report (page 9, lines 8-28). I was the primary author of the Report and it discusses
4 concerns of the 2011 rate of replacements and the reality in the future if the level of
5 replacements were continued at the same level. The Report encourages increasing
6 replacement rates for cast iron and “older steel pipelines”. Specifically, pointing out that
7 “older steel pipelines have been involved in the two recent incidents in Missouri” (Spire
8 Witness Hoferlin, page 9, lines 25-26).

9 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) **File No. GO-2019-0356**
Replacement Surcharge in its Spire Missouri East)
Service Territory)

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

A F F I D A V I T

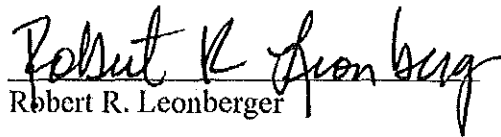
STATE OF MISSOURI)
) SS.
CITY OF ST. LOUIS)

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.

