

Exhibit No:
Issue: Replacement Programs, Worn Out
or Deteriorated Condition of Cast
Iron and Bare Steel Facilities
Witness: Robert R. Leonberger
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Sponsoring Party: Spire Missouri Inc.
Case Nos.: GO-2018-0309, GO-2018-0310

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SPIRE MISSOURI, INC.

File Nos. GO-2018-0309, GO-2018-0310

DIRECT TESTIMONY

OF

ROBERT R. LEONBERGER

MAY 2020

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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, Kentucky, Alabama and Canada, as well
18 as one natural gas 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 on 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 A. As the Pipeline Safety Program Manager in the Commission's Safety Engineering Unit, I
23 managed all facets of the Commission's Pipeline Safety Program and supervised eight

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

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

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

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

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

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

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

16 **Q. HAVE YOU PREVIOUSLY FILED TESTIMONY BEFORE THIS**
17 **COMMISSION?**

18 A. Yes. I have presented testimony before the Commission in over a dozen cases, including
19 the two most recent ISRS cases filed by Spire Missouri Inc. (“Spire Missouri”), and have
20 been deposed several times in association with these cases and incident investigations. I
21 have also been called to testify in two court cases, one involving a Staff incident
22 investigation and the other the applicability of the Commission’s Pipeline Safety
23 Regulations.

1 **I. PURPOSE OF DIRECT TESTIMONY**

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

3 A. The purpose of my testimony is to address whether the cast iron and bare steel service lines
4 included in the Company’s 2018 ISRS filings are worn out or in a deteriorated condition
5 as those terms are used in the mandate issued in these cases by the Western District Court
6 of Appeals. To do that I will provide some background information on the Commission’s
7 pipeline safety replacement regulations and, as someone who was deeply involved in their
8 formulation, explain how such regulations were triggered by a number of fatal explosions
9 that occurred because such facilities were *already* in a deteriorated condition nearly three
10 decades ago. I will also address the various factors and evidence showing that such
11 facilities remain in a deteriorated condition today and, in fact, have only become more
12 deteriorated over that time. Finally, I will touch upon the universal consensus that has been
13 reached by federal and state safety officials regarding the need to replace these facilities on
14 an accelerated basis because of their deteriorated condition. I will also explain how that
15 consensus has been implemented by utilities across the United States who have been
16 replacing such facilities at a pace that is equivalent to, or even faster than the pace being
17 undertaken by Spire Missouri with its systematic cast iron and bare steel replacement
18 programs.

19
20 **II. HISTORY OF MISSOURI GAS PIPELINE REPLACEMENT PROGRAMS**

21 **Q. WERE YOU INVOLVED IN THE PROMULGATION OF THE COMMISSION’S**
22 **SAFETY RULES AS THEY PERTAIN TO THE REPLACEMENT OF GAS**
23 **PIPELINE FACILITIES?**

1 A. Yes.

2 **Q. PLEASE EXPLAIN YOUR INVOLVEMENT.**

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

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

9 A. The revisions to the regulations during this time were extensive and covered changes to
10 improve pipeline safety in numerous areas; however, I will limit my answer specifically to
11 the replacement programs. During the winter of 1988/1989 there were several natural gas
12 explosions in Missouri and Kansas caused by leakage from unprotected (non-cathodically
13 protected) steel service lines due to corrosion. Several people were killed and several were
14 injured. This drew the attention of the Governors and Commissions of both states, the
15 Missouri Legislature, as well as national and state-wide media. The then Chairman of the
16 Commission stated that in light of these terrible incidents, which involved the loss of life
17 and serious injuries, it was obvious that the "minimum" Federal Pipeline Safety
18 Regulations in effect at the time were not enough. The Commissioners of the Missouri
19 Public Service Commission, wanted to address these pipeline safety issues and directed the
20 Staff to draft comprehensive revisions to its Pipeline Safety Regulations. For the most part,
21 the Missouri pipeline safety regulations in effect at the time simply duplicated the
22 minimum safety requirements contained in the Federal Pipeline Safety Regulations
23 contained in the Code of Federal Regulations.

1 **Q. HOW DID THESE NEW COMMISSION SAFETY RULES ADDRESS THE**
2 **DETERIORATING CONDITION OF BARE STEEL AND CAST IRON PIPES?**

3 A. The first issue was to address the materials and factors that caused the natural gas
4 explosions that had recently occurred. Specifically, this meant addressing
5 leakage due to corrosion of unprotected steel service and yard lines and to put in place
6 requirements to replace such lines. However, it was equally important to address
7 replacement of deteriorated unprotected steel mains and cast iron mains that also posed a
8 hazard to safety. The unprotected steel mains were in the same ground as the unprotected
9 steel service lines and had been for decades, and were subject to the same kind of corrosion.
10 The cast iron mains had also been in the ground for an even longer period of time, some
11 having already exceeded 100 years, and were susceptible to fracturing and other conditions
12 that could result in catastrophic leaks.

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

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

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

22 A. The purpose of the accelerated replacement programs was to eliminate piping materials
23 that had been identified as deteriorated and presented a hazard to safety. The ultimate goal

1 was to reduce the number of natural gas leaks and the number of natural gas explosions.
2 The ISRS statute passed by the General Assembly in 2003 provided utility companies an
3 incentive to accelerate the replacement of deteriorated infrastructure, such as the bare steel
4 mains and other facilities with identified integrity risks. Or more exactly, it removed a
5 disincentive by allowing utilities to begin recovering the costs for such investments shortly
6 after they were placed into service rather than making them permanently forego the
7 depreciation, carrying costs and other expenses until a subsequent rate case was finalized.
8 As a pipeline safety engineer on the Commission's Pipeline Safety Staff for over 20 years
9 as of 2003, I believed the ISRS statute appropriately encouraged utilities to accelerate
10 replacements of these facilities. As a manager responsible for pipeline safety, I wanted
11 utilities to use these tools to expedite elimination of hazardous and deteriorated facilities.
12 I think the developments addressed by Spire Missouri witness Goodson in his direct
13 testimony, including the increased emphasis at the federal and state level on such
14 accelerated replacements, underscores the wisdom of and need for the approach that has
15 been taken by Spire Missouri.

16
17 **III. WORN OUT OR DETERIORATED CONDITION**
18 **OF CAST IRON AND BARE STEEL FACILITIES**
19

20 **Q. ARE YOU FAMILIAR WITH THE WESTERN DISTRICT COURT OF APPEALS**
21 **MANDATE THAT THE COMMISSION REMOVE COSTS INCURRED TO**
22 **REPLACE CAST IRON AND BARE STEEL MAINS AND SERVICE LINES NOT**
23 **SHOWN TO BE WORN OUT OR DETERIORATED?**

24 **A.** Yes, I have read the Court's mandate.

1 **Q. IN YOUR OPINION, IS THERE SUFFICIENT EVIDENCE SHOWING THAT**
2 **SUCH CAST IRON AND BARE STEEL FACILITIES ARE WORN OUT OR IN A**
3 **DETERIORATED CONDITION?**

4 A. Yes. I think the evidence is not only sufficient but overwhelming.

5 **Q. ON WHAT DO YOU BASE THAT CONCLUSION?**

6 A. I base it on a number of factors, including: (a) the Commission's recognition long ago of
7 the deteriorated nature of these facilities; (b) the impact that aging in the ground for many
8 years has had on the condition of such facilities; (c) repeated findings by both federal and
9 state safety officials that these kind of facilities are sufficiently worn out or deteriorated
10 and that they need to be replaced on an accelerated basis; (d) physical evidence confirming
11 what the collective judgement of all of these entities has concluded; and (e) leak data that
12 even today demonstrates that the propensity of these facilities to leak is 10 to 60 times
13 greater than plastic facilities.

14 **Q. PLEASE EXPLAIN WHAT YOU MEAN WHEN YOU REFER TO THE**
15 **COMMISSION'S RECOGNITION LONG AGO OF THE DETERIORATED**
16 **NAURE OF THESE FACILITIES.**

17 A. What I mean is that when the Commission passed rules three decades ago to specifically
18 require that cast iron and bare steel facilities be replaced or remediated, it did so because
19 such facilities were already in a deteriorated condition in that they had become sufficiently
20 "inferior in quality or value compared to their original condition" that they posed a risk to
21 public safety. As someone who had become all too familiar with the flaws inherent in these
22 materials, and their consequences for public safety, I can say without reservation that such
23 facilities were in a deteriorated condition even then.

1 **Q. HOW HAS THE PASSAGE OF TIME AFFECTED THE CONDITION OF SUCH**
2 **FACILITIES SINCE THE COMMISSION PROMULGATED THESE RULES?**

3 A. It has caused them to deteriorate to an even greater degree, as one would expect such metals
4 to do over time. In its recent Orders, the Commission itself has described the processes by
5 which both cast iron and bare steel deteriorate over time, and even OPC's own witness has
6 acknowledged that such deterioration, in the form of corrosion for bare steel line, begins
7 immediately upon installation in the ground. Spire witness David Norfleet, the metallurgist
8 retained by the Company for these cases, describes in great detail the science underlying
9 the processes by which this deterioration occurs, and Spire witness Spanos explains, based
10 on hundreds of thousands of observations over time involving both Spire and other gas
11 utilities, the relationship between the advanced age of the Company's facilities and the
12 state of their deteriorated condition today.

13 **Q. PLEASE EXPLAIN WHAT YOU MEAN ABOUT HOW THE COLLECTIVE**
14 **JUDGEMENT OF FEDERAL AND STATE SAFETY OFFICIALS IS A FURTHER**
15 **INDICATION OF THE WORN OUT OR DETERIORATED CONDITION OF THE**
16 **COMPANY'S FACILITIES.**

17 A. Company witness Goodson, as well as other witnesses who have testified for the Company,
18 have gone into considerable detail regarding what federal and state safety officials have
19 said regarding the need to replace cast iron and bare steel facilities on an expedited basis.
20 The multiple reports, advisories, recommendations and other warnings these experts have
21 issued are not only a response to the catastrophic incidents that have occurred involving
22 these facilities, but also represent a universal confirmation of the science behind the worn
23 out or deteriorated condition of these facilities. The fact that utilities and regulators across

1 the United States have acted to invest, or approve the investment and recovery, of hundreds
2 of million of dollars to replace cast iron and bare steel facilities at a pace similar to Spire's
3 current systematic programs only underscores the universality of these science-based
4 judgments. Having been one of those safety officials for many years I can once again say
5 without reservation that I fully endorse this judgment.

6 **Q. YOU ALSO MENTIONED PHYSICAL EVIDENCE THAT FURTHER**
7 **CONFIRMS THE WORN OUT OR DETERIORATED CONDITION OF THE**
8 **COMPANY'S CAST IRON AND BARE STEEL FACILITIES. PLEASE EXPLAIN**
9 **WHAT YOU MEANT.**

10 A. In the last ISRS proceeding, Spire Missouri presented pictures of the some of the cast iron
11 and bare steel facilities being replaced, as well as a physical specimen of both. In this case,
12 the Company has also provided additional samples of such facilities. I have examined all
13 of these samples and I can testify that they all demonstrate that the Company's facilities
14 are in a worn out or deteriorated condition. Of course, the Commission, Spire, Staff and
15 the rest of the utility world already knew that to be true based on science and all of the
16 other factors mentioned above, but if further evidence of these obvious truisms was
17 necessary, it has been provided.

18 **Q. PLEASE EXPLAIN WHAT YOU MEANT ABOUT LEAK EXPERIENCE**
19 **DEMONSTRATING THE WORN OUT OR DETERIORATED CONDITION OF**
20 **THE COMPANY'S CAST IRON AND BARE STEEL FACILITIES.**

21 A. In Spire's most recent ISRS cases, Spire witness Hoeflerlin graphically presented the leak
22 history being experienced by the Company on its cast iron and bare steel facilities. That
23 data showed that bare steel facilities, including those bare steel facilities that were

1 cathodically protected decades after being first installed, had a much higher propensity to
2 leak than plastic or coated steel facilities. Specifically, even after years of accelerated
3 replacement programs, the Company's steel facilities are still some 10 times more likely
4 to leak than plastic or coated steel facilities, while cast iron facilities are up to 60 times
5 more likely to leak. As someone who has had the grim task of investigating the fatalities
6 and extensive property damage that can result from such leaks, I view such leaks as
7 powerful evidence of the deteriorated and, in many instances, worn out nature of such
8 facilities. I would like to point out a possible misunderstanding of the phrase "bare steel
9 facilities that were cathodically protected". The piping had already been in the ground
10 corroding for 30 to 50 years and applying cathodic protection did not fix the deterioration
11 that had already occurred. Using the phrase "bare steel facilities that were cathodically
12 protected" might be misperceived as indicating that after the cathodic protection was
13 applied, all deterioration of the main due to corrosion is now stopped. This is simply not
14 the case. Application of cathodic protection to these mains did not eliminate any pre-
15 existing corrosion, prevent significant additional corrosion in the future, or repair corrosion
16 that had occurred. The fact that leaks are still occurring on bare steel main that had cathodic
17 protection applied at a later date, demonstrates that the addition of cathodic protection did
18 nothing to reverse the already worn out or deteriorated condition of these facilities.

19 **Q. IN LIGHT OF ALL OF THE EVIDENCE DISCUSSED ABOVE, DO YOU**
20 **BELIEVE THAT ALL OF THE COMPANY'S CAST IRON AND BARE STEEL**
21 **FACILITIES ARE WORN OUT OR IN DETERIORATED CONDITION AS THAT**
22 **LANGUAGE IS USED IN THE COURT'S MANDATE AND THE ISRS STATUE?**

1 A. Absolutely. I believe that the inclusion of such costs fully satisfies the mandate issued by
2 the Court of Appeals, as well as the requirements under the ISRS Statute, because these
3 facilities are worn out or in a deteriorated condition. As I previously testified, the ISRS
4 Statute, which was passed when I was managing the Commission's Safety Staff in 2003,
5 was designed to eliminate a financial disincentive to replace deteriorated infrastructure,
6 such as the cast iron and steel mains that Spire has been focusing on with its current
7 systematic replacement programs. While I am not an attorney, I can say as a safety
8 professional who has significant experience with these facilities, that it would be absurd to
9 construe the ISRS Statute in a way that pretends the worn out or deteriorate nature of these
10 facilities has not been demonstrated. Requiring that gas utilities re-prove the worn out or
11 deteriorated nature of cast iron and bare steel in each ISRS case creates an obstacle to
12 replacing such facilities, places an unnecessary strain on company resources, creates
13 additional costs for customers and frustrates the basic purposes of the ISRS Statute.

14 **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 Establish an Infrastructure)
System Replacement Surcharge in its Spire)
Missouri East Service Territory) **File No. GO-2018-0309**

In the Matter of the Application of Spire)
Missouri Inc. to Establish an Infrastructure)
System Replacement Surcharge in its Spire)
Missouri West Service Territory) **File No. GO-2018-0310**

A F F I D A V I T

STATE OF MISSOURI)
) SS.
COUNTY OF COLE)

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

1. My name is Robert R. Leonberger. I am Engineer/Natural Gas Expert for NatGas 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. Under penalty of perjury 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
Robert R. Leonberger

This 13th day of May 2020.