M E M O R A N D U M

TO: Missouri Public Service Commission Official Case File,
Case No. GE-2023-0112, Spire Missouri Inc.

FROM: John D. Kottwitz, Associate Engineer, Safety Engineering Department
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/s/*Kathleen A. McNelis* 09/29/2023
Safety Engineering Department/ Date

/s/ *J. Scott Stacey* 09/29/2023
Staff Counsel Division / Date

SUBJECT: Staff Recommendations Regarding Spire Missouri Inc. Request for Approval of Waivers from 20 CSR 4240-40.030(4)(CC), (4)(EE)9., (4)(FF)3., (12)(M)2., and (13)(R)1.G.

DATE: September 29, 2023

Executive Summary

On September 23, 2022, Spire Missouri Inc. ("Spire") filed an Verified Application for Waiver (Application) requesting a permanent waiver of compliance for certain Spire Missouri East facilities from the Commission's requirements in 20 CSR 4240-40.030(4)(CC), (4)(EE)9., (4)(FF)3., (12)(M)2., and (13)(R)1.G. that require adequate overpressure protection to be provided for all district regulator stations regardless of installation date. Spire's Application was silent with respect to potentially applicable federal regulations pertaining to adequate overpressure protection.

Spire is requesting this waiver while it completes replacement of the low-pressure systems in St. Louis, which will eliminate the need for the associated regulator stations that do not have adequate overpressure protection devices installed at each regulator station. For the Reynolds regulator stations, Spire anticipates either retiring the stations or replacing them with temporary worker-monitor style stations by 2024 its North St. Louis District and by the end of 2026 in its South St. Louis District.[1]

[1] Paragraph 15 of Application.

The Commission's Safety Engineering Department Staff ("Staff") performed the following review and analysis to reach its recommendations:

- Reviewed the Application and additional information provided by Spire as responses to Staff data requests;
- Reviewed applicable Commission and federal pipeline safety rules; and
- Coordinated with the U.S. Department of Transportation (U.S. DOT) Pipeline and Hazardous Materials Safety Administration (PHMSA) regarding federal pipeline safety requirements.

The Commission's requirements in 20 CSR 4240-40.030(18) provides that "the commission, by authority order and under such terms and conditions as the commission deems appropriate, may waive in whole or part compliance with any of the requirements contained in this rule." However, section (18) also states: "Waivers will be granted only on a showing that gas safety is not compromised." Staff does not find that the inspection, testing and monitoring actions described in the current Application provide an equivalent level of gas safety as the rule requirements to install a full overpressure protection device at each remaining Reynolds regulator station.

Staff discussed the waiver request in the Application with PHMSA personnel and were unable to determine a set of conditions and limitations that would provide an equivalent level of gas safety as following Commission and federal rules requiring adequate overpressure protection devices. Staff filed a progress report on May 24, 2023 to this effect and discussed the concerns with Spire personnel. Spire filed a Supplement to Application ("Supplement") on July 27, 2023, wherein Spire committed to additional measures for Staff's review.

Staff discussed Spire's Supplement with PHMSA personnel and agreed that the actions proposed by Spire did not provide an equivalent level of gas safety as following Commission rules and federal rules requiring adequate overpressure protection devices.

Following an overpressure event in May 2019, Spire installed a 1-inch relief valve at each remaining Reynolds regulator station. Commission and federal rules require that changes to pipeline segments must be in accordance with currently effective rules.[2] The 1-inch relief valves

[2] 20 CSR 4240-40.030(1)(G)2 and 49 CFR 192.13(b).

that Spire installed do not have sufficient relieving capacity to prevent the downstream piping from overpressuring during a wide-open failure of the Reynolds regulator, and therefore do not comply with applicable Commission and federal rules pertaining to overpressure protection. Staff notes that the Spire waiver request is also a waiver request from the federal regulations applicable to overpressure protection of distribution systems. Based on Staff's discussions with PHMSA personnel regarding the failure of Spire's proposed waiver conditions to provide an equivalent level of safety, Staff believes it is likely that PHMSA would object if the Commission grants the waiver.

20 CSR 4240-40.030(18) states that "Waivers will be granted only on a showing that gas safety is not compromised." Staff recommends that the Commission deny Spire's request for waiver on the basis that Spire has not shown that gas safety will not be compromised.

Staff further recommends that the Commission direct Spire to take actions to comply with the applicable overpressure protection rules at each remaining Reynold regulation station. Acceptable options include:

- Replacement of the Reynolds regulator station with a regulator station that provides full overpressure protection of the downstream distribution system. For example, Spire has installed other regulator stations that meet these requirements and has used temporary worker-monitor style regulator stations for this purpose as described in the Application.
- Installation of additional overpressure protection device(s) at the Reynolds regulator station that in combination with existing 1-inch relief valve will provide full overpressure protection of the downstream distribution system.
- Abandonment or deactivation of the Reynolds regulator station.

Until the remaining Reynolds regulator stations have either been retired or a full overpressure device is installed at the station, Staff believes there are additional measures that can be implemented to provide a higher level of safety and further mitigate the safety risks related to a Reynolds regulator station failure. The additional measures are discussed later in this memorandum and include the additional measures that Spire committed to in its Supplement filing.

1.0 Background Information

1.1 Low Pressure Distribution Systems and Reynolds Regulator Stations

Spire historically used Reynolds regulator stations[3] to reduce the pressure to the city-wide and integrated[4] low-pressure natural gas distribution system in St. Louis. The low-pressure distribution system has a Maximum Allowable Operating Pressure (MAOP) of 14-inches water column[5] (w.c.).[6]

Spire's low-pressure distribution system was installed with cast iron mains. Spire has been replacing the low-pressure system with a high-pressure (operating at higher than 14-inches w.c.) distribution system to eliminate the cast iron mains. A safety feature in high-pressure distribution systems is that an additional pressure regulator is installed near the transition point of each service line to customer piping (often referred to as a "service regulator"). The service regulator protects the downstream customer piping and connected appliances from higher upstream pressures in the pipeline. Service regulators were not installed in low-pressure systems due to the gas being delivered at utilization pressures.

When installed as part of a large, integrated system, a higher than intended or needed flow through an individual Reynolds regulator station could be off-set by the downstream system customer demand, and by reduced flows at neighboring regulator stations as the integrated system pressure increased. The overall extent of the low-pressure distribution system, and consequently the number of Reynolds regulator stations, is being reduced over time as part of Spire's cast iron main replacement program. Spire has stated in response to a Staff Data Request that 32 Reynolds regulator stations still remained in operation as of April 13, 2023.[7]

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[3] Reynolds regulator stations include a regulator and associated equipment manufactured by the Reynolds Gas Regulator Company. Paragraph 7 of Application states that installation of Reynolds regulator stations began in early 1900's with the last station installed in the 1960's. The Federal pipeline safety code became effective in 1970.

[4] The original low-pressure system was installed throughout the City of St. Louis in most of the streets and was interconnected throughout the street grid providing integrated source of supply to points within the system.

[5] Spire response to Staff Data Request No. 0011. The MAOP of 14-inches w.c. is also the maximum MAOP permitted for low-pressure distribution systems by 20 CSR 4240-40.030(12)(O)1.

[6] 14-inches w.c. equals approximately 0.5 psig (Pounds per square Inch Gauge).

[7] Spire response to Staff Data Request No. 0006.2.

Additionally, due to the replacement of segments from various locations within Spire's low-pressure system, the low-pressure distribution system is no longer fully integrated as it had been historically. It currently consists of smaller, isolated low-pressure distribution systems as shown in Exhibit B to the Application. The reduced size of the isolated systems, and corresponding reduced downstream system customer demand presents in a higher risk of system overpressure if a higher than intended or needed flow through a Reynolds regulator station occurs going forward. Since there are no service regulators downstream of the Reynolds regulator stations, this results in a higher risk of delivering high pressure gas to customer piping and appliances.

Because of the absence of service regulators in low-pressure systems, the consequences of overpressure events can be significant. For example:

- On September 13, 2018, an incident occurred in the Merrimack Valley region of Massachusetts as a result of accidental overpressurization of a low-pressure natural gas system. The natural gas operator, Columbia Gas of Massachusetts, was implementing a cast iron removal project when the incident occurred. The National Transportation Safety Board (NTSB) investigated the incident and determined that the probable cause of the overpressurization of the natural gas distribution system and the resulting fires and explosions was Columbia Gas of Massachusetts' weak engineering management that did not adequately plan, review, sequence, and oversee the construction project that led to the abandonment of a cast iron main without first relocating regulator sensing lines to the new polyethylene main. Contributing to the accident was a low-pressure natural gas distribution system designed and operated without adequate overpressure protection. As a result of this incident, there was one fatality, 22 injuries, and 131 structures were damaged including five homes that were destroyed.[8]
- On October 10, 2005, an incident occurred in Boonville, Missouri as a result of accidental overpressurization of a low-pressure natural gas system. A natural gas valve was opened to a section of the Boonville natural gas systems that was being converted from low-pressure to high-pressure. Natural gas at a pressure of 10 psig entered the

[8] *Overpressurization of Natural Gas Distribution System, Explosions, and Fires in Merrimack Valley, Massachusetts September 13, 2018,* National Transportation Safety Board (NTSB) Accident Report No. NTSB/PAR-19/02, PB2019-101365 PAR1902.pdf (ntsb.gov).

system section being converted as intended, but also entered the Boonville low-pressure system through a connecting main that had not been disconnected. Seven residences and a fire station received fire and smoke damage, and a number of other customers received overpressure damage to natural gas utilization equipment.[9]

- On January 17, 1992, an incident occurred in Chicago, Illinois as a result of accidental overpressurization of a low-pressure natural gas system. The incident occurred when employees of the natural gas operator, Peoples Gas Light Coke Company, were performing a routine inspection at one of the natural gas regulator stations. The NTSB investigated the incident and determined that the probable cause was failure of the operator to adequately train its gas operations employees in recognizing and correctly responding to abnormal situations, resulting in failure to properly monitor and control the pressure of gas during a routine inspection. Gas at as high as 10 psig escaped through gas appliances into homes and other buildings. The resulting explosion and fires resulted in four fatalities, four injuries, and damages to 14 houses and three commercial buildings.[10]
- On January 22, 1982, an incident occurred in Centralia, Missouri as a result of accidental overpressurization of a low-pressure natural gas system. The NTSB investigated the incident, and determined that the probable cause was the rupture of a pressure regulator control line by a city backhoe and the isolation by the gas company of a related relief valve, which allowed natural gas at 47 psig to enter the low-pressure distribution system rather than vent to the atmosphere. Contributing to the accident was the failure of city officials to notify the gas company of its excavation and the failure of the gas company to take prompt actions prior to the incident to adjust and return the relief valve to service. High pressure gas entering customer piping in some cases resulted in ignition, and in other cases resulted in gas build-up within structures. As a result of the incident, five persons were injured, 12 buildings were destroyed and 32 were damaged.[11]

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[9] *Gas Incident Report, AmerenUE, Case No. GS-2006-0199, Boonville, Missouri, October 10, 2005*, Missouri Public Service Commission Case No. GS-2006-0199. 133925 (mo.gov)

[10] *Over-Pressure of the Peoples Gas Light and Coke Company Low-Pressure Distribution System, Chicago Illinois, January 17, 1992*, National Transportation Safety Board (NTSB) Accident Report No. NTSB/PAR-93/02/SUM, PB93-916501 par9301sum.pdf (ntsb.gov).

[11] Missouri Power and Light Company, Natural Gas Fires, Centralia, Missouri, January 28, 1982, National Transportation Safety Board (NTSB) Accident Report No. NTSB/PAR-82, PAR8203.pdf (ntsb.gov).

1.2 Spire's Request

Spire filed its Application requesting a waiver of compliance for certain Spire facilities in St. Louis from the Commission's requirements in 20 CSR 4240-40.030(4)(CC), (4)(EE)9., (4)(FF)3., (12)(M)2., and (13)(R)1.G. that require adequate overpressure protection to be provided for all district regulator stations regardless of installation date.[12] The provisions of 20 CSR 4240-40.030(4)(EE)9. require:

> (EE) Requirements for Design of Pressure Relief and Limiting Devices.
> Except for rupture discs, each pressure relief or pressure limiting device must –
>
> 9. Be designed and installed so that adequate overpressure protection is provided for all town border stations and district regulator stations regardless of installation date;

Spire requests the waiver to obtain Commission approval to continue operating Reynolds regulator stations without installing an adequate overpressure protection device at each station until the low-pressure systems are replaced and the Reynolds regulator stations supplying gas to the systems are no longer needed. Projected completion of low-pressure system replacement is the end of 2023 for the north district in St. Louis and the end of 2026 for the south district in St. Louis.[13]

In paragraph 10 of its Application, Spire stated the reason the permanent waiver is necessary is that:

> ... due to the Company's emphasis on retiring the facilities, the multiple measures currently in place to protect against overpressurization, and the overall cost-benefit analysis of investing in new pressure controls versus retirement of the LPOP system. ...

Spire further stated in Paragraph 13 of its Application that:

> Spire Missouri's primary concern with the application of the existing requirements noted in paragraph 8 above is that it contemplates that a device will be installed to accomplish overpressure protection. However, Spire Missouri has successfully used the inherent design of the stations and pressure limiting measures to accomplish overpressure protection for decades. Given the Company's plans to replace all of its remaining

[12] See following sentence in paragraph (4)(EE)9. that includes "regardless of installation date" language. The other cited requirements are copied in section 2.2 below.
[13] A map identifying the North District and South District was attached as Exhibit B to the Application.

> Reynolds stations in the near future, installing a device on these facilities would add unnecessary expense given the current mechanisms already in place to ensure the safety of its system. Without the requested Waiver, customers would bear an unnecessary cost in exchange for no net safety benefit. Accordingly, Spire Missouri does not believe that the Company should be required to design and install new overpressure protection on these legacy stations, which would create new stranded assets. Spire Missouri has sufficient overpressure protection through its system design which utilizes a combination of regulators along with travel stops, shroud mechanisms, 1" relief valves, and gas control monitoring to prevent undesirable pressure build-up in the event of regulator failure (See Exhibit A).

Spire further stated in Paragraph 15 of its Application that:

> Spire Missouri believes that focusing on its efforts on retirement of the system is the most effective approach to take and this Waiver will allow Spire Missouri to more effectively achieve this goal.

1.3 Spire Proposed Actions

In paragraph 14 of the Application, Spire stated that it had 35 Reynolds regulator stations still serving integrated low-pressure systems[14] containing approximately 250 miles of pipe that are being replaced or retired. Spire also states in paragraph 14 that it will continue to analyze annually which of the Reynolds regulator stations can be shut down during the summer months so that most of the Reynolds regulator stations are out of service between May and September. In response to Staff Data Request No. 0006.2, Spire provided an update that 32 Reynolds regulator stations still need to be retired as of April 12, 2023.

Since the remaining Reynolds regulator stations do not have an adequate overpressure protection device installed at each regulator station, Spire is requesting a waiver to continue operating the remaining Reynolds regulator stations as needed while it completes replacement of the low-pressure systems. In paragraph 15 of the Application, Spire states that it anticipates completing replacement of the low-pressure systems in less than 5 years. Spire further states that it anticipates eliminating the remaining Reynolds regulator stations by 2024 in the north section

[14] 20 CSR 4240-40.030(1)(B)21. defines low-pressure distribution system as a distribution system in which the gas pressure in the main is less than or equal to an equivalent of fourteen inches (14") water column. Customers are served directly from the low-pressure system at the pressure in the system, which is why Spire refers in the Application to "utilization pressure system" for its low-pressure systems in St. Louis.

of St. Louis and by the end of 2026 in the south section of St. Louis.[15] As part of this process, Spire plans to install two temporary worker-monitor style regulator stations each year in the south section of St. Louis.[16] Confidential Exhibit C to the Application contains an updated Gas Interruption/Shutdown of Main Procedure that Spire will continue to use during replacements, abandonments, and other work on the low-pressure systems to monitor system pressures and avoid a system overpressure.

Staff requested information from Spire about the costs to provide overpressure protection devices at the 35[17] remaining Reynolds stations locations. In November 2022, Spire completed estimates to install a compliant regulator station to replace a Reynolds regulator station[18] and determined it would cost between $9 and $12 million to replace the remaining Reynolds regulator stations with operator-monitor[19] regulator stations[20]. Spire also estimated that replacement of the remaining Reynolds regulator stations would take approximately three years.[21]

1.4 Spire Commitments if Waiver is Granted

Spire states in paragraph 16 of the Application that if this Waiver is granted by the Commission, Spire commits that it will continue to utilize the Low Pressure Overpressure Protection ("LPOP") Program outlined in Exhibit D of the Application. Spire has since filed a Supplement that commits to an Amended Exhibit D that, in addition to the existing annual Low Pressure System Model study and travel stop calculations, provides for annual field simulated wide-open failure test ("quick" test) to be conducted each calendar year for each remaining Reynolds regulator station until the downstream system is replaced. If a "quick" test finds a station has overpressure

[15] Exhibits A and B to the Application provide details on the replacement schedule and a map identifying the north and south sections.
[16] Exhibit A to the Application and response to Staff Data Request No. 0009.
[17] In response to Staff Data Request No. 0006.2, Spire updated that there are 32 remaining stations as of April 13, 2023; total cost is less as remaining stations are eliminated.
[18] In response to Staff Data Request No. 0003, Spire provided estimated costs of $324,053 for a regulator station installation in a belowground vault and $242,420 for an aboveground regulator station installation.
[19] Operator-monitor regulator stations include an operator regulator and a monitor regulator in series. The operator regulator reduces the inlet pressure to the outlet system pressure. If the operator regulator fails and the downstream pressure begins increasing, the monitor regulator will start functioning and limit the outlet system pressure to a higher pressure that does not exceed the maximum pressure allowed by rule requirements.
[20] Spire response to Staff Data Request No. 0003.
[21] Spire response to Staff Data Request No. 0004.

characteristics (a test stopped at 14-inches w.c. or less, because the failure pressure would have been greater than 14-inches w.c.), Spire will immediately either adjust the travel stop setting to eliminate the overpressure characteristic and re-test, or place the existing station out of service. If a station continues to exhibit overpressure characteristics when retested, Spire may either 1) replace the existing Reynolds station with a temporary modern monitor-type station, 2) place the existing station out of service, or 3) adjust station travel stop settings to eliminate the overpressure characteristic and re-test. In addition to the Amended Exhibit D, Spire further committed in the Supplement to inspect all remaining Reynolds stations weekly, to conduct pressure and alarm testing with the control room monthly, to replace Reynolds regulator stations that are currently a single feed into a downstream system with temporary modern monitor type stations prior to October 1, 2023, and to replace other Reynolds stations prior to becoming a single feed into a downstream system. Spire also committed to replacing the one remaining Reynolds regulator station that is served by an intermediate pressure (IP)[22] system prior to December 1, 2023.

2.0 Applicable Commission Rules

2.1 Waivers of Compliance

20 CSR 4240-40.030(18) states that upon written request to the secretary of the commission[23], the commission, by authority order and under such terms and conditions as the commission deems appropriate, may waive in whole or part compliance with any of the requirements contained in this rule.[24] Waivers will be granted only on a showing that gas safety is not compromised. If the waiver request would waive compliance with a federal requirement in 49 CFR part 192, additional actions shall be taken in accordance with 49 U.S.C. 60118 except when the provisions of subsection (17)(G)[25] apply.

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[22] The intermediate pressure system has an MAOP of 60 psig. The other Reynolds regulator stations are served by medium pressure systems with an MAOP of 25 psig.

[23] As defined by 20 CSR 4240-40.030(1)(B)6., commission means the Missouri Public Service Commission.

[24] Rule in this context refers to 20 CSR 4240-40.030.

[25] Commission rule 20 CSR 4240-40.030(17)(G) applies to an operator's gas distribution integrity management program and the requirement defines when an operator may deviate from required periodic inspections. Section 17 of 20 CSR 4240-40.030 is not applicable to the current pipeline as the applicability is limited to gas distribution pipelines.

2.2 Overpressure Protection Requirements

Commission rule 20 CSR 4240-40.030(12)(M)2. requires that:

> (M) Maximum Allowable Operating Pressure−Steel or Plastic Pipelines. (49 CFR 192.619 and 192.620)
>
> ...
>
> 2. No person may operate a segment of pipeline to which this subsection applies unless overpressure protective devices are installed for the segment in a manner that will prevent the maximum allowable operating pressure from being exceeded, in accordance with subsection (4)(CC) of this rule.

As shown above, paragraph (12)(M)2. references subsection (4)(CC). Commission rule 20 CSR 4240-40.030(4)(CC) requires the following:

> (CC) Protection Against Accidental Overpressuring. (49 CFR 192.195)
>
> 1. General requirements. Except as provided in subsection (4)(DD) (49 CFR 192.197), each pipeline that is connected to a gas source so that the maximum allowable operating pressure could be exceeded, as the result of pressure control failure or of some other type of failure, must have pressure relieving or pressure limiting devices that meet the requirements of subsections (4) (EE) and (FF). (49 CFR 192.199 and 192.201)
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> 2. Additional requirements for distributions systems. Each distribution system that is supplied from a source of gas that is at a higher pressure than the maximum allowable operating pressure for the system must—
>
> A. Have pressure regulation devices capable of meeting the pressure, load and other service conditions that will be experienced in normal operation of the system, and that could be activated in the event of failure of some portion of the system; and
>
> B. Be designed so as to prevent accidental overpressuring.

As shown above, subsection (4)(CC) references subsections (4)(EE) and (4)(FF). Commission rule 20 CSR 4240-40.030(4)(EE)9. and (4)(FF) require the following:

> (EE) Requirements for Design of Pressure Relief and Limiting Devices. (49 CFR 192.199) Except for rupture discs, each pressure relief or pressure limiting device must –
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> ...
>
> 9. Be designed and installed so that adequate overpressure protection is provided for all town border stations and district regulator stations regardless of installation date;
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> (FF) Required Capacity of Pressure Relieving and Limiting Stations. (49 CFR 192.201)
>
> 1. Each pressure relief station or pressure limiting station or group of those stations installed to protect a pipeline must have enough capacity, and must be set to operate, to ensure the following:
>
> A. In a low-pressure distribution system, the pressure may not cause the unsafe operation of any connected and properly adjusted gas utilization equipment;
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> ...
>
> 3. Relief valves or other pressure limiting devices must be installed at or near each regulator station in a low-pressure distribution system, with a capacity to limit the maximum pressure in the main to a pressure that will not exceed the safe operating pressure for any connected and properly adjusted gas utilization equipment.

The provisions of 20 CSR 4240-40.030(13)(R)1.G. require:

> (R) Pressure Limiting and Regulating Stations—Inspection and Testing. (49 CFR 192.739)
>
> 1. Each pressure limiting station, relief device (except rupture discs), and pressure regulating station and its equipment must be subjected at intervals not exceeding fifteen (15) months but at least once each calendar year to inspections and tests to determine that it is –
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> ...
>
> G. Equipped with adequate over-pressure protection in accordance with paragraph (4)(EE)9.

3.0 Previous Commission Decisions

The Commission has not received previous applications for waivers regarding the installation of overpressure protection devices to provide adequate overpressure protection in accordance with the Commission rules.

4.0 Coordination with U.S. DOT and Spire

The Commission has an annual certification from the U.S. DOT under 49 U.S.C. Section 60105 of 49 U.S. Code to implement its pipeline safety program. 49 U.S.C. 60118 addresses waivers of pipeline safety standards by state authorities. 49 U.S.C. 60118 (d) requires that:

> If a certification under section 60105 of this title or an agreement under section 60106 of this title is in effect, the State authority may waive compliance with a safety standard to which the certification or agreement applies in the same way and to the same extent the Secretary may waive compliance under subsection (c) of this section. However, the authority must give the Secretary written notice of the waiver at least 60 days before its effective date. If the Secretary makes a written objection before the effective date of the waiver, the waiver is stayed. After notifying the authority of the objection, the Secretary shall provide a prompt opportunity for a hearing. The Secretary shall make the final decision on granting the waiver.

In guidelines provided to state programs, PHMSA encourages state programs to coordinate review of waiver requests with PHMSA prior to finalizing state approval. Staff therefore submitted a copy of the Spire Application waiver of compliance from the overpressure protection requirements to PHMSA on September 26, 2022. Staff was unable to determine a set of conditions and limitations that would provide an equivalent level of gas safety as installing a full overpressure protection device at each remaining Reynolds regulator station. Staff discussed the proposed Spire waiver with PHMSA, and requested additional information from Spire related to questions from PHMSA. PHMSA personnel concurred with Staff that the requested waiver as filed does not provide an equivalent level of safety as would installation of adequate overpressure protection devices. PHMSA personnel requested to be kept advised of actions on this waiver request.

Staff filed a progress report on May 24, 2023, and discussed Staff and PHMSA's safety concerns with Spire personnel. Spire filed a Supplement on July 27, 2023, wherein Spire committed to additional monitoring, inspection, and testing measures. Staff discussed Spire's Supplement with PHMSA personnel and agreed that the actions proposed by Spire did not provide an equivalent

level of gas safety as following Commission rules and federal rules requiring adequate overpressure protection devices.

In discussions with PHMSA, it was noted that following an overpressure event in May 2019, Spire installed a 1-inch relief valve at each remaining Reynolds regulator station.[26] These relief valves do not have sufficient relieving capacity to prevent the downstream piping from overpressuring during a wide-open failure of the Reynolds regulator, and therefore do not comply with Commission or federal requirements for adequate overpressure protection. Commission and federal pipeline safety rules state that no person may operate a segment of pipeline that is "replaced, relocated or otherwise changed" unless that replacement, relocation or change has been made in accordance with this rule.[27] Staff's understanding based on discussions with PHMSA personnel is that because the regulator stations had been modified, the federal regulations require the relief valve to be designed to meet the federal regulations pertaining to overpressure protection. Staff notes that this means the Spire waiver request from Commission pipeline safety rules is also a waiver request from the federal pipeline safety regulations[28] requiring adequate overpressure protection of distribution systems, and PHMSA will have the authority to object in the event the Commission grants the waiver.[29] Based on Staff's discussions with PHMSA personnel regarding Spire's proposed waiver conditions, Staff believes it is likely that PHMSA would object if the Commission grants the waiver.

5.0 Staff Analysis

5.1 Adequacy of Current Overpressure Protection

As described in the Application, Spire uses internal shrouds and a travel-stop mechanism to limit the maximum flow through the Reynolds regulator station and a 1-inch relief valve has been added

[26] Spire response to Staff Data Request No. 0008.
[27] 20 CSR 4240-40.030(1)(G)2., and 49 CFR 192.13(b).
[28] Multiple federal regulations apply to design and installation of a relief valve at a regulator station. The federal version of 20 CSR 4240-40.030(4)(FF)3. is 49 CFR 192.201(c), which states:

> Relief valves or other pressure limiting devices must be installed at or near each regulator station in a low-pressure distribution system, with a capacity to limit the maximum pressure in the main to a pressure that will not exceed the safe operating pressure for any connected and properly adjusted gas utilization equipment.

[29] 49 U.S.C. subsection 60118(d).

at each station. An electronic pressure recorder is located at the outlet of each station that would send an alarm to Spire's Gas Control if an overpressure event were to occur. As discussed in section 2.2 of this memo, 20 CSR 4240-40.030(4)(FF)3. requires that relief valves or other pressure limiting devices must be installed at or near each regulator station in a low-pressure distribution system, with a capacity to limit the maximum pressure in the main to a pressure that will not exceed the safe operating pressure for any connected and properly adjusted gas utilization equipment. Spire has installed a pressure relief device (a relief valve) at each Reynolds regulator station in the low-pressure distribution systems, but the capacity of each relief valve is lower than the volume of gas that would be released by each Reynolds regulator if a wide-open failure occurred. The Spire response on April 4, 2023 to Staff Data Request No. 0006.1 states that the relief capacity for the relief valve installed at each of the 32 remaining Reynolds regulator stations is ** [redacted] **. Based on Staff's calculations at each regulator station, this represents between ** [redacted] ** of the wide-open failed capacity of the 32 remaining Reynolds regulators (See list in Confidential Attachment A). No additional pressure limiting device (such as a monitor regulator) is installed on the downstream side of the Reynolds regulators. Relief valves or other pressure limiting devices with adequate capacity would need to be installed at or near each Reynolds regulator station to meet the requirements of 20 CSR 4240-40.030(4)(FF)3.

Staff notes that Spire did have a partial failure at a Reynolds regulator station[30] in May 2019, where some gas was passing though the Reynolds regulator in the closed position (an internal part of the regulator did to fully seal off in the closed position as intended[31]). The event occurred as a Spire

[30] Spire response to Staff Data Request No. 0008A: A) In May 2019, Spire had stopped the flow of gas in a segment of one of its low-pressure distribution systems providing natural gas to the Delmar Loop area of University City in preparation for a replacement project. With the flow to part of the system blocked, gas leaking through Reynolds Station No. 217 caused the pressure to rise to 26-inches w.c. in the remaining section of piping. Spire controllers received high pressure alarms and notified Instrumentation and Control. Due to a malfunctioning pressure gauge, the construction crew did not immediately observe the pressure increase. As soon as the crew realized there was an issue with the pressure gauge, they replaced the gauge and noted the pressure increase. At the same time, Instrumentation and Control arrived on site and communicated with the construction crew. At the direction of Instrumentation and Control, the construction crew began to vent the gas.

[31] Spire response to Staff Data Request No. 0008B and C: B) There were chips in the valve orifice of Station 217 that allowed gas to seep around the edges of the orifice. C) The valve orifice in the regulator was chipped which allowed gas to leak through the station.

construction crew had blocked the flow of gas downstream of this regulator station in preparation for a cast iron replacement project. The construction crew was initially unaware of the increased pressure downstream, however the overpressure condition was detected by an electronic pressure recorder and an alarm was transmitted to Spire control room. Spire personnel then responded to correct the situation before pressures reached a level that could damage customer equipment, and this specific Reynolds regulator station has since been abandoned.[32] Spire has installed 1-inch relief valves and implemented a revised procedure for main tie-ins and shutdowns to address this situation and minimize the possibility of a recurrence.[33]

While overpressurization of the low-pressure systems is not expected, the overpressure event that occurred in May 2019 demonstrates that overpressure of the low-pressure system can occur due to unexpected circumstances. The capability of the system to off-set a higher than intended flow is reduced as the low-pressure distribution systems are replaced and become less integrated resulting in less takeaway system capacity and less neighboring regulator stations to reduce their flow. Ensuring that overpressurization of the low-pressure system does not occur is difficult without the installation of adequate overpressure protection devices at the Reynolds regulator stations.

The consequences of an overpressure event on a low-pressure system can be significant, and historically have included loss of life, injuries, and extensive property damage (see Section 1.1 of this memo for examples of incident consequences).

5.2 Field Simulated Tests

The Low Pressure Overpressure Protection Program in Exhibit D to the Application provides for field simulated tests ("quick" tests) to be scheduled at intervals of one, three, or five years was developed when over 100 Reynolds regulator stations remained and the scheduling of "quick" tests needed to be prioritized. Due to the significant drop in the number of remaining stations, Staff asked if an annual "quick" test could be conducted at each remaining Reynolds regulator station.[34]

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[32] Spire response to Staff Data Request No. 0001.
[33] Spire response to Staff Data Request No. 0008D and E: D) The Company added 1" relief valves to all its Reynolds Regulator Stations to minimize the possibility of a recurrence. E) The Company began using gauge trees with multiple types of pressure monitoring devices during construction work and implemented the Gas Interruption Procedure to minimize the possibility of a recurrence.
[34] Staff Data Request No. 0002.

Spires responded that if periods of appropriate testing weather are of sufficient duration[35], the Company can test each remaining Reynolds regulator station annually. In the Supplement, Spire included an Amended Exhibit D that commits to testing each remaining Reynolds regulator station during each calendar year until the downstream distribution system is replaced.

5.3 Does the Waiver Request Demonstrate that Gas Safety Will Not Be Compromised?

Staff is not persuaded that anything short of meeting the requirements of applicable Commission rules with respect to installing adequate overpressure protection devices will provide an equivalent level of gas safety. Staff's understanding is that PHMSA agrees with respect to the same requirements for adequate overpressure protection devices in applicable federal rules. In the event of a full or partial failure of a Reynolds regulator, the downstream low-pressure system could become overpressured to an extent that would compromise safety of the public and the affected customers on the low-pressure system. If each remaining Reynolds station had an adequate overpressure protection device such as a monitor regulator or full-capacity relief valve installed, the downstream low-pressure system would be protected from overpressurization in the event of a full or partial failure of a Reynolds regulator.

6.0 Staff's Conclusions

1. Staff concludes that the downstream system could be overpressured to an unsafe level if a Reynolds regulator as configured in current operation experienced a full or partial failure that exceeds relief valve capacity plus the downstream system takeaway capacity (customer usage on the downstream system). While a full failure has not occurred in the past, the possibility of a wide-open or near wide-open failure cannot be eliminated. Staff therefore does not agree with Spire's assertion that granting the waiver requested in the Spire Application will not compromise gas safety.

2. During the time until the remaining Reynolds regulator stations have either been retired or an adequate overpressure device is installed at the station, Staff concludes there are additional measures that can be implemented to provide a higher level of

[35] In the November 2022 response to Staff Data Request No. 0002.1, Spire estimated seven days of sufficient temperature (65ºF or above) prior to April 1 would be needed to test the 32 remaining Reynolds stations in 2023.

safety and further mitigate the safety risks related to a Reynolds regulator station failure, including the additional measures Spire described in its Supplement to Application filed on July 27, 2023. Additional measures should be developed and implemented, such as a plan for response to each high-pressure alarm, individualized project plans for work on the remaining low-pressure systems, and maximizing the use of temporary worker-monitor regulator stations to replace remaining Reynolds regulator stations.

3. Staff concludes that each of the remaining Reynolds regulator stations should be annually "quick" tested as Spire now commits to in Amended Exhibit D that was filed with its Supplement to Application. This is an interim measure until adequate overpressure protection is provided or the station is retired.

7.0 Staff's Recommendations

1. Staff recommends that the Commission deny the Application as filed and supplemented.
2. Staff recommends that the Commission direct Spire to take actions to comply with Commission's requirements in 20 CSR 4240-40.030(4)(CC), (4)(EE)9., (4)(FF)3., (12)(M)2., and (13)(R)1.G. that require adequate overpressure protection to be provided at all district regulator stations. Acceptable options include:
   A. Replacement of the Reynolds regulator station with a regulator station that provides adequate overpressure protection of the downstream distribution system. For example, Spire has installed other regulator stations that meet these requirements and has used temporary worker-monitor style regulator stations for this purpose as described in the Application.
   B. Installation of additional overpressure protection device(s) at the Reynolds regulator station that in combination with existing 1-inch relief valve will provide adequate overpressure protection of the downstream distribution system.
   C. Abandonment or deactivation of the Reynolds regulator station.
3. Staff recommends that Spire follow the additional safety measures that are described in the *Supplement to Application* for the remaining Reynolds regulator stations until

such time as adequate overpressure devices are installed at each station or the station is retired. The following measures are included in the Supplement:

- Spire Missouri will follow Amended Exhibit D, its Low Pressure Overpressure Protection Program, which is attached to the Supplement filing.
- For all remaining Reynolds stations, Spire Missouri will complete weekly inspections to confirm stations are operating correctly and safely.
- Spire Missouri will complete monthly pressure and alarm testing with the control room.
- Spire Missouri will replace Reynolds stations that are currently a single feed into a downstream system with temporary modern monitor type stations prior to October 1, 2023, and replace other Reynolds stations prior to becoming a single feed into a downstream system.
- Spire Missouri will replace the one remaining station that is served by an intermediate pressure (IP) system prior to December 1, 2023.

4. Staff recommends that Spire evaluate what other safety measures can be implemented until the remaining Reynolds regulator stations have been retired or an adequate overpressure device is installed at the station. Examples of additional measures that Spire should evaluate and consider are listed below.
   A. Determine how much time it will take, or a best estimate of the time it will take, between the activation of a high-pressure alarm and a system pressure exceeding safe limits of operation for each remaining Reynolds regulator station, and develop a plan to provide on-site response and evaluation for each high-pressure alarm in time to prevent overpressure of customer appliances;
   B. Develop and implement individualized project plans that require added precautions during replacement and other work on the remaining low-pressure systems and continue to use the procedure in Confidential Exhibit C to the Application.
   C. Obtain or construct additional temporary worker-monitor regulator stations and use them to replace the remaining Reynolds regulator stations where permitted by the location, minimum station capacity necessary to meet customer peak demand, and other pertinent considerations.

ATTACHMENT A

HAS BEEN DEEMED

CONFIDENTIAL

IN ITS ENTIRETY

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Spire Missouri, Inc. d/b/a Spire for a Permanent Waiver from the Requirement to use a "device" for Overpressure Protection in 20 CSR 4240-40.030(4), (12) and (13) for Certain Spire East Facilities	))))))	**Case No. GE-2023-0112**

AFFIDAVIT OF KATHLEEN A. McNELIS, PE

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

COMES NOW Kathleen A. McNelis, PE, and on her oath states that she is of sound mind and lawful age; that she contributed to the foregoing *Staff Recommendation, in Memorandum form*; and that the same is true and correct according to her best knowledge and belief.

Further the Affiant sayeth not.

Kathleen A. McNelis

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 27th day of September, 2023.

Notary Public

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
My Commission Expires: July 18, 2027
Commission Number: 15207377

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of the Application of Spire Missouri, Inc. d/b/a Spire for a Permanent Waiver from the Requirement to use a "device" for Overpressure Protection in 20 CSR 4240-40.030(4), (12) and (13) for Certain Spire East Facilities	))))))	**Case No. GE-2023-0112**

AFFIDAVIT OF JOHN D. KOTTWITZ

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

COMES NOW John D. Kottwitz, and on his oath states that he is of sound mind and lawful age; that he contributed to the foregoing *Staff Recommendation, in Memorandum form*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

John D. Kottwitz

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Cole, State of Missouri, at my office in Jefferson City, on this 27th day of September, 2023.

Notary Public

DIANNA L. VAUGHT
Notary Public - Notary Seal
State of Missouri
Commissioned for Cole County
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