Exhibit No:	
Issue:	**Worn or Deteriorated Condition of Replaced Facilities**
Witness:	**Timothy H. Goodson**
Type of Exhibit:	**Direct Testimony**
Sponsoring Party:	**Spire Missouri Inc.**
Case No.:	**GO-2021-0030**
Date Prepared:	**August 14, 2020**

SPIRE MISSOURI INC.

File No. GO-2021-0030

DIRECT TESTIMONY

OF

TIMOTHY H. GOODSON

August 2020

TABLE OF CONTENTS

DIRECT TESTIMONY OF TIM GOODSON

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Timothy Goodson, and my business address is 700 Market Street, St. Louis, Missouri, 63101.

Q. WHAT IS YOUR PRESENT POSITION?

A. I am presently employed by Spire Missouri ("Spire Missouri" or "Company") as Vice President – Field Operations.

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

A. I was appointed to my current position in 2015. In this capacity, I oversee all field operations of the company, including physical pipeline installation and replacement.

Q. PLEASE DESCRIBE YOUR EXPERIENCE WITH SPIRE MISSOURI PRIOR TO ASSUMING YOUR CURRENT POSITION.

A. From 2013-2014, I was the Company's Managing Director of Environmental, Health, Safety and Emergency Management.

Q. WHAT OTHER EXPERIENCE DO YOU HAVE WITH REGARDS TO PIPELINE OPERATIONS AND SAFETY?

A. Prior to joining the Company, I held various positions at AGL Resources, Inc. (now part of Southern Company). Most recently, I served as the Vice President of Operations of Nicor Gas, a natural gas LDC serving approximately two million customers in the Chicago area, with over 32,000 miles of pipeline. I previously held the positions of Vice President of Midstream Operations and Projects, and Managing Director of Environmental, Health,

Safety and Emergency Management, both for AGL Resources, Inc. In total, I have 42 years of experience in the energy, chemicals, and environmental engineering industries.

Q. WHAT IS YOUR EDUCATIONAL BACKGROUND?

A. I received a Bachelor of Science degree from Clemson University in 1976, and a Masters of Science degree from University of South Carolina in 1981.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THIS COMMISSION?

A. No.

I. PURPOSE OF TESTIMONY

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

A. The purpose of my direct testimony is to provide general background on the condition of cast iron and bare steel pipes in the Spire distribution system, based upon my personal observation of these facilities in the field, my experience with Spire's engineering department findings, my observation of specimens removed for testing and inspection, and the experience of the field teams I oversee.

ISRS STATUTE

Q. WILL YOU PLEASE DESCRIBE, IN GENERAL TERMS, THE ISRS MECHANISM.

A. In 2003, the Missouri legislature enacted the ISRS statute to allow for certain infrastructure replacement costs to be recovered by utilities more quickly and outside of a general rate case. Among other things, the ISRS legislation addressed a safety issue previously identified by the Commission related to aged cast iron and bare steel pipes. It also reduces

the regulatory cost of frequent rate cases and ensures that utility companies are able to attract investor capital to fund these multimillion-dollar efforts.

Q. HOW HAS THE ISRS STATUTE IMPACTED SPIRE AND MISSOURI?

A. At Spire, safety is our top priority. The ISRS mechanism has played a valuable role in supporting our efforts to accelerate the replacement of aged cast iron and bare steel infrastructure. In the past 10 years, pipeline replacement in Missouri has accelerated considerably. During this period, Spire has replaced more than 2,400 miles of aging pipeline across the state through the ISRS, and has reduced the anticipated time to complete its cast iron replacement program from 80-plus years to approximately 25 years. Without mechanisms such as the ISRS, which ease the financial burden of deploying large amounts of capital between rate cases, this magnitude of investment would not be possible. At the same time, the systematic replacement approach has substantially reduced the long-term cost of eliminating these problematic facilities while lower commodity costs and lower interest rates have further helped to reduce the burden on our customers.

Q. EXPLAIN HOW THE COMPANY'S ISRS FILINGS AND THE REPLACEMENT OF CAST IRON AND BARE STEEL INFRASTRUCTURE ARE RELATED?

A. Spire's systematic cast iron and bare steel main replacement programs are major components of its ISRS filings. These programs are designed to comply with the Commission's rules mandating the replacement of aged cast iron and bare steel infrastructure, found at 20 CSR 4240-40.030(15). These safety rules were promulgated by the Commission in 1989 after several gas explosions involving bare steel service and yard lines; however, as acknowledged by the Commission in Case Nos. GO-2019-0115 and GO-2019-0116, Spire has been actively engaged in replacing cast iron and steel pipes since the

1950's. Spire employs a systematic, neighborhood approach to conducting these programs which has resulted in improved system integrity and reliability, efficient operations and customer savings related to not only the replacements themselves, but also by reducing the ongoing maintenance needs and operating costs of the Company's distribution system.

CAST IRON AND BARE STEEL

Q. PLEASE EXPLAIN THE PROBLEMATIC CHARACTERISTICS OF CAST IRON AND BARE STEEL PIPE.

A. There is no question that there are clear safety-related concerns regarding aging cast iron and bare steel infrastructure. The cast iron and bare steel pipes being retired or replaced as part of Spire's ISRS projects are 50-100+ years old. While there has certainly been an increased focus in more recent years on eliminating cast iron and bare steel pipe given some of the very serious incidents that have occurred involving such facilities, it is important to recognize that the problematic characteristics of these facilities has been known for some time. Cast iron facilities experience graphitic corrosion that weakens their integrity without impacting wall thickness, whereas uncoated "bare" steel facilities experience oxidative and reductive corrosion, even where cathodic protection has been later applied.

Q. ARE THE CONCERNS REGARDING CAST IRON AND BARE STEEL PIPE SHARED BY FEDERAL REGULATORY ORGANIZATIONS AND THE NATURAL GAS INDUSTRY?

A. Yes. It is widely accepted by leading industry experts and organizations, as well as the scientific community, that there are significant risks associated with cast iron and bare steel

infrastructure and that there is an acute need to implement aggressive programs to remove this pipe from service. Following tragic incidents in 2010 and 2011, the Secretary of the Department of Transportation, Ray LaHood, sent letters to Governors of each state inviting them and others to a DOT Pipeline Safety Forum at DOT's Washington headquarters to address these issues. Spire representatives attended and participated in this forum. Similarly, a letter was sent to utility commissioners urging them to review their State's replacement plans (for cast iron and bare steel specifically) and "consider what would be necessary to accelerate these plans." (March 31, 2011 letter from Cynthia Quarterman, DOT Administrator). The stated goal of the DOT's April 2011 Pipeline Safety Forum was "accelerating the rehabilitation, repair, and replacement of critical pipeline infrastructure with known integrity risks."

Q. PLEASE CONTINUE.

A. Also in 2011, the federal Pipeline and Hazardous Materials Safety Administration ("PHMSA")issued a White Paper reviewing the programs available in various states "to support efforts to accelerate the repair, rehabilitation and replacement of high-risk infrastructure in pipeline systems…" PHMSA looked favorably upon Missouri's ISRS Statute as one of the programs available to protect the public "by ensuring the prompt rehabilitation, repair, or replacement of high-risk gas distribution infrastructure." PHMSA further urged State commissions to "accelerate the repair, rehabilitation, and replacement of high-risk pipeline infrastructure." (PHMSA White Paper, p. 17). In March 2012, PHMSA issued an Advisory Bulletin to gas operators and state pipeline safety representatives on Cast Iron Pipe. The Bulletin urged pipeline operators, like Spire, to conduct a comprehensive review of their cast iron distribution pipelines and replacement

programs, and accelerate the pipeline repair, rehabilitation, and replacement of high-risk pipelines. The Bulletin also requested that agencies consider enhancements to cast iron replacement plans and programs.

Q. HOW HAVE STATES AND THE NATURAL GAS INDUSTRY RESPONDED TO THESE CALLS TO ACTION?

A. According to the American Gas Association, over 40 state jurisdictions have mechanisms in place similar to Missouri's ISRS and the heightened awareness of this issue combined with effective cost recovery mechanisms has facilitated billions of dollars in utility investment in replacing aging, high risk cast iron and bare steel pipe. In fact, gas utilities throughout the country have been replacing their cast iron and bare steel facilities on the same accelerated pace as Spire – another factor that broadly confirms the deteriorated condition of such facilities.

FIELD CONDITIONS OF SPIRE'S CAST IRON AND BARE STEEL

Q. WHAT OPPORTUNITIES HAVE YOU HAD TO VIEW SPIRE'S CAST IRON AND BARE STEEL FACILITIES IN PERSON.

A. During my tenure as Vice President of Field Operations for Spire, I have visited hundreds of job sites at which crews under my direction are engaged in strategic replacement of Spire's cast iron and bare steel facilities. I have observed the condition of these facilities on site, as they are exposed for abandonment. I have also observed numerous specimens of these facilities that have been removed from service for testing and analysis.

Q. PLEASE DESCRIBE THE TYPICAL CONDITION OF CAST IRON MAINS IN SPIRE'S DISTRIBUTION SYSTEM.

A. Spire's distribution systems still utilizes cast iron mains, in both the Missouri East and Missouri West operating units. These facilities are typically between 60 and 110 years old, with most exceeding their estimated service life. The facilities tend to be located in older, and often more economically disadvantaged areas of our service territories. Because they utilize lower operating pressures, these pipes are larger in diameter than equivalent modern facilities. They have been subjected to many years of freeze-thaw cycles and associated frost heave. When originally installed, the joints were sealed using a rope-like material called oakum that has now worn out and in many cases is no longer functional. Essentially all of Spire's cast iron facilities exhibit evidence of graphitic corrosion, in which the structural iron leaches out of the pipe. This leaves the cast iron pipes very brittle and likely to crack easily. Their large diameter, rigidity, and exposure to Midwestern freeze-thaw cycles all exacerbate this problem, and lead to much higher leak rates than any other material in the Spire distribution system.

Q. DO YOU HAVE AN OPINION REGARDING WHETHER CAST IRON PIPES IN SPIRE'S SYSTEM ARE "WORN OUT OR IN A DETERIORATED CONDITION"?

A. Yes. Many of the cast iron mains in Spire's distribution systems are completely worn out and at the end of their useful life. All cast iron mains in Spire's distribution system are in a deteriorated condition.

Q. WHY DO YOU THINK ALL OF SPIRE'S CAST IRON FACILITIES ARE IN A DETERIORATED CONDITION?

A. It's a combination of age and the action of the elements on these materials over time. I haven't seen a single piece of cast iron pipe in Spire's system that did not exhibit signs of graphitic corrosion and oakum deterioration. These materials were simply never intended

to last, or remain in service, indefinitely. Our field crews have experienced numerous situations in which the dirt surrounding the cast iron main was the only thing holding the pipe together. As soon as the crew excavated dirt below the pipe, it just collapsed into pieces.

Q. PLEASE DESCRIBE THE TYPICAL CONDITION OF UNCOATED "BARE" STEEL FACILITIES IN SPIRE'S DISTRIBUTION SYSTEM?

A. The bare steel pipes in Spire's system were typically installed between 1920 and 1960. They were not installed with any protective coating, meaning that the steel pipes' walls are in direct and constant contact with the soil matrix. Steel corrodes when it comes in contact with water, through both oxidative and reductive processes. In the Midwest, soils are typically wet at least part of the year, and exhibit wet-dry cycling. This results in significant corrosion of the uncoated "bare" steel pipe in the Spire distribution system. These corrosive processes weaken the structure of the steel pipe, and compromise its integrity over time. In the worst cases, holes develop in the pipe wall itself where the material has completely corroded through. Over time, this makes uncoated "bare" steel pipe susceptible to leaks and other failures. We experience that frequently in the field. Uncoated "bare" steel pipes have a much higher leak rate than modern pipe materials, and exhibit the second highest leak rate (behind only cast iron) of all materials in the Spire distribution system.

Q. DO YOU HAVE AN OPINION REGARDING WHETHER BARE STEEL PIPES IN SPIRE'S SYSTEM ARE "WORN OUT OR IN A DETERIORATED CONDITION"?

A. Yes. Some portion of the uncoated "bare" steel in Spire's system is worn out. Those would be sections with active leaks resulting from wall failure due to corrosion. But certainly all uncoated "bare" steel pipe in Spire's distribution system is in a deteriorated condition.

These pipes began to deteriorate almost immediately after they were installed, because they were not installed with any type of protective coating that would have slowed or prevented interaction with soil moisture. The oxidative and reductive processes would have begun to work on these facilities immediately, and progressed unabated for many years.

CONDITION OF PHYSICAL EVIDENCE IN THIS CASE

Q. HAVE YOU REVIEWED THE PHYSICAL EVIDENCE SUBMITTED IN THESE CASES?

A. Yes. The physical evidence presented in these cases consist of samples of cast iron pipe that were pulled from the field under my direction by field crews in Spire East. After it was removed from the field, the physical samples were assembled at our Shrewsbury Service Center and photographed. I inspected the photographs the week of August 10, 2020, and will inspect the physical samples prior to the hearing in these cases

Q. PLEASE DESCRIBE THE PHYSICAL EVIDENCE.

A. The physical evidence consists of two pallets of samples of pipe from Spire East. The pallets include numerous samples of cast iron pipes. These samples are all connected to ISRS projects from the Company's ISRS filings at issue in these cases.

Q. HOW DID THE COMPANY DETERMINE WHAT SAMPLES TO SUBMIT AS EVIDENCE IN THESE CASES?

A. We tried to obtain samples from a variety of areas in our service territory as well as samples that represented some of the Company's larger replacement projects. Please see Schedule THG-1 for detailed information pertaining to the pipe samples, including work order numbers, footage of pipe replaced, and location where pipe was removed from.

Q. WHEN WERE THE 2018 PIPE SAMPLES OBTAINED BY SPIRE?

A. The pipe samples were retrieved in July and August 2020.

Q. ARE THE PIPE SAMPLES IN THE SAME OR SUBSTANTIALLY SIMILAR CONDITION TODAY AS THEY WERE WHEN REMOVED FROM SERVICE?

A. Yes. Given the advanced age of these pipes, the amount of wear and deterioration in the short time between their removal from service and the present would not have materially changed their condition.

Q. HAVE YOU REVIEWED THE PHOTOGRAPHS OF THESE SAMPLES, SUBMITTED WITH YOUR TESTIMONY AND LABELED AS THG- 2 FIGURES 1 THROUGH 43?

A. Yes.

Q. DO THESE FIGURES CONTAIN A TRUE AND ACCURATE DEPICTION OF THE SAMPLES YOU'RE REFERRING TO?

A. Yes.

Q. DO YOU BELIEVE THIS EVIDENCE IS REPRESENTATIVE OF THE FIELD CONDITION OF CAST IRON PIPE IN SPIRE'S DISTRIBUTION SYSTEM GENERALLY?

A. Yes, absolutely. There is nothing unique about the pipe samples taken for this case. They are very representative of the condition of the facilities replaced in the course of our systematics replacement programs. They aren't the "best of the best" or the "worst of the worst;" they are a representative sample of what we typically see in the field.

Q. DO YOU BELIEVE THIS EVIDENCE DEMONSTRATES THAT THE REPLACED FACILITIES AT ISSUE IN THIS CASE WERE WORN OUT OR IN A DETERIORATED CONDITION AT THE TIME THEY WERE REPLACED?

A. Yes. You don't have to be a scientist or an engineer to see that these pipes have deteriorated significantly from their original condition. Some of them are completely broken in two. Others show significant, irregular wall thickness degradation. Others have propagating cracks. They aren't all worn out, but they are certainly all significantly deteriorated from their original condition. Our experience with cast iron pipe repairs clearly shows embrittlement of these pipes is also prevalent, consistent with metallurgical analysis filed by the Company in prior ISRS cases

Q. DO YOU HAVE ANY CONCLUDING REMARKS?

A. Yes. At Spire, the safety of our customers is paramount and our primary value. The Company has followed the Missouri legislature and this Commission's lead on addressing the critical safety issue of cast iron and bare steel replacement. Since the inception of the ISRS, Spire has replaced more than 2,500 miles of aging pipeline across the state through the ISRS and has reduced the anticipated time to complete its cast iron replacement program from 80-plus years to approximately 25 years. The Company has continued to employ best practices and pursue these replacements in a strategic, efficient manner that provides customers with not only safety benefits now, but savings and benefits that will continue long into the future. The Commission's continued support of cast iron and bare steel replacement cost recovery through the ISRS is crucial to ensuring that Spire can continue its programs at its current pace and deliver these benefits to its customers.

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-2021-0030**
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-2021-0031**

AFFIDAVIT

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

Tim Goodson, of lawful age, being first duly sworn, deposes and states:

1. My name is Tim Goodson. I am the Vice President of Field Operations for Spire Missouri Inc. My business address is 700 Market St., St. Louis, Missouri, 63101.

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.

Tim Goodson

This 14th day of August 2020.

Region	Project	Work Order	WO Description	Sample Location	Pipe Diameter	Year Installed *
South	901765	15621830	Dogtown Cast Iron Main Replacement Grid Phase 4D	Tamm & Wise	4"	1905
South	901765	15621830	Dogtown Cast Iron Main Replacement Grid Phase 4D	Clayton & Childress	4"	1920
South	901726	15515587	Dogtown Cast Iron Main Replacement Grid Phase 4A	Tamm & Nashville	6"	1905
South	902953	19700612	Holly Hills & Leona Strategic Grid Replacement Phase D	Morganford & Tyrolean	6"	1926
South	902690	19251195	Ivanhoe & Pernod Strategic Grid Replacement Phase 1D	Watson & Marquette	6"	1923
South	902139	17133652	Cardinal & Park Grid Main Replacement Phase H	California & Saint Vincent	4"	
South	903424	20655987	Pennsylvania MREPL	3166 Pennsylvania	4"	1903
South	903042	19844852	Bingham & S 37th Replacement	Meramec & 37th	6"	1911
South	902926	19655334	Bates & Virginia Phase D	Fasson & Virginia	6"	1905
South	902927	19655345	Bates & Virginia Grid Replacement Phase E	Bates & Alabama	4"	1909
North	903472	20765542	MLK BILLUPS TO PAGE	MLK & BELLE GRADE	6"	1878
North	902420	18698313	CORA & LEE PHASE G	LEE & NEWSTEAD	6"	1902
North	902960	19653420	FAIR & PENROSE 1A	West Florissant & Adelaide	12"	1905
North	903280	20351410	Fair & Penrose 2A	Athlone & Penrose	6"	1906
North	902419	18698297	CORA & LEE PHASE F	Bessie & Cintra	6"	1927
North	903039	19833676	FAIR & PENROSE PHASE 1C	Green Lea Pl & Warne	6"	1903
North	902822	19444783	22nd & Howard Phase I	Monroe & N. Florissant	4"	1874
North	902820	19444778	22nd & Howard Phase G	St. Louis & N. Florissant	6"	1895
North	902532	18899931	Kingshighway & Natural Bridge Phase C	N. Euclid & Lexington	6"	1929

* Year Installed per information found in GIS records based on sample location

Sponsoring Party: **Spire Missouri Inc.**
Case No: **GO-2021-0030**

Date Prepared: **August 14, 2020**

SPIRE MISSOURI INC.

File No. GO-2021-0030

PHOTOGRAPHS OF REPLACED PIPE

Figure 1, Spire East, North Region, Cast Iron, Work Order #83698313

Figure 2, Spire East, North Region, Cast Iron, Work Order #83698313

Figure 3, Spire East, North Region, Cast Iron, Work Order #19444783

Figure 4, Spire East, North Region, Cast Iron, Work Order #19444783

Figure 5, Spire East, North Region, Cast Iron, Work Order #19444783

Figure 6, Spire East, North Region, Cast Iron, Work Order #18698297

Figure 7, Spire East, North Region, Cast Iron, Work Order #18698297

Figure 8, Spire East, North Region, Cast Iron, Work Order #19444778

Figure 9, Spire East, North Region, Cast Iron, Work Order #18698297

Figure 10, Spire East, North Region, Cast Iron, Work Order #18698297

Figure 11, Spire East, North Region, Cast Iron, Work Order #20765542

Figure 12, Spire East, North Region, Cast Iron, Work Order #20765542

Figure 13, Spire East, North Region, Cast Iron, Work Order #18899931

Figure 14, Spire East, North Region, Cast Iron, Work Order #18899931

Figure 15, Spire East, North Region, Cast Iron, Work Order #20351410

Figure 16, Spire East, North Region, Cast Iron, Work Order #20351410

Figure 17, Spire East, North Region, Cast Iron, Work Order #20351410

Figure 18, Spire East, North Region, Cast Iron, Work Order #20351410

Figure 19, Spire East, North Region, Cast Iron, Work Order #20351410

Figure 20, Spire East, South Region, Cast Iron, Work Order #19251195

Figure 21, Spire East, South Region, Cast Iron, Work Order #19251195

Figure 22, Spire East, South Region, Cast Iron, Work Order #19700612

Figure 23, Spire East, South Region, Cast Iron, Work Order #19700612

Figure 24, Spire East, South Region, Cast Iron, Work Order #20655987

Figure 25, Spire East, South Region, Cast Iron, Work Order #19844852

Figure 26, Spire East, South Region, Cast Iron, Work Order #171733652

Figure 27, Spire East, South Region, Cast Iron, Work Order #171733652

Figure 28, Spire East, South Region, Cast Iron, Work Order #171733652

Figure 29, Spire East, South Region, Cast Iron, Work Order #171733652

Figure 30, Spire East, South Region, Cast Iron, Work Order #171733652

Figure 31, Spire East, South Region, Cast Iron, Work Order #171733652

Figure 32, Spire East, South Region, Cast Iron, Work Order #17984965

Figure 33, Spire East, South Region, Cast Iron, Work Order #17984965

Figure 34, Spire East, South Region, Cast Iron, Work Order #19814663

Figure 35, Spire East, South Region, Cast Iron, Work Order #19814663

Figure 36, Spire East, South Region, Cast Iron, Work Order #19655345

Figure 37, Spire East, South Region, Cast Iron, Work Order #19655345

Figure 38, Spire East, South Region, Cast Iron, Work Order #19655345

Figure 39, Spire East, South Region, Cast Iron, Work Order #15515587

Figure 40, Spire East, South Region, Cast Iron, Work Order #15515587

Figure 41, Spire East, South Region, Cast Iron, Work Order #15515587

Figure 42, Spire East, South Region, Cast Iron, Work Order #196553364

Figure 43, Spire East, South Region, Cast Iron, Work Order #196553364