Missouri Public Service Commission

Staff's Investigation Report

In the Matter of an Investigation into Spire Missouri Inc., d/b/a Spire's Compliance with The Commission's Rules Regarding Natural Gas Safety Found at 20 CSR 4240-40.030

Spire Missouri Inc., d/b/a Spire

Case No. GS-2022-0047

Industry Analysis Division
Safety Engineering Department
November 15, 2023 - Jefferson City, Missouri

** Denotes Confidential Information **

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I. EXECUTIVE SUMMARY

Spire Missouri Inc. ("Spire") operates the two largest natural gas distribution systems in Missouri: Spire Missouri East and Spire Missouri West, serving approximately 1.2 million customers combined.[1] Spire Missouri East (formerly known as Laclede Gas Company) serves the St. Louis area and other communities in the eastern part of Missouri. Spire Missouri West (formerly known as Missouri Gas Energy) serves the Kansas City area and other communities in the western part of Missouri.

The Commission's Safety Engineering Department Staff ("Staff") performs routine inspections of natural gas operators jurisdictional to the Commission for gas pipeline safety.[2] This includes performing inspections of new pipeline facility construction for purposes of evaluating compliance with the Commission's rules applicable to materials, design, welding, joining of materials other than by welding, construction, and installation.[3] During inspections of new pipeline facility construction, Staff also observes installation processes to determine if operator personnel perform welding, joining of materials other than by welding, construction, installation, and related tasks according to the operator's written, established procedures.[4]

[1] From Spire Inc. 2022 Form 10-K.
[2] RSMo 386.310 establishes the commission's jurisdiction with respect to gas pipeline safety jurisdiction.
[3] Commission rules 20 CSR 4240-40.030 Sections (2), (3), (4), (5), (6), (7), and (8).
[4] Commission rules 20 CSR 4240-40.030 Sections (5), (6), and (12) contain language requiring individuals to complete welding, joining, and operations and maintenance tasks according to written, established procedures.

Commission and federal pipeline safety rules[5] require that each individual joining plastic pipe to be used in natural gas service be trained and qualified under the applicable joining procedure.[6] Requalification intervals are also specified in the Commission and federal rules as once each calendar year, not to exceed 15 months.[7] During an inspection of new pipeline facility construction conducted in August 2020, Staff observed that one of the Spire employees completing mechanical joints[8] on plastic pipe had not been requalified on the procedure within 15 months as is required by 20 CSR 4240-40.030(6)(H)3. As a result of this finding, Spire conducted a review of the requalification intervals of all of its employees and determined that more than 15 months had elapsed without requalification of 431 of its employees who performed mechanical joining. Spire additionally identified two Spire employees who may have completed heat fusion plastic pipe joints[9] without first being requalified in accordance with Commission rule 20 CSR 4240-40.030(6)(H)3.

The course of action preferred by Staff when such circumstances have arisen in the past is for the gas operator to determine when an individual was most recently previously considered to be qualified under the rule, determine where that individual had subsequently completed joints, and removal and replacement of those joints by individuals with current qualifications. However, Staff's past experience with such situations has been limited to a small number of

[5] Commission rules pertaining to Joining of Materials Other Than by Welding are in 20 CSR 4240-40.030(6). Federal requirements are in 49 CFR 192, Subpart F.
[6] 20 CSR 4240-40.030(6)(H)1. and 2. set forth qualification requirements. These correspond to federal requirements in 49 CFR 192.285(a) and (b).
[7] 20 CSR 4240-40.030(6)(H)3. sets forth requalification requirement. This corresponds to the federal requirement in 49 CFR 192.285(c).
[8] Mechanical joints are made using a mechanical fitting to join sections of pipe. Types of mechanical fittings include stab type fittings, nut follower type fittings, bolted type fittings, and compression type fittings.
[9] Heat fusion as it applies to plastic pipelines is the process of heating two or more plastic pipeline components to a degree where when forced together the plastic of both pieces is allowed to flow and mix, resulting in a single fused piece once cooled. Heat fusion plastic pipe joints can be completed through various methods including butt fusion, saddle fusion, socket fusion, or electrofusion.

individuals (typically one or two), a short duration of time during which qualifications had lapsed, and therefore a limited number of joints to be removed and replaced (frequently ten or fewer). Based on Spire's investigation into this matter, the 431 employees who were not requalified within 15 months may have installed mechanical joints in as many as 6,112 locations. While Spire keeps records of which materials are used on each project, it does not document the locations where each joint is installed within each project, or which employee completed the installation of specific joints within a project.

Spire has stated that in this circumstance, it would like to take a different approach to removal and replacement of the joints, and has provided reasons it believes that the joints should remain in service. Staff has evaluated Spire's rationale, and is not fully persuaded by Spire's assertions that all joints were completed correctly and should remain in service (See Section V. *Staff's Analysis of Spire's Position* of this report). Staff does however agree that given the magnitude of the issue, further consideration of remedies is warranted. In this report, Staff has:

- Described the results of its inspections both prior to requesting that this case be opened (See Section II. *Background* of this report) and subsequent to the opening of this case (See Section III. *Subsequent Inspections* of this report),
- Analyzed Spire's compliance with the Commission rules regarding qualifications of persons making plastic joints (See Section IV. *Staff's Analysis of Spire's Compliance with Commission Rules* of this report),
- Evaluated Spire's position and basis for proposing limited actions (See Section V. *Staff's Analysis of Spire's Position* of this report), and

- Gathered and analyzed additional information in order to make an informed recommendation on the most appropriate remedy (See Section VI. *Staff's Analysis of Remedies* of this report).

As a result of this investigation, Staff found that sufficient facts and information[10] exist to assert the following violations of Commission rules:

1. Failure to ensure that 431 individuals making plastic pipe mechanical joints and two individuals making plastic pipe heat fusion joints in the Spire Missouri East operating area, and one individual making plastic pipe mechanical joints in the Spire Missouri West operating area were requalified under the applicable joining procedure at an interval not exceeding 15 months was a violation of 20 CSR 4240-40.030(6)(H)3.

   (See Section IV.A. *Qualification Requirements for Persons to Make Plastic Pipe Joints*)

2. Failure to install mechanical joints in accordance with written procedures that have been proved by test or experience to produce strong gastight joints was a violation of 20 CSR 4240-40.030(6)(B)2. Specifically, ** [redacted] . **

   (See Section IV.B. *Requirements to Follow Joining Procedures*)

3. Failure to have adequate methods in 2020 to determine that each person making joints in plastic pipelines in Spire's system is qualified in accordance with 20 CSR 4240-40.030(6) was a violation of 20 CSR 4240-40.030(6)(H)4.

   (See Section IV.C. *Method for Determining Qualifications*)

[10] Prior to finalizing this report, Staff provided a copy of the factual basis for its analysis to Spire to provide an opportunity to correct any factual inaccuracies and to identify confidential content. A copy of information edited to address Spire's comments is provided in Confidential Appendix A.

4. Failure to investigate the failure of the mechanical plastic pipe joint in ** [redacted] ** as required by Spire's procedure ** [redacted] ** for testing failed materials was a violation of 20 CSR 4240-40.030(12)(C)1.

   (See Section IV.D. *Failure Investigation and Leak Repair Records*)

Staff's analysis of the public safety risks associated with these violations is discussed in Section IV. *Staff's Analysis of Spire's Compliance with Commission Rules* of this report. Staff's analysis of potential remedies and mitigation measures for the public safety risks is discussed in Section VI. *Staff's Analysis of Remedies* of this report. Staff's recommendations regarding these violations, including remedies and mitigation measures to address the public safety risks, are listed in Section VIII. *Staff's Recommendations* of this report.

II. BACKGROUND

Commission rules require that pipelines must be designed and installed so that each joint will sustain the longitudinal pullout or thrust forces caused by contraction or expansion of the piping or by anticipated external or internal loading. 20 CSR 4240-40.030, Section (6), Joining of Materials Other Than by Welding, specifies the minimum requirements for developing and testing joining procedures, and qualifying and requalifying individuals on the procedures.

20 CSR 4240-40.030(6)(H) requires that persons joining plastic pipelines for use in natural gas service must be qualified under the applicable joining procedure by appropriate training or experience in the use of the procedure[11] and by making a specimen joint from pipe sections joined in accordance to the procedure that passes the inspection and test set forth in 20 CSR 4240-40.030(6)(H)2.[12] Additionally, a person must be requalified under an applicable

[11] 20 CSR 4240-40.030(6)(H)1.A.
[12] 20 CSR 4240-40.030(6)(H)1.B.

procedure at least once each calendar year at intervals not exceeding 15 months, or after any production joint is found unacceptable by pressure testing.[13] As part of inspections of new pipeline construction, Staff reviews the qualification records for the individuals Staff observes completing plastic pipe joints on a pipeline during the inspection.[14]

This section summarizes probable violations of the Commission rule to requalify individuals that had been identified by Staff prior to the opening of Case No. GS-2022-0047.

A. Spire Missouri East

On August 25-27, 2020, Staff conducted an inspection of new pipeline construction[15] being performed in the Spire Missouri East operating area for compliance with the Commission's pipeline safety standards in 20 CSR 4240-40.030. Staff observed Spire crews complete work on four projects during the inspection. Staff observed five Spire employees complete mechanical plastic pipe joints.[16] At the time of the inspection, Spire did not have documentation of the employees' joiner requalification available for Staff to review.

Spire provided the dates that the five employees had most recently been requalified on the applicable joining procedures following the inspection. Staff confirmed that four of the five Spire employees had been requalified to join plastic pipe with mechanical fittings within 15 months as required by Commission rules.[17] However, one of the Spire employees installing

[13] 20 CSR 4240-40.030(6)(H)3.
[14] 20 CSR 4240-40.030 (6)(H) sets forth the requirements for qualifying persons to make joints on plastic pipe used in natural gas pipeline systems.
[15] Construction inspections include observation of construction activity conducted on operator pipeline facilities by the operator or on the behalf of the operator, review of design documents, and review of other related records including plastic pipe joining qualification records.
[16] Mechanical plastic pipe joints are made using a mechanical fitting to join sections of plastic pipe. 20 CSR 4240-40.030(17)(A)5. defines a mechanical fitting as a mechanical device used to connect sections of pipe and that the term mechanical fitting only applies to stab type fittings, nut follower type fittings, bolted type fittings, and other compression type fittings.
[17] 20 CSR 4240-40.030(6)(H)1 requires that a person must be requalified under an applicable procedure once each calendar year at intervals not exceeding fifteen (15) months, or after any production joint is found

mechanical joints on August 26, 2020 had most recently been requalified on April 24, 2019, approximately 16 months prior to the date of Staff's inspection (approximately one month longer than the maximum 15 month interval between requalification).

Staff informed Spire following the inspection[18] that failure to requalify this individual on the applicable procedures within 15 months of the previous requalification date was a probable violation of Commission rules.[19] Staff requested information from Spire specific to joints completed by the individual Staff observed completing mechanical plastic pipe joints more than 15 months after their most recent previous requalification date, and before they were subsequently requalified. Staff additionally requested that Spire review its records with respect to the requalification of other Spire employees joining plastic pipe with mechanical fittings.

Spire performed an investigation of its records to determine which employees may have completed mechanical plastic pipe joints during a time interval when that employee had not been requalified in accordance with Commission rules. Spire determined that 431 employees[20] exceeded 15 months for requalification between April 13, 2020 and October 9, 2020, and that all employees had been requalified by December 16, 2020. Spire estimated that these employees may have completed mechanical plastic pipe joint installations at 6,112 locations during the time intervals between qualifications exceeding 15 months and requalification.[21]

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unacceptable by testing under subsection (10)(G).

[18] Also by letter, dated September 27, 2020.

[19] 20 CSR 4240-40.030(6)(H)1. requires that no person may make a plastic pipe joint unless that person has been qualified under the applicable joining procedure. 20 CSR 4240-40.030(6)(H)3. requires that persons making plastic pipe joints must be requalified under applicable procedures once each calendar year at intervals not to exceed fifteen (15) months.

[20] The initial estimate provided by Spire to Staff in a July 2, 2021 email was 436 employees. Spire's response to Staff Data Request No. 0001.1 stated that the correct number of employees was 431. Spire's response additionally stated that four duplicate employee counts and a spreadsheet formula error led to the initial employee count of 436.

[21] The initial estimate provided by Spire to Staff in a July 2, 2021 was 4,226 locations. Spire's response to Staff Data Request No. 0010.1 stated that the correct number of potential locations was 6,112. Spire's response stated

Spire additionally determined that two Spire employees in the Spire Missouri East operating area may have completed heat fusion plastic pipe joints[22] without being requalified within 15 months.[23] Spire estimated that these two employees may have completed up to 345 heat fusion plastic pipe joints as part of two projects during the time interval when the employees had not been requalified within 15 months, and before they were subsequently requalified.[24]

B. Spire Missouri West

Staff conducted an inspection of new pipeline construction in the Spire Missouri West operating area on October 22, 2020. During that inspection, ** [redacted][25] [redacted] **

that the initial location count was based on pressure test records, and the additional locations identified utilized timecard data to determine locations where a fitting may have been installed by an employee with lapsed qualifications. Spire's response additionally stated that these additional locations were less likely to have joints installed by an unqualified person, but could not be ruled out.

[22] Heat fusion plastic pipe joints are made by heating plastic pipe, and fittings if necessary, to the point of melting and bringing pipe ends, or pipe and a fitting, together so that the plastic can fuse together and create a joint. Types of heat fusion plastic pipe joining include butt heat fusion, saddle or sidewall fusion, and electrofusion.

[23] Spire's response to Staff Data Request No. 0011.

[24] Spire's response to Staff Data Request No. 0011.3.

[25] 20 CSR 4240-40.030(6)(H)1. requires that no person may make a plastic pipe joint unless that person has been qualified under the applicable joining procedure. 20 CSR 4240-40.030(6)(H)3. requires that persons making plastic pipe joints must be requalified under applicable procedures once each calendar year at intervals not to exceed fifteen (15) months.

C. Remedy for Joints not Installed in Accordance with Commission Rules

Spire stated that its typical process is to repair, remove, and/or replace any piping or material that was installed outside prescribed guidelines at the time of construction.[26] This is the approach that was taken with respect to the ** [redacted] . ** However, in the Spire Missouri East operating area where a larger number of joints were installed, Spire has suggested that a different approach should be taken. Spire is suggesting that no immediate replacement actions be taken with respect to the mechanical plastic pipe joints completed by individuals in the Spire Missouri East operating area who were not timely requalified. Spire provided seven reasons it does not believe replacement of these joints is necessary, which Staff has analyzed in Section V. *Staff's Analysis of Spire's Position* of this report.

On August 24, 2021, Staff filed its *Motion to Open Case* which recommended that the Commission open this case to gather additional information and make an informed recommendation on the most appropriate remedy. Staff requested to include both Spire Missouri East and Spire Missouri West in its investigation due to similar circumstances[27] in each operating area. On September 1, 2021, the Commission granted Staff's motion and in its *Order Opening an Investigation* ordered that Staff shall undertake an investigation of Spire's compliance with the Commission's rules regarding gas safety.

[26] Spire stated that this is its typical remedy in a July 2, 2021 email to Staff, as confirmed by Spire's response to Staff Data Request No. 0031. Spire further clarified that there have been no instances where Spire discovered employees who had lapsed qualifications and did not remove the joints as stated in Spire's response to Staff Data Request No. 0040.

[27] Contact restrictions due to the Covid-19 pandemic and incorrect coding in Spire's OQ software program (Energy Worldnet).

III. SUBSEQUENT INSPECTIONS

Between September 1, 2021 (the opening of this case) and September 1, 2023,[28] Staff has conducted routine natural gas pipeline safety inspections at Spire Missouri East and Spire Missouri West that included a review of joining requalification for individuals working on Spire's pipelines. These inspections included:

- Spire Missouri West Operations and Maintenance Records Inspections[29] conducted October 19-20, 2021,[30] and November 14-17, 2022;
- Spire Missouri East Operations and Maintenance Records Inspection conducted May 10-13, 2022;
- Inspections of new pipeline construction conducted in the Spire Missouri East operating area on April 25-28, 2022, August 1-4, 2022, November 7-10, 2022, December 13-14, 2022, June 12-15, 2023, and July 24-27, 2023; and
- Inspections of new pipeline construction conducted in the Spire Missouri West operating area on March 21, 2022, April 25-28, 2022, July 25-27, 2022, August 22-25, 2022, December 5-8, 2022, and July 17-20, 2023.

Staff did not identify any indications of subsequent violations of the requirements related to joiner requalification in 20 CSR 4240-40.030(6)(H)3. during these inspections.

However, during inspections of new plastic pipe installation, Staff observed ** [redacted]

[28] Although Staff continues to conduct routine gas pipeline safety inspections of Spire facilities, Staff used September 1, 2023 as an ending date for purposes of finalizing this report.
[29] Operations and Maintenance Records Inspections include a review of a broad range of operator records, documents, plans, and procedures including plastic pipe joining qualification records.
[30] Staff's Inspection included a Spire demonstration of the typical plastic joiner qualification process as a follow-up to Staff's October 22, 2020 construction inspection in the Spire Missouri West operating area.

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted] **

IV. STAFF'S ANALYSIS OF SPIRE'S COMPLIANCE WITH COMMISSION RULES

A. Qualification Requirements for Persons to Make Plastic Pipe Joints

1. Regulatory Requirements

Commission and federal rules set a minimum standard required to safely join plastic pipe for use in the transportation of natural gas.

20 CSR 4240-40.030(6)(H)1. requires that no person may make a plastic pipe joint unless that person has been qualified under the applicable joining procedure by—

1. Appropriate training or experience in the use of the procedure; and
2. Making a specimen joint from pipe sections joined according to the procedure that passes the inspection and test set forth in paragraph (6)(H)2.

20 CSR 4240-40.030(6)(H)2. sets forth the requirements for inspection and testing of specimen joints.[31]

20 CSR 4240-40.030(6)(H)3. requires that a person must be requalified under an applicable procedure once each calendar year at intervals not exceeding fifteen (15) months, or after any production joint is found unacceptable by testing under subsection (10)(G).[32]

[31] 20 CSR 4240-40.030(6)(H)2. includes the requirements that specimen joints must pass in order for an individual to be considered qualified to join plastic pipe. For both heat fusion and mechanical joints made on plastic pipe, (6)(H)2. requires the specimen joint must be visually examined during and after assembly or joining and found to have the same appearance as a joint or photographs of a joint that is acceptable under the procedure. For heat fusion joints, the joints must either be ultrasonically inspected and found not to contain flaws that would cause failure, or be destructively tested to evaluate if failure occurs in the joint area when a specimen cut from the joint is bent.

[32] 20 CSR 4240-40.030(10)(G) covers the minimum pressure testing requirements for plastic pipelines.

On March 20, 2020, the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration ("PHMSA") published Notice of Stay of Enforcement and Notice of Enforcement Discretion to Operators Affected by the Coronavirus ("COVID-19") Outbreak.[33] This notice included information that PHMSA did not intend to take any enforcement action with regard to Operator Qualification[34] and Control Room Management requirements, and will consider exercising its enforcement discretion with regard to Part 199 drug testing requirements. PHMSA continued, "In addition to these three specific areas, PHMSA realizes there may be other regulatory requirements under the Federal pipeline safety laws in 49 C.F.R. Parts 190 through 199 that pose compliance challenges for operators during this National Emergency. For intrastate operators regulated by State authorities, PHMSA will not object to waivers, special permits, stays of enforcement, or similar measures granted by State authorities to pipeline operators for noncompliance due to COVID-19 with State regulations equivalent to the Federal regulations. On May 19, 2021, PHMSA terminated the March 20, 2020 Stay of Enforcement, effective May 26, 2021.

Staff notes that the Missouri Public Service Commission ("MOPSC") did not issue temporary stays of enforcement during the COVID-19 pandemic in the same manner as PHMSA, but instead granted several temporary waivers of compliance with Commission rules in accordance with 20 CSR 4240-40.030(18) – Waivers of Compliance.

Commission rule 20 CSR 4240-40.030(18) provides the Commission's requirements for granting waivers of the pipeline safety standards:

> (18) Waivers of Compliance. Upon written request to the secretary of the commission, the commission, by authority order and under such terms and conditions as the commission deems appropriate, may waive in whole or part

[33] A copy of the notice is included in Appendix B.
[34] Staff notes that the PHMSA plastic pipe joiner qualification regulations are found in 49 CFR 192.285 as part of Subpart F, and the PHMSA operator qualification regulations are found in 49 CFR 192 Subpart N.

> compliance with any of the requirements contained in this rule. 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 USC 60118 except when the provisions of subsection (17)(G) apply.

During the time period between March 2020 and May 2021 (the duration of the federal Stay of Enforcement), Staff had discussions with operators regarding difficulties associated with implementation of certain aspects of the pipeline safety rules, in light of stay-at-home orders, and quarantine and social distancing restrictions. As a result, several temporary waivers of certain Commission rules were requested and granted. One of these wavier requests was initiated by Staff to address concerns operators expressed regarding difficulties entering residences during the earlier months of the pandemic, and applied to intrastate natural gas operators subject to the Commission's pipeline safety rules.[35] Additionally, Spire requested and was granted a temporary waiver from certain additional Commission pipeline safety rules and Commission Orders, citing COVID-19 related concerns and restrictions as reasons.[36]

Staff notes that although Spire requested and was granted temporary waivers of compliance from other Commission pipeline safety rules due to the COVID-19 pandemic, Spire did not request and the Commission did not grant a waiver from any operator qualification or requalification requirements, including requirements related to plastic pipeline joining

[35] In Case No. GE-2020-0297, Staff recommended that the Commission temporarily waive the requirements for operators of intrastate natural gas pipeline in Missouri to comply with the requirements of 20 SR 4240-40.030(12)(S)1.B., a rule which requires operators to visually inspect interior and exterior accessible customer gas piping and all connected equipment at the time an operator physically turns on the flow of gas to a customer.
[36] In Case No. GE-2020-0373, Spire sought and was granted a temporary waiver from compliance with certain requirements of Commission orders in File nos. GO-2002-50 and GO-93-343 as modified by the Unanimous Stipulation and Agreement in File No. GO-99-155, as well as requirements from Commission rules 20 CSR 4240-40.030(9)(Q)1 and 20 CSR 4240-40.030(13)(K) related respectively to inspections for atmospheric corrosion and routine leakage surveys of Spire facilities located inside customer premises.

qualification or requalification requirements in 20 CSR 4240-40.030(6)(H).[37] Because no such waiver was previously requested, Staff and the Commission have not previously considered whether gas safety would be compromised by failing to timely requalify employees.

2. Spire's 2020 Mechanical Joining Qualification and Requalification

A total of 555 Spire employees in the Spire Missouri East operating area were qualified to complete mechanical plastic pipe joints on Spire's pipelines at some point during 2020.[38] Between April 13, 2020 and November 25, 2020,[39] the interval between requalification on applicable procedures for mechanical plastic pipe joining exceeded 15 months for 431 of these 555 Spire employees in the Spire Missouri East operating area.[40]

Spire records document which work orders each employee has worked on, however Spire does not keep records regarding which employee completed specific joints within each work order.[41] Additionally, Spire does not maintain records of the locations of individual joints installed on its pipelines. Spire reviewed records of materials pulled from its storeroom for each work order, work records of pipe footages installed, and general installation practices to estimate that up to 41,392 mechanical plastic pipe joints[42] may have been completed in 6,112 locations[43] in the Spire Missouri East operating area by employees during time intervals when requalification had not been completed within 15 months.

[37] Spire requested waivers from Commission Rules 20 CSR 4240-40.030(9)(Q), (13)(M), (15)(C), (15)(D), and (15)(E) through Commission Case GE-2020-0373.
[38] Spire's response to Staff Data Request No. 0004.
[39] Spire's response to Staff Data Request No. 0001.1 corrected the last date of expiration from October 9, 2020 to November 25, 2020.
[40] Spire's response to Staff Data Request No. 0001.1 clarified that the correct number of employees whose qualifications lapsed was 431 rather than 436.
[41] Spire's response to Staff Data Request No. 0016.
[42] Attachment 10.2 in Spire's response to Staff Data Request No. 0010.2.
[43] Attachment 10-supplemental in Spire's response to Staff Data Request No. 0010.

Staff reviewed Spire's requalification records to evaluate the amount of time each individual continued to install mechanical joints after they had exceeded 15 months for requalification. The amount of time ranged from ** [redacted]. ** The average length of time that requalification exceeded 15 months was ** [redacted]. **[44] Confidential Figure 1 shows the distribution of the lengths of time beyond 15 months for employee requalification:

**

[redacted]

**

A total of 274 Spire employees in the Spire Missouri West operating area were qualified to complete mechanical plastic pipe joints on Spire's pipelines at some point during 2020.[45] Spire's review of plastic pipe joining qualification records indicated that the interval for requalification for completing mechanical plastic pipe joints exceeded one calendar year or

[44] Attachment 1 to Spire's response to Staff Data Request No. 0001.
[45] Spire's Response to Staff Data Request No. 0004.

15 months between qualification dates for one employee in the Spire Missouri West operating area.[46] ** [redacted] ** Additionally, a total of 163 contractor employees in the Spire Missouri West operating area were qualified to complete mechanical plastic pipe joints on Spire's pipelines at some point in 2020.[47] Based on Spire's review of plastic pipe joining qualification records for contractor employees, each contractor employee was requalified within 15 months to complete mechanical plastic pipe joints in 2020.[48]

3. Spire's 2020 Heat Fusion Qualification

The interval between requalification of 21 Spire employees in the Spire Missouri East operating area to preform joining plastic pipe by heat fusion[49] methods exceeded 15 months in 2020.[50] Nineteen of these 21 employees did not complete heat fusion plastic pipe joints prior to being requalified. Two of these 21 employees in the Spire Missouri East operating area may have completed up to 345 heat fusion joint installations as part of two construction projects in the Spire Missouri East operating area prior to being requalified. The length of time that the two employees' heat fusion[51] joining requalification exceeded 15 months were

[46] Attachment 2 in Spire's response to Staff Data Request No. 0002.
[47] Spire's Response to Staff Data Request No. 0005.
[48] Spire's Response to Staff Data Request No. 0003.
[49] Heat fusion used in this report refers to butt heat fusion, saddle heat fusion, and electrofusion.
[50] Spire's response to Staff Data Request No. 0011.
[51] Attachment 1 and Exhibit 11.1 in Spire's responses to Staff Data Request Nos. 0001 and 0011.1 show that the employees' mechanical plastic pipe joining qualifications also lapsed. One employee's heat fusion and mechanical joining qualifications were lapsed for the same period of time, while one employee was requalified on heat fusion months prior to being requalified for mechanical joining.

** [redacted]. **[52] Spire does not maintain records of which employee completed each heat fusion joint. In order to estimate the number of heat fusion joints that may have been completed after the employees during the time interval when requalification had not been completed within 15 months, Spire reviewed records of materials pulled from its storeroom for each work order, work records of pipe footages installed, and general installation practices.[53]

Spire records indicate that there were no instances in the Spire Missouri West operating area when the interval between requalification of a Spire or contractor employee completing heat fusion joints on Spire's pipelines exceeded 15 months between qualification dates in 2020.[54]

4. Staff Analysis

4.1 Spire's Compliance with Commission Rules Regarding Gas Safety

In 2020, the interval between requalification on plastic pipe joining exceeded 15 months for:

- Up to 431 employees in the Spire Missouri East operating area who continued to complete mechanical plastic pipe joints on Spire's system,
- Two employees in the Spire Missouri East operating area who may have continued to complete heat fusion plastic pipe joints on Spire's system, and
- One employee in the Spire Missouri West operating area who may have continued to complete mechanical plastic pipe joints on Spire's system.

[52] Exhibit 11.1 in Spire's response to Staff Data Request No. 0011.1.
[53] Spire's response to Staff Data Request No. 0011.3.
[54] Exhibit 11.2 in Spire's response to Staff Data Request No. 0011.2 only lists Spire employees in the Spire Missouri East operating area as having expired heat fusion qualifications.

Staff concludes that Spire did not comply with the requirement of Commission rule 20 CSR 4240-40.030(6)(H)3. to requalify individuals completing plastic pipe joints on its system.

4.2 Probability of Joint Failure

Mechanical plastic pipe joints are made using mechanical fittings to join and pressure seal two pipe segments together. Most mechanical fittings rely on elastomers and compression as sealing mechanisms. There are several general types of mechanical fittings available to join plastic pipe, which can be generally categorized by the following types:

- Stab Type Mechanical Fitting – Internally there are specially designed components including an elastomer seal, such as an "O" ring, and a gripping device to affect pressure sealing and pull-out resistance capabilities. Self-contained stiffeners are included in this type of fitting. With this style fitting the operator would have to prepare the pipe ends, mark the stab depth on the pipe, and "stab" the pipe in to the depth prescribed for the fitting being used. This fitting style is normally used in pipelines 2-inches in diameter and smaller.
- Nut Follower Type Mechanical Fitting – The components are generally a body; a threaded compression nut or a follower; an elastomer seal ring; a stiffener or an integrated stiffener for plastic pipe a gripping ring. Normally the design concept of this type of fitting typically includes an elastomer seal in the assembly. The seal, when compressed by tightening of a threaded compression nut grips the outside of the pipe, affecting a pressure-tight seal and provides pull-out resistance. For plastic pipe, the inside of the pipe wall should be supported by the stiffener under the seal ring and under the gripping ring to prevent collapse of the pipe. A lack of this support

could result in a loss of the seal affected by the seal ring or the gripping of the pipe for pull-out resistance. This fitting style is normally used in pipelines 2-inches in diameter and smaller.

- Bolted Type Mechanical Fitting – The bolt type mechanical fitting has similar components as the nut follower except instead of a threaded compression nut or follower, there is a bolt arrangement. These are often used in pipelines 2-inches in diameter or larger.

Mechanical fittings appear in a variety of configurations such as straight or inline couplings, elbows (45 or 90 degree), tees, reducing couplings (for joining pipes of different diameters), and couplings integrated with risers. Properly installed and supported, mechanical fittings can successfully connect steel, cast iron, copper, and plastic pipes. However, improper installation of a mechanical joint by failing to follow manufacturer's instructions can result in a failure. The potential for a pullout failure may not be detected during a pressure test of the pipe, since additional factors including cyclic fatigue from changing of the seasons, or soil shifting by other means (e.g., ground movement from earthquakes or after heavy rains) may contribute to the ultimate failure of the joint. The application of excessive force (such as the use of wrenches) to tighten mechanical joints can result in damage to the plastic components and seals.

Plastic pipe joints that have been completed by individuals who were not timely requalified on the applicable plastic pipe joining procedure are at an unknown, higher risk of failure than joints installed by timely requalified individuals.

As of June 6, 2023,[55] there have been 12 leak indications identified at locations where mechanical plastic pipe joints may have been installed[56] by Spire employees when the interval between requalification exceeded 15 months. As of June 11, 2023,[57] eight of these leaks have been repaired or eliminated by replacement.[58]

From Spire's responses to Staff data requests, Staff observed that Spire does not always expose and investigate the cause(s) of a leak, but instead at times abandons the leaking facility in place and installs a replacement facility.[59] Additionally, Staff learned that Spire has not tested any of the failed joints to determine if improper installation may have caused or contributed to the failure of the joints, although in some instances field notes ** [redacted] ** suggest to Staff improper installation. Due to the absence of detailed analysis of the causes of joint failures, Staff cannot eliminate improper installation as a cause or contributing factor to the failures of any of these joints.

As further discussed in Section IV.D. *Failure Investigation and Leak Repair Records* of this report, it is unclear to Staff why Spire has not more fully investigated the cause(s) of failures of facilities so recently installed.

Heat fusion plastic pipe joints refers collectively to joints installed using butt heat fusion, saddle heat fusion, and electrofusion. Butt heat fusion plastic pipe joints are made by joining the ends of two segments of plastic pipe by applying heat to the ends of the pipe,

[55] Date of Spire's response to Staff Data Request No. 0015.8.
[56] As discussed in Section IV.A.2. *Spire's 2020 Mechanical Joining Qualifications and Requalifications* of this report, Spire's records document the employees who worked on each project, but do not show which employee completed specific joints. As a result of this gap in the available information, Spire provided information on leaks related to 2020 installations where an individual with lapsed qualifications completed work and a mechanical plastic pipe joint was installed.
[57] Date of Spire's response to Staff Data Request No. 0015.9.
[58] Spire's responses to Staff Data Request Nos. 0015, 0015.3, 0015.6, and 0015.7.
[59] In some instances where abandonment of the leaking facility and replacement occurs Spire may not expose the leaking portion of the facility, and therefore does not completely investigate the cause of the leak. Staff further discusses these scenarios in Section IV.D. *Failure Investigation and Leak Repair Records* of this report.

bringing the melted ends of the pipe together, applying and maintaining a force between the pipe ends, and allowing the joint to cool. Butt heat fusion joining procedures generally specify requirements for cleaning and preparation of the pipe ends, and ranges of temperatures, pressures, and times that may be used in the fusion process. Saddle heat fusion plastic pipe joints are made in a similar fashion as butt heat fusion joints, except the joint is between a fitting (e.g. a tapping tee) and the top or side of a pipe segment. Electrofusion plastic pipe joints are made using an electrofusion fitting to join two segments of plastic pipe (using a coupling), install a tapping tee, or cap the end of a pipe with a fitting. Electrofusion fittings contain a heating element within the fitting itself, which is connected to a power source to heat and melt the pipe and fitting contact points. Procedures for joining by electrofusion include preparation and cleaning of the pipe and fitting surfaces, securing the fitting to the pipe (e.g. using a clamp), connecting the fitting to a power source, entering or verifying that the power source has the correct electrical settings, engaging the power source for a specified duration, and allowing the joint to cool.

Deviations from heat fusion joining procedures can lead to the failure of the resulting joint. Inadequate cleaning of the pipe and fitting surfaces can allow contaminants to be present in the fusion area. Incomplete or improper preparation of the pipe and fitting surfaces can affect the quality of the joint. Examples of incomplete or improper preparation include incomplete facing of pipe ends or misaligned pipe ends for butt fusion, insufficient roughing of the pipe or fitting for saddle fusion, or incomplete/lack of scraping of the pipe surface for electrofusion. Insufficient or excessive heat can affect the quality of the joint as well. During the heating process, force should not be applied between the heating surface and the pipe or fitting being heated. Applying force during the heating of the plastic can push the melted plastic out of the

fusion area, resulting in "cold fusion" of the joint. Issues during any of the part of a heat fusion procedure can lead to incomplete fusion of the plastic pipe joint.

As of June 6, 2023,[60] Spire had not identified any leaks on heat fusion joints that may have been completed by individuals who were not timely requalified on the applicable joining procedures.

4.3 Consequences of Joint Failures

Unintentional releases of gas from a pipeline pose a hazard to the public and may result in severe consequences. One of the possible consequences of a release of gas from a failed pipeline joint is gas migration through the ground, entering a building and igniting, resulting in explosions and fires.

On December 28, 2004, a natural gas ignition and explosion occurred at an office building in Ramsey, Minnesota that resulted in three fatalities and one serious injury. The plastic service line pipe was found to have insufficient penetration into a Dresser[61] Style 90 mechanical coupling to provide an adequate seal. Analysis of the failed piping indicated that the pull-out of the pipe from the mechanical joint occurred over several stages, possibly due to thermal contraction due to frost cycles.[62] An investigation by the Minnesota Office of Pipeline Safety indicated that:

> While the Dresser Style 90 coupling is designed to join steel or plastic pipe, additional internal parts are required for use in plastic pipe joining. The internal parts aid in forming a connection that resists the forces of contraction caused by frost cycles, as well as tensile forces due to soil loads. This

[60] Date of Spire's response to Staff Data Request No. 0037.1.
[61] Dresser manufactures several types of mechanical compression couplings.
[62] Information from PHMSA's Source Data webpage (Distribution, Transmission & Gathering, LNG, and Liquid Accident and Incident Data | PHMSA (dot.gov)) for gas distribution incidents occurring from March 2004 to December 2009.

> particular installation was insufficient to resist those forces, ultimately resulting in a catastrophic failure.[63]

Following the incident, CenterPoint Energy announced that the failure occurred in a part of its distribution system acquired from Midwest Gas. CenterPoint Energy estimated that up to 35,000 customer service lines might have couplings that did not meet standards, and announced a plan to replace these couplings.[64]

On December 14, 2015, a natural gas explosion and fire occurred at the residential home located at 5730 Mango Drive in Oakville, Missouri.[65] A failed butt heat fusion joint on a 3-inch diameter plastic main in front of the residence released natural gas, which migrated through the ground and into the residence. External forces exerted by tree roots were identified as a contributing cause to the failure of the butt heat fusion joint. In its investigation report, Staff noted that while it could not determine if there had been any violations of the applicable joining requirements in 1978 when the pipe was installed, the failed joint would not have met current regulatory requirements for joining plastic, which result in making butt heat-fusion joints that are stronger than the body of the pipe.

On November 27, 2015, a natural gas fire occurred along the ground and side of the El Carnaval Restaurant building at 3404 Georgia Street in Louisiana, Missouri.[66] The restaurant building was destroyed as a result of the subsequent structure fire. The source of the natural gas leak that ignited was an underground compression coupling in the plastic service

[63] Information from Minnesota Office of Pipeline Safety, Pipeline Incident report, edocket (searchDocuments.do (state.mn.us)).
[64] Information from CenterPoint Energy News Release, May 18, 2005 (CenterPoint Energy to Replace Service Lines That Might Contain Improperly Installed Couplings | CenterPoint Energy, Inc., (gcs-web.com)).
[65] Commission Case No. GS-2016-0160.
[66] Commission Case No. GS-2016-0159.

line. A compression coupling (also called a compression fitting) is a type of mechanical fitting used to join pipe. The service line had been successfully pressure tested in 2003.

On July 2, 2017, a natural gas-fueled explosion occurred at a home at 206 Springdale Lane in Millersville, Pennsylvania, resulting in one fatality and three injuries as well as a total loss of the residence and damage to six neighboring homes. The National Transportation Safety Board (NTSB) Pipeline Accident Brief regarding the incident indicates that the probable cause of the incident was an improperly installed mechanical tapping tee that leaked and allowed gas to migrate into the house where it ignited.[67]

On March 12, 2014, two adjacent five-story buildings in New York City, New York were destroyed by a natural gas fueled explosion and resulting fire. Eight people died, more than 50 were injured and more than 100 families were displaced from their homes as a result of the incident. The NTSB determined the probable cause of the incident to be the failure of a defective fusion joint that had been installed in 2011. Contributing to the incident was a breach in a sewer line that went unrepaired, resulting in a loss of support for the gas main, which caused the line to sag and overstressed the defective fusion joint.[68]

4.4 Staff Conclusions

1. In 2020, a significant number of individuals installed joints on Spire East's plastic pipelines during a period in which more than 15 months had passed since their most recent previous requalification.

[67] NTSB *Pipeline Accident Brief UGI Utilities Natural Gas-Fueled Explosion Millersville, Pennsylvania July 2, 2017* was issued on February 25, 2019. A copy of the brief is included in Appendix B.
[68] National Transportation Safety Board, Accident Report PB2015-104889, *Natural Gas-Fueled Building Explosion and Resulting Fire, New York City, New York, March 12, 2014*: Natural Gas-Fueled Building Explosion and Resulting Fire New York City, New York, March 12, 2014 (ntsb.gov).

2. There have already been failures of some of these joints, and the probability of future failures is unknown.
3. Improper installation of the joints cannot be ruled out as the cause of these joint failures.
4. The consequences of failures of these joints can be severe, including loss of life, serious injury, and property damage, as illustrated by the pipeline incident descriptions included in Section IV.A.4.3 *Consequences of Joint Failures* of this report.

5. Violations

Failure to ensure that 431 individuals making plastic pipe mechanical joints and two individuals making plastic pipe heat fusion joints in the Spire Missouri East operating area, and one individual making plastic pipe mechanical joints in the Spire Missouri West operating area were requalified under the applicable joining procedure at an interval not exceeding 15 months was a violation of 20 CSR 4240-40.030(6)(H)3.

B. Requirements to Follow Joining Procedures

1. Regulatory Requirements

Commission and federal rules set a minimum standard required to safely join plastic pipe for use in the transportation of natural gas. The applicable rules[69] include requirements for following written joining procedures that have been proved by test or experience to produce strong gastight joints.

[69] Commission rule 20 CSR 4240-40.030, Section 6; 49 CFR Part 192, Subpart F.

20 CSR 4240-40.030(6)(B)1. requires that the pipeline must be designed and installed so that each joint will sustain the longitudinal pullout or thrust forces caused by contraction or expansion of the piping or by anticipated external or internal loading.

20 CSR 4240-40.030(6)(B)2. requires that each joint must be made in accordance with written procedures that have been proved by test or experience to produce strong gastight joints.

2. *Spire's Actions*

As noted in Section III. *Subsequent Inspections* of this report, while conducing inspections of new pipeline facilities, Staff observed ** [redacted] **

3. *Staff Analysis*

** [redacted] [70]

[70] Spire's response to Staff Data Request No. 0043.

[redacted][71] ** As discussed in Section IV.A.4.3 *Consequences of Joint Failures* of this report, incidents have occurred due to improperly made plastic pipe joints.

4. Violations

Failure to install mechanical joints in accordance with written procedures that have been proved by test or experience to produce strong gastight joints was a violation of 20 CSR 4240-40.030(6)(B)2. Specifically, ** [redacted]. **

C. Method for Determining Qualifications

1. Regulatory Requirements

20 CSR 4240-40.030(6)(H)4. requires that each operator shall establish a method to determine that each person making joints in plastic pipelines in the operator's system is qualified in accordance with subsection 20 CSR 4240-40.030(6).

[71] Spire provided the information regarding the supplemental leak survey to Staff in its comments on Confidential Appendix A of this Report.

2. Spire's Actions

2.1 Prior to Identification of the Lapse of Joiner Requalification

Prior to identifying the lapse in plastic pipe joiner requalification, Spire used the following procedures and manufacturer's instructions to determine that each person making plastic pipe joints on Spire's pipelines were qualified in accordance with 20 CSR 4240-40.030(6)(H):

- ** [redacted][72] [redacted]
- [redacted][73] [redacted]
- [redacted]
- [redacted] **

Spire provided and Staff reviewed copies of each referenced procedure. The ** [redacted]

[72] Spire's response to Staff Data Request No. 0020. ** [redacted] ** a copy of which was provided in Spire's Attachment 20 in Spire's response to Staff Data Request No. 0020.

[73] ** [redacted] ** a copy of which was provided in Spire's Attachment 20 in Spire's response to Staff Data Request No. 0020.

[redacted][74]** did not contain procedures or methods for determining that each person making joints in plastic pipelines in a company's system is qualified in accordance with subsection 20 CSR 4240-40.030(6). Spire's procedure ** [redacted] ** for butt heat fusion, sidewall fusion and socket fusion and ** [redacted] ** for electrofusion each contained a procedures or methods for determining that each person making joints in plastic pipelines in a company's system is qualified in accordance with subsection 20 CSR 4240-40.030(6). However, neither Spire's procedure ** [redacted] ** for mechanical fitting installation nor the mechanical fitting manufacturer instructions provided by Spire contained methods for determining that each person making joints is qualified on the applicable procedures.

Spire additionally provided its Operator Qualification Plan as part of its method to determine that each person making joints on the Company's plastic pipelines is qualified in accordance with subsection 20 CSR 4240-40.030(6). Spire indicated that, as part of its operator qualification program, it compiles data management relating to mechanical joining qualifications in an Energy Worldnet ("EWN") database.[75] The use of the EWN database to compile this data began in the early 2000s for the Spire Missouri West operating area, and in 2020 for the Spire Missouri East operating area.[76] Spire stated that when it first began tracking mechanical joining qualifications in EWN, the requalification interval and grace period was three years not to exceed 39 months however the Company's practice was to complete the requalification for mechanical joining annually along with plastic pipe fusion qualification.

[74] Spire's response to Staff Data Request No. 0020 and Attachment 20 to Staff's Data Request No. 0020. Included in Attachment 20 were the following manufacturer installation instructions for mechanical fittings: ** [redacted] **.
[75] Spire's response to Staff Data Request No. 0017.
[76] Spire's response to Staff Data Request No. 0018.

2.2 Subsequent to the Identification of the Lapse of Joiner Requalification

Spire has taken action to amend its procedures and processes related to how Spire determines that each person joining plastic pipelines its system is qualified in accordance with subsection 20 CSR 4240-40.030(6).

Spire provided updated copies of ** [redacted] ** and ** [redacted] **, as well as ** [redacted] **[77] that were amended following the timeframe where Spire employees had qualifications lapse and made joints.

** [redacted] **, added the following requirement:

> ** [redacted] **[78]

Spire stated that it changed the operator qualification program requalification interval for mechanical joining in EWN from three years not to exceed 39 months to every 12 months not to exceed 15 months in 2020.[79]

[77] Attachment 12 in response to Staff Data Request Nos. 0012 and 0020, and Attachment 20 in response to Staff Data Request No. 0020.
[78] The discussion in this section of the report was limited to Spire's written procedures related to mechanical joining of plastic pipe. Similar language to ** [redacted] **, ** [redacted] **, and ** [redacted] ** was included in both the 2020 and 2021 versions of the ** [redacted] ** and ** [redacted] ** standards relating to plastic heat fusion, socket fusion, and electrofusion.
[79] Spire's response to Staff Data Request No. 0018.

Spire additionally stated that it developed a more formal Quality Assurance department that will have high-level oversight of the Operator Qualification (OQ) Plan, OQ program, and monitoring of Operator Qualification expiration dates.[80] Spire's Quality Assurance department routinely monitors qualification and requalification dates for contractors and Spire employees using the reporting and analysis functionality of the EWN system data.[81] Spire's Quality Assurance department selects field audits by focusing on the type of work being completed. Auditors prioritize jobs where directional boring, pulling back of main, fusion/installation of main, and welding are being completed. If multiple jobs of the same type are being done, the auditor will randomly select which job will be audited. Auditors will check the qualifications for each individual present that is performing work for the Company on the selected project for all covered tasks observed. Spire's Quality Assurance department will conduct audits weekly and Spire plans to conduct an average of 1-2 field audits per week per auditor. Distribution Evaluators are responsible for conducting field audits of internal crews, and Quality Assurance Evaluators are responsible for conducting field audits of contractor crews.[82]

3. Staff Analysis

A significant number of Spire employees completed joints on the Company's Spire Missouri East pipeline facilities without timely being requalified in 2020 (as described in Section IV.A. *Qualification Requirements for Persons to Make Plastic Pipe Joints* of this report). Staff therefore concludes that Spire's method established to determine that each person

[80] Spire's response to Staff Data Request No. 0035.
[81] In Spire's Response to Staff Data Request 0035.1, Spire said that Spire's Quality Assurance department can also verify an employee's or contractor's qualification status by scanning the EWN OQ-QR readable card during periodic field audits. In Spire's Response to Staff Data Request No. 0035.2, Spire Stated that the field audit process is implemented by scanning the EWN OQ-QR readable cards with a cell phone, then reviewing the output from EWN compared to the work being completed by the employee in the field to verify that the employee is qualified. The output from EWN displays the employee's name, photo, qualifications, and the date their qualifications expire.
[82] Spire's response to Staff Data Request No. 0035.3.

making joints in plastic pipelines in the operator's system is qualified in accordance with subsection 20 CSR 4240-40.030(6) was not sufficient to comply with 20 CSR 4240-40.030(6)(H)4.

Since 2020, Spire has updated its mechanical plastic pipe joining procedure and Operator Qualification Plan. The updates include changes to define the requalification interval for mechanical joining on plastic pipe to be annually not to exceed 15 months, which matches the requalification requirement set forth in 20 CSR 4240-40.030(6)(H)3. The updated mechanical plastic pipe joining procedure and the changes to Spire's Quality Assurance department address deficiencies which previously contributed to Spire's non-compliance with timely requalification of its employees. However, Spire additionally stated that there are not currently written documents, plans, or procedures that include information on the monitoring of Operator Qualification expiration dates by the Quality Assurance department or the field audit process.[83] Staff recommends that Spire develop a written document, plan, or procedure related to Spire's Quality Assurance's monitoring of OQ expiration dates and field audit processes. A written document, plan, or procedure will aid Spire in clearly defining the expectations and requirements of the monitoring and field audit process, as well as facilitating consistent implementation with those expectations and requirements. Effective implementation of the monitoring of Operator Qualification expiration dates and the field audit process will help ensure that individuals completing plastic pipe joints in Spire's pipelines are timely requalified on the applicable joining procedure(s).

[83] Spire's responses to Staff Data Request Nos. 0035.1 and 0035.2.

Spire stated that its quality assurance auditors prioritize jobs where directional boring, pulling back of main, fusion/installation of main, and welding are being completed.[84] Staff notes that in addition to installing mains, Spire's joiners also complete pipeline joints on service lines. There are typically multiple locations where a joint exists on a service line, at the tapping tee, at the excess flow valve, and at the service riser. A failure of any one of these joints could lead to severe consequences as discussed in Section IV.A.4.3 *Consequences of Joint Failures*. Staff recommends that Spire's quality assurance auditors also prioritize jobs that include fusion/installation of service lines.

Spire stated that ** [redacted] **[85] Spire has subsequently changed the operator qualification program requalification interval for mechanical joining in EWN from three years not to exceed 39 months to every 12 months not to exceed 15 months in 2020. Staff recommends that Spire conduct a review of its OQ program to determine if correct requalification frequencies have been entered in the ** [redacted] ** for all covered tasks included in the program. Additionally Staff recommends that Spire complete this review anytime changes are made to Spire's OQ program.

4. <u>Violations</u>

Failure to have adequate methods in 2020 to determine that each person making joints in plastic pipelines in Spire's system is qualified in accordance with 20 CSR 4240-40.030(6) was a violation of 20 CSR 4240-40.030(6)(H)4.

[84] Spire's response to Staff Data Request No. 0035.3.
[85] Confidential Attachment 31 to Spire's response to Staff Data Request No. 0031.

Spire has subsequently taken steps to address this deficiency by revising procedures and implementing Quality Assurance department changes. Staff recommends that Spire develop a written document, plan, or procedure related to Spire's Quality Assurance's monitoring of OQ expiration dates and field audit processes. Staff additionally recommends that that Spire conduct a review of its OQ program to determine if correct requalification frequencies have been utilized in the ** [redacted] ** for all covered tasks included in the program, additionally Staff recommends that Spire complete this review anytime changes are made to Spire's OQ program.

D. Failure Investigation and Leak Repair Records

1. Regulatory Requirements

Operators are required by 20 CSR 4240-40.020(7)(A) to submit annual reports to PHMSA and MOPSC which includes the number of hazardous leaks eliminated/repaired (categorized by cause), the total number of leaks eliminated/repaired (categorized by cause), the number of excavation damages, and the number of excavation tickets.[86] The leak causes included on the Gas Distribution Annual Report Form PHMSA F 7100.1-1 (most recently revised May 2021) are: "Corrosion Failure", "Natural Force Damage", "Excavation Damage", "Other Outside Force Damage", "Pipe, Weld, or Joint Failure", "Equipment Failure", "Incorrect Operation", and "Other Cause". PHMSA provides instructions for completing annual reports, a copy of which is included in Appendix B of this report.

[86] These data points are performance measures required to be monitored by 20 CSR 4240-40.030(17)(D)5. as part of an operator's Distribution Integrity Management Program (DIMP).

20 CSR 4240-40.030(12)(C)1. requires that each operator shall prepare and follow for each pipeline, a manual of written procedures for conducting operations and maintenance activities and for emergency response.

20 CSR 4240-40.030(12)(C)5. requires that the procedures required by subsection (12)(L) must be included in the manual required by paragraph (12)(C)1.

20 CSR 4240-40.030(12)(L) requires that each operator shall establish procedures for analyzing accidents and failures, including the selection of samples of the failed facility or equipment for laboratory examination, where appropriate, for the purpose of determining the causes of the failure and minimizing the possibility of a recurrence.

20 CSR 4240-40.030(13)(F)2.C. requires that for feeder lines, mains, and service lines, each operator shall maintain records pertaining to each leak repair for the life of the facility involved, except no record is required for repairs of aboveground Class 4 leaks.[87] These records shall at least contain sufficient information to determine the promptness of actions taken, address of the leak, pipe condition at the leak site, leak classification at the time of the repair and other such information necessary for proper completion of DOT annual Distribution and Transmission Line report forms (PHSMA F 7100.1-1 and PHMSA F 7100.2-1, respectively).

20 CSR 4240-40.030(17)(D)5. requires that an operator must develop and monitor performance measures from an established baseline to evaluate the effectiveness of its integrity management program.

[87] A Class 4 leak, as described in 20 CSR 4240-40.030(14)(C)4., is a confined or localized leak which is completely nonhazardous.

2. Spire's Actions

2.1 Spire's Actions Related to Requirements in 20 CSR 4240-40.020(7)(A)

Spire has submitted to the MOPSC completed Gas Distribution Annual Report Forms (Form No. PHMSA F 7100.1-1) for the Spire Missouri East operating area. The annual reports submitted for calendar years 2020 through 2022 have included eliminated or repaired leaks on mechanical plastic pipe joints that may have been completed by joiners during time intervals when requalification had not been completed within 15 months. On its annual report forms, Spire includes the causes of leaks that have been eliminated or repaired during the calendar year. See Sections IV.D.2.4 *Spire's Actions Related to Requirements in 20 CSR 4240-40.030(12)(L)* and IV.D.2.5 *Spire's Actions Related to Requirements in 20 CSR 4240-40.030(13)(F)2.C.* of this report for additional discussion of Spire's determination and documentation of leak causes.

2.2 Spire's Actions Related to Requirements in 20 CSR 4240-40.030(12)(C)1.

Spire has prepared a manual of written procedures for conducting operations and maintenance activities and for emergency response as required by 20 CSR 4240-40.030(12)(C)1. During the course of this investigation, Staff has identified one instance where Spire did not follow a procedure in its written manual of procedures.

** [redacted] [88] [redacted]

[88] The version of Spire's procedure effective at the time that ** [redacted] ** was completed, according to Spire's response to Staff Data Request No. 0042.1.

[redacted] **

2.3 Spire's Actions Related to Requirements in 20 CSR 4240-40.030(12)(C)5.

Spire has included procedures for accident and failure investigation in Spire's manual of written procedures as required by 20 CSR 4240-40.030(12)(C)5.

Spire provided a copy of its procedure for the testing of failed materials ** [redacted] ** that was in effect during the time that the leaks were eliminated or repaired at locations where mechanical plastic pipe joints were installed during time intervals when joiner requalification had not been completed within 15 months (Confidential Table 1 summarizes the leak repair information). ** [redacted][89] ** Spire additionally provided a copy of its procedure for failure investigation ** [redacted]

[89] This corresponds to Commission rules 20 CSR 4240-40.020(7)(B), 20 CSR 4240-40.030(12)(L), and 20 CSR 4240-40.030(17)(E). Staff notes that 20 CSR 4240-40.020(7)(B) and 20 CSR 4240-40.030(17)(E) are now reserved. 20 CSR 4240-40.030(12)(C)1. requires that operators must have and follow procedures for conducting operations and maintenance activities, including procedures for 20 CSR 4240-40.030(12)(L) as required by 20 CSR 4240-40.030(12)(C)5.

[redacted]

[redacted] **[90]

2.4 Spire's Actions Related to Requirements in 20 CSR 4240-40.030(12)(L).

** [redacted] [91] [redacted]

[redacted] **[92]

Spire stated in response to Staff Data Request No. 0033 that ** [redacted]

[redacted] **[93]

As of June 6, 2023,[94] Spire had identified 12 leak indications at locations where mechanical plastic pipe joints were completed during time intervals when requalification had

[90] This corresponds to Commission rule 20 CSR 4240-40.030(12)(L). 20 CSR 4240-40.030(12)(C)1. requires that operators must have and follow procedures for conducting operations and maintenance activities, including procedures for 20 CSR 4240-40.030(12)(L) as required by 20 CSR 4240-40.030(12)(C)5.
[91] 20 CSR 4240-40.030(12)(C)1. requires that operators must have and follow procedures for conducting operations and maintenance activities, including procedures for 20 CSR 4240-40.030(12)(L) as required by 20 CSR 4240-40.030(12)(C)5.
[92] Confidential Attachment 33 to Spire's response to Staff Data Request No. 0033.
[93] Spire's response to Staff Data Request No. 0033.
[94] Date of Spire's response to Staff Data Request No. 0015.8.

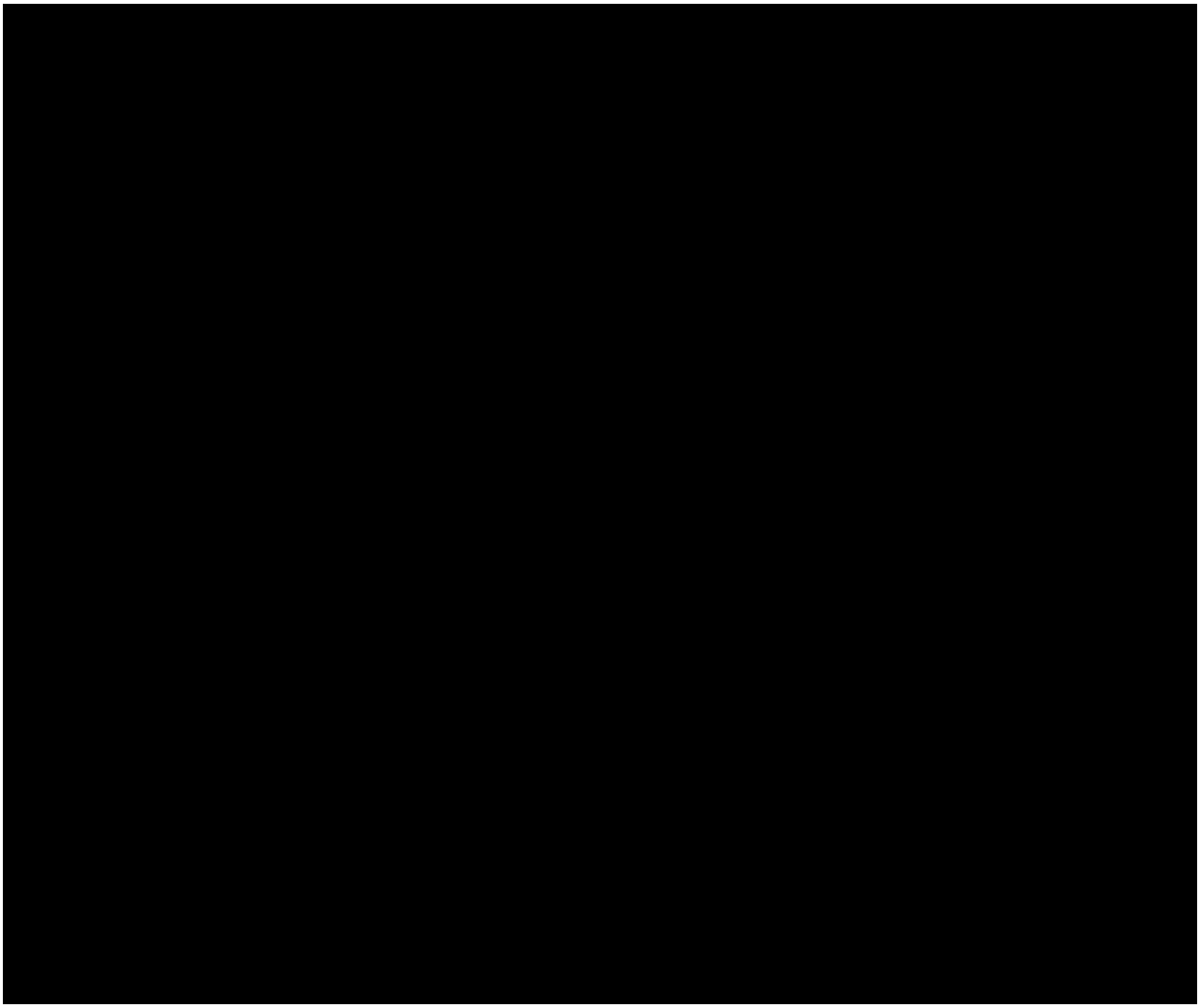
not been completed within 15 months. Spire closed one of these 12 leaks without exposing the facilities after two subsequent rechecks at the location indicated no gas was present.[95] Spire has repaired or eliminated by replacement eight of the leak indications and provided copies of the leak repair documentation.[96] The relevant information from the leak repair documentation[97] for the leaks that Spire has repaired or eliminated by replacement is summarized in Confidential Table 1, including the leak causes to be included on Spire's annual reports submitted in accordance with 20 CSR 4240-40.020(7)(A).[98]

Confidential Table 1: Leak Repair Information

**

[redacted]

[95] Spire's response to Staff Data Request No. 0015.9. Spire uses the term "Class N rechecks" for rechecks of leak indications where no additional leak indications are found. Spire closes leaks that have two consecutive Class N rechecks, which are typically weeks apart to account for changing environmental conditions.
[96] Spire's responses to Staff Data Request Nos. 0015, 0015.3, 0015.6, and 0015.7.
[97] Leak repair documentation is required by 20 CSR 4240-40.030(13)(F)2.C.
[98] The leak cause data on annual reports is used to monitor the performance of an operator's DIMP in accordance with 20 CSR 4240-40.030(17)(D)5.
[99] Leak repair information was provided in Exhibit 15.1, Confidential Attachments 15.3, 15.6, and 15.7 to Spire's responses to Staff Data Request Nos. 0015.1, 0015.3, 0015.6, and 0015.7, respectively.
[100] 20 CSR 4240-40.030(14)(C) defines leak classes. A Class 1 leak is a gas leak which, due to its location and/or magnitude, constitutes an immediate hazard to a building and/or the general public. A Class 1 leak requires immediate corrective action. A Class 2 leak is a leak that does not constitute an immediate hazard to a building or to the general public, but is of a nature requiring action as soon as possible. A Class 3 leak is a leak that does not constitute a hazard to property or to the general public but is of a nature requiring routine action. A Class 4 leak is a confined or localized leak which is completely nonhazardous.
[101] Spire's responses to Staff Data Request Nos. 0015.2, 0015.3, and 0015.6.
[102] Action Taken field was not available on some of the leak repair documentation provided by Spire. For these actions, Staff submitted and Spire responded to data requests.
[103] Leak Sub-Causes were not available on some of the leak repair documentation provided by Spire.
[104] Spire's response to Staff Data Request No. 0015 – the leaking facility was not exposed because the entire service line was replaced to eliminate the leak.
[105] Spire's response to Staff Data Request No. 0015 – the entire service line was replaced to eliminate the leak.



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2.5 Spire's Actions Related to Requirements in 20 CSR 4240-40.030(13)(F)2.C.

Spire provided copies of records of repaired leaks on mechanical plastic pipe joints that may have been completed by joiners when requalification had not been completed within 15 months, which is summarized in Confidential Table 1.

[106] Spire's response to Staff Data Request No. 0015.3 – the leaking facility was not exposed because the entire service line was replaced to eliminate the leak.
[107] Spire's response to Staff Data Request No. 0015.3 – the entire service line was replaced to eliminate the leak.
[108] Spire's response to Staff Data Request No. 0015.7 – the leak was repaired by tightening the fitting, so the leak would not be reported on Spire's annual report.
[109] Spire's response to Staff Data Request No. 0015.9 – the leak was repaired by replacement from the tee to the curb, so the leaking facility was not exposed.

2.6 Spire's Actions Related to Requirements in 20 CSR 4240-40.030(17)(D)5.

Spire has developed and monitored performance measures from an established baseline to evaluate the effectiveness of its Distribution Integrity Management Program (DIMP), including both the number of hazardous leaks and total number of leaks eliminated or repair, categorized by cause.

3. Staff Analysis

Staff reviewed Spire's procedure for determining leak causes, testing failed materials, and leak repair documentation which included information regarding leak cause determinations for the repaired leaks.

3.1 Spire's Compliance with the Requirements of 20 CSR 4240-40.020(7)(A).

20 CSR 4240-40.020(7)(A) requires operators to submit annual reports to PHMSA and MOPSC. Accurate reporting of the leak cause data required in annual reports depends on accurate determination of leak causes. As discussed in Sections IV.D.3.4 *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(L)* and IV.D.3.5 *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(13)(F)2.C.* of this report, it is unclear to Staff if Spire's procedures and actions with respect to the leaks Staff investigated in this case are sufficient to accurately determine leak causes.

PHMSA's Instructions for Completing Form PHMSA F 7100.1-1 (revision May 2021) lists leak cause classifications in the section that covers Part C (total leaks and hazardous leaks eliminated/repaired during year) of the annual report form. The definitions in Spire's procedure to determine leak causes, ** [redacted] **, do not contain all of the information listed in PHMSA's Instructions for Completing Form PHMSA F 7100.1-1. Examples of specific differences between Spire's procedure ** [redacted] ** and PHMSA's Instructions for

Completing Form PHMSA F 7100.1-1 are provided in Confidential Appendix C. Staff recommends that Spire's procedure to determine leak causes be consistent with the leak category descriptions in PHMSA's Instructions for Completing Form PHMSA F 7100.1-1.

3.2 Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(C)1.

Spire's ** [redacted] ** This corresponds to Commission rule 20 CSR 4240-40.030(12)(L). Commission rules require that each operator shall prepare and follow a manual of written procedures for conducting operations and maintenance activities and for emergency response,[110] and that the procedures required by subsection (12)(L) must be included in the manual.[111] Staff concludes that Spire did not comply with Commission rule 20 CSR 4240-40.030(12)(C)1. by failing to follow its procedure ** [redacted] ** to investigate the failure of the joint involved in ** [redacted] **.

3.3 Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(C)5.

Spire has written procedures for failure investigations in its written procedural manual. Therefore, Staff has not identified any issues with Spire's compliance with Commission rule 20 CSR 4240-40.030(12)(C)5., which requires operators to have procedures required by 20 CSR 4240-40.030(12)(L) in the written manual of procedures required by 20 CSR 4240-40.030(12)(C)1.

[110] 20 CSR 4240-40.030(12)(C)1.
[111] 20 CSR 4240-40.030(12)(C)5.

3.4 Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(L).

Spire's procedure for determining leak causes, ** [redacted] **, does not set forth specific steps for determining and documenting the causes of leak. As discussed in Section IV.D.3.1 *Spire's Compliance with the Requirements of 20 CSR 4240-40.020(7)(A)* and Confidential Appendix C of this report, the definitions in Spire's procedure to determine leak causes, ** [redacted] **, do not contain all of the information listed in PHMSA's Instructions for Completing Form PHMSA F 7100.1-1 (revision May 2021). Additionally, as discussed later in this section and Section IV.D.3.5 *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(13)(F)2.C.* of this report, some of the leak causes shown in Spire's leak repair documentation do not seem to be consistent with PHMSA's Instructions for Completing Form PHMSA F 7100.1-1 (revision May 2021). Staff recommends improvements to Spire's procedure for determining and documenting (including supporting information) leak causes to help address the inconsistencies identified in this report. Staff further recommends that Spire train personnel responsible for determining leak causes on the updated procedure once finalized.

Spire did not expose the leaking facility for ** [redacted] **. For ** [redacted] **, the leak was eliminated by replacing the entire service line, and the leak for ** [redacted] ** were eliminated by replacing a portion of the service line. The documentation for ** [redacted] ** did not include additional information that explained why Spire decided not to expose the leaking facility.[112] Additionally, the documentation for

[112] Exhibit 15.1 to Spire's response to Staff Data Request No. 0015.1, Confidential Attachment 15.3 to Spire's response to Staff Data Request No. 0015.3, and Confidential Attachment 15.9 to Spire's response to Staff Data Request No. 0015.9.

** [redacted] [113] ** Due to the relatively recent installation date of the existing service line, the age of the pipeline facilities and the materials of which they were constructed should not have been factors when the determination was made to replace the majority of the service line rather than locating and only replacing the leaking portion of the service line. It is unclear to Staff why Spire did not determine the cause(s) of failures on these facilities that occurred within 2 years of installation. Information gathered from exposing a leaking facility to determine the leak cause can be valuable to Spire's knowledge of its system, and can also contribute to the safety of Spire's pipeline facilities by minimizing the possibility of the same failure recurring. Staff has a recommendation related to the exposure and testing of failed facilities to identify the cause(s) of leaks.

3.5 Spire's Compliance with the Requirements of 20 CSR 4240-40.030(13)(F)2.C.

Staff reviewed the leak repair documentation for leaks eliminated or repaired at addresses where mechanical plastic pipe joints may have been completed by joiners during time intervals when requalification had not been completed within 15 months. Of the leaking facilities that Spire exposed (** [redacted] **), Spire's determination of leak cause does not always appear to be supported by leak repair documentation.

For example:

- Spire reported the leak cause for ** [redacted] ** as "Pipe, Weld, or Joint Failure", however the leaking facility was not exposed. The instructions for

[113] Confidential Attachment 15.3 to Spire's response to Staff Data Request No. 0015.3.

leak cause classification provided in *Instructions (rev 5-2021) for completing Form PHMSA F 7100.1-1* (copy provided in Appendix B of this report), state that the category of "Pipe, Weld, or Joint Failure" should be used when a leak has resulted from a material defect within the pipe, component or joint due to faulty manufacturing procedures, design defects, or in-service stresses such as vibration, fatigue and environmental cracking. Material defect means an inherent flaw in the material or weld that occurred in the manufacture or at a point prior to construction, fabrication or installation. It is unclear how Spire determined that this leak was caused by a material defect due to faulty manufacturing procedures. It appears to Staff that "Improper Operation" (which includes any leak resulting from poor construction) would be equally likely. The category "Other Cause" would also be appropriate for a belowground leak that was not exposed.

- Spire reported the leak cause for ** [redacted] ** as "Pipe, Weld, or Joint Failure". The field notes for ** [redacted] ** stated ** [redacted] **. This is a known failure mechanism when mechanical joints have not been completed properly. The *Instructions (rev 5-2021) for completing Form PHMSA F 7100.1-1* (copy provided as Appendix B of this report) state that any leak that is associated with a component or process that joins pipe such as threaded connections, flanges, mechanical couplings, welds, and pipe fusions that leak as a result from poor construction should be classified as "Incorrect Operation". Since Spire did not perform any testing of the failed joint,[114] it does not seem appropriate that Spire has attributed the failure to a defect in the joint itself as opposed to the installation method.

Spire objected to Staff data requests for additional information regarding how Spire determined the leak causes for the above leak repairs as well as additional leak repairs that have occurred on other mechanical plastic pipe joints discussed within this report. During a June 17,

[114] Spire's response to Staff Data Request No. 0042.

2022 meeting regarding the objections, Spire indicated that no additional, relevant information was available, beyond what had already been provided, regarding the leak cause determinations.

3.6 Spire's Compliance with the Requirements of 20 CSR 4240-40.030(17)(D)5.

Determination of leak causes is necessary in order to monitor performance of an operator's DIMP. 20 CSR 4240-40.030(17)(D)5. requires that both the number of hazardous leaks and total number of leaks eliminated or repair, categorized by cause, must be included as performance measures as part of an operator's DIMP. ** [redacted] **[115] Staff is concerned that failing to completely investigate leak causes will limit Spire's ability to comply with the requirements of 20 CSR 4240-40.030(17)(D)5. which requires that both the number of hazardous leaks and total number of leaks eliminated or repair, categorized by cause, must be included as performance measures as part of an operator's DIMP.

4. Violations

Failure to investigate the failure of the mechanical plastic pipe joint in ** [redacted] ** as required by Spire's procedure ** [redacted] ** for testing failed materials was a violation of 20 CSR 4240-40.030(12)(C)1., which requires each operator to prepare and follow written procedures for conducting operations and maintenance activities and for emergency response.

[115] As discussed in Sections IV.D.3.1 *Spire's Compliance with the Requirements of 20 CSR 4240-40.020(7)(A)*, IV.D.3.4. *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(L)*, and IV.D.3.5. *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(13)(F)2.C.* of this report.

V. STAFF'S ANALYSIS OF SPIRE'S POSITION

Spire's position as stated in its July 2, 2021 email, and reaffirmed in its response to Staff Data Request Nos. 0021 and 0031, is that the mechanical plastic pipe joints that may have been completed by employees who had not been requalified within 15 months should remain in service and that the Company will monitor the joints for increased risk in the future. As a basis, Spire stated that:

- The requalification of the affected employees was begun in early October, soon after discovery of the condition. (See subsection A below)
- In the requalification process, the employee goes through a session of review and installation of a sample mechanical plastic pipe fitting in the presence of the qualifier. Each employee was able to complete a proper sample installation without any issues. The Company had a 100% passage rate. (See subsection B below)
- All of the mechanical plastic pipe fittings installed during this time in the field were completed using the approved installation procedures. (See subsection C below)
- None of the employees completing work during this timeframe were recent hires or new employees. Therefore, they had successfully made mechanical plastic pipe fitting installations over the prior months while qualified and were familiar with the approved installation process. (See subsection D below)
- The mechanical plastic pipe fittings were pressure tested and the joints were soap tested at the time of the installation without any deficiencies or issues. If an issue would have been discovered, the approved installation procedures would have required the mechanical plastic pipe fitting to be replaced at the time of installation. (See subsection E below)

- Replacing the affected mechanical plastic pipe joints would divert resources from higher risk replacement priorities such as Low Pressure Overpressure Protection (LPOP)[116] and cast iron. (See subsection F below)
- The added risks and costs of re-exposing the installs and evaluating or replacing the existing installed mechanical plastic pipe fittings outweighs the risk of leaving the current install in place. (See subsection G below)

Additionally, Spire's position as stated in its response to Staff Data Request No. 0034 is that the heat fusion plastic pipe joints that may have been installed by employees who had not been requalified within 15 months, should remain in service and that the Company will monitor the joints for increased risk in the future. As a basis, Spire stated that:

- The Company strongly believes that the installs were done correctly. (See subsection C below)
- Both employees have a long tenure and have achieved the highest level of field installation job title within their career progression. (See subsection D below)
- Replacing the installed joints would divert resources from higher risk replacement priorities, such as LPOP and cast iron. (See subsection F below)
- The added risks and costs of re-exposing the installs and evaluating or replacing the existing installed joints outweighs the risk of leaving the current install in place. (See subsection G below)

[116] Staff notes that Spire defines the acronym "LPOP" in its application for waiver in Case No. GE-2022-0112. What Spire is referring to by LPOP are its legacy Reynolds regulator stations. These regulator stations do not have overpressure protection meeting the requirements of 20 CSR 4240-40.030 (4) (CC), 20 CSR 4240- 40.030 (4)(EE) 9 and 20 CSR 4240-40.030 4(FF) 3, 20 CSR 4240-40.030 (12)(M)2 and 20 CSR 4240-40.030 (13)(R)1G of the Commission's Pipeline Safety Standards.

- The Company believes that there is no increased risk associated with these installations compared to other heat fusion joints. (See subsection H below)

A. Amount of Time between Requalification

1. Spire's Point

Mechanical Joining: The requalification of the affected employees was begun in early October, soon after discovery of the condition.

2. Staff Analysis

Staff appreciates Spire's prompt actions to requalify its workforce following discovery of the lapse in employee requalification. The number of locations where mechanical plastic pipe joints were being completed by employees not timely requalified could have been greater without this corrective measure implemented by Spire.

Staff notes that despite Spire's requalification of employees following discovery of the lapse in employee requalification, there are still a number of joints that were installed before these requalification efforts began, some of which have leaked. Staff therefore does not find this argument to be a persuasive basis for taking no action with respect to mechanical plastic pipe joints completed by individuals who were not timely requalified.

B. Requalification Results

1. Spire's Point

Mechanical Joining: In the requalification process, the employee goes through a session of review and installation of a sample fitting in the presence of the qualifier. Each employee was able to complete a proper sample installation without any issues, and Spire had a 100% passage rate.

2. Staff Analysis

Since the employees took part in a session of review prior to requalification, no information is available regarding what the passage rate would have been prior to the procedure review. It is therefore unclear to Staff whether the 100% passage rate for requalification was representative of the employees' ability to make proper mechanical plastic pipe joints prior to the review. Staff therefore does not find this to be a persuasive argument for taking no action.

C. Following Procedures

1. Spire's Points

Mechanical Joining: All of the mechanical fittings installed during this time in the field were completed using the approved installation procedures.

Heat Fusion Joining: The Company strongly believes that the affected heat fusion plastic pipe joints were installed correctly.

2. Staff Analysis

Since April 13, 2020,[117] Staff has completed 30 inspections of new pipeline construction at Spire pipeline projects that involved plastic pipe joining. ** [redacted] **

[117] Data provided in Attachment 1 to Spire's response to Staff Data Request No. 0001 indicates that the lapses in timely requalification of joiners began on April 13, 2020.

Staff recognizes that Spire's intent is that all joints will be completed using approved installation procedures. However, Staff does not believe this is always the case, as indicated by Staff's observations during inspections. Without any supporting evidence (e.g. removal and testing of a statistically representative sample of the joints), Staff is not persuaded there is a basis to conclude that all mechanical fittings and heat fusion joints were installed in accordance with applicable procedures by individuals who were not timely requalified.

D. Personnel Experience

1. Spire's Points

Mechanical Joining: None of the employees completing work during this timeframe were recent hires or new employees.[118] Therefore, they had successfully made mechanical fitting installations over the prior months while qualified and were familiar with the approved installation process.

Heat Fusion Joining: Both of the employees have a long tenure and have achieved the highest level of field installation job title within their career progression.

2. Staff Analysis

Staff believes that Spire's point is that the employee familiarity with Spire's installation process ensures that the process was followed correctly. Staff notes however, that as discussed in Section IV.A.4.2 *Probability of Joint Failure* of this report, some mechanical plastic pipe joints installed during the time period when employees had not been requalified within 15 months have already failed. Staff therefore is not persuaded that the experience of the crew installing the mechanical plastic pipe joints is a guarantee against failure in instances when

[118] All of the employees whose qualifications expired in 2020 completed their initial qualification prior to 2019 – Spire's response to Staff Data Request No. 001.3.

requalification requirements have not been achieved. Staff notes that Spire has not yet identified any leak indications on heat fusion joints that may have been completed by the two employees completing joints more than 15 months after requalification.

E. Pressure Testing

1. Spire's Point

Mechanical Joining: The fittings were pressure tested and the joints were soap tested at the time of the installation without any deficiencies or issues. If an issue would have been discovered, the approved installation procedures would have required the fitting to be replaced at the time of installation.

2. Staff Analysis

As discussed in Section IV.A.4.2 *Probability of Joint Failure* of this report, one of the mechanisms for mechanical plastic pipe joint failure is pullout of the pipe from the fitting as a result of external stresses on the pipe (such as ground movement, thermal expansion and contraction of the plastic). Failure by this mechanism may go undetected during a pressure test.

In Section IV.A.4.3 *Consequences of Joint Failures* of this report, Staff summarized the consequences of five incidents that had occurred as a result of joint failures on plastic pipes. Two of the incidents occurred in Missouri, the other three occurred in different states. Staff notes that in its investigation of Commission Case No. GS-2016-0159, the original service line installation record was misplaced, however a pressure test had been documented for the failed service line joint in 2003 when the service line was tied to a different main. External forces exerted by tree roots were identified as a contributing cause to the failure of the butt heat fusion joint in Commission Case No. GS-2016-0160.

In three of the five incidents discussed in Section IV.A.4.3 *Consequences of Joint Failures* of this report, external forces exerted subsequent to installation and pressure testing were found to have contributed to the failure of the joints. Staff therefore is not persuaded that a pressure test conducted at the time of installation is sufficient to ensure that improperly completed joints will remain gas tight in the future.

F. Spire's Ongoing Replacement Programs

1. Spire's Points

Mechanical and Heat Fusion Joining: Replacing the affected mechanical and heat fusion plastic pipe joints would divert resources from higher risk replacement priorities such as LPOP and cast iron.

2. Staff Analysis

Staff recognizes the importance of the replacement programs for cast iron pipelines and LPOP. Staff notes that Spire's cast iron replacement programs, as required by 20 CSR 4240-40.030(15)(D), have been approved pursuant to Commission orders in File Nos. GO-2002-50 for Spire Missouri West and GO-91-275 for Spire Missouri East. Certain deadlines were extended by the Commission in its approval of Spire's application for temporary waiver in Case No. GE-2020-0737. Staff is not aware of a Commission ordered or approved replacement program for LPOP, and assumes Spire is referring to its proposed schedule for replacement of its Reynolds regulator stations in Commission Case No. GE-2023-0112, in which Spire seeks a waiver of certain Commission rules until such time as these legacy regulator stations are replaced.

Staff further notes that while Spire has existing replacement programs for high risk facilities, Spire is still required to identify, evaluate and address additional safety concerns that may be present in its system as part of its DIMP.[119]

G. Added Risk and Costs

1. Spire's Points

Mechanical and Heat Fusion Joining: The added risks and costs of re-exposing the installs and evaluating or replacing the existing installed mechanical plastic pipe fittings and heat fusion joints outweighs the risk of leaving the current install in place.

2. Staff Analysis

Staff acknowledges that there are risks associated with excavating and removing mechanical and heat fusion plastic pipe joints. However, Staff also notes that individuals who are properly trained and qualified should be able to safely perform work on Spire's plastic pipelines as with other Spire replacement programs for unprotected steel and cast iron pipelines. Staff additionally does not find the costs associated with addressing issues in Spire's pipelines to be a persuasive reason to not take action to address safety concerns that arise in Spire's system.

H. No Increased Risk

1. Spire's Point

Heat Fusion Joining: The Company believes that there is no increased risk associated with these installations compared to other heat fusion joints.

[119] Commission Rule 20 CSR 4240-40.030(17) requires operators to identify pipeline characteristics, identify threats, evaluate and rank risks and identify and implement measures to address risks.

2. Staff Analysis

Staff acknowledges that as of June 6, 2023,[120] Spire has not identified any leak indications on heat fusion plastic pipe joints that may have been completed by employees after their qualifications had lapsed. However, without additional supporting information, such as the removal and testing of a sample of the affected joints, Staff is not persuaded that there is a basis to conclude that there is no increased risk associated with these heat fusion joints compared to heat fusion joints installed by timely requalified individuals. Staff notes that some joints can fail years after installation.

VI. STAFF'S ANALYSIS OF REMEDIES

A. Spire's Proposed Remedy

Spire has proposed that the mechanical and heat fusion plastic pipe joints that may have been completed by employees with expired qualifications should remain installed as-is and Spire will monitor them for increased risk in the future.

Staff has addressed each of Spire's points supporting its proposed remedy in Section V. *Staff's Analysis of Spire's Position* of this report. Staff is not persuaded that there is no risk of failure of the joints installed by Spire personnel who had not been timely requalified. As discussed in Section IV.A.4.2 *Probability of Joint Failure* of this report, failures of several of these joints have already occurred. However, Staff does agree that Spire should monitor the affected joints for increased risk in the future.

[120] Date of Spire's response to Staff Data Request No. 0037.1.

B. Survey of Other State Pipeline Safety Programs

1. Survey Questions and Results

In order to gather information on remedies taken in other states when similar issues have been identified, Staff requested a survey[121] of other pipeline safety programs through the National Association of Pipeline Safety Representatives ("NAPSR") consisting of the following questions:

Q1. Which state program do you represent?

Q2. Prior to March 2020, did your inspections find probable violations of 49 CFR 192.285(c),[122] specifically failing to requalify joiners under an applicable procedure once each calendar year at intervals not exceeding 15 months?

Q3. If, you responded "yes" to Question 2, please explain what enforcement actions your state generally took as a result of operators failing to requalify joiners per 49 CFR 192.285(c). Please provide citations or links to applicable public documents.

Q4. Since March 2020, have you observed instances of operators failing to requalify joiners in accordance with 49 CFR 192.285(c) and stating that such omission was a result of the pandemic?

Q5. Did your state have a Stay of Enforcement or were operators granted a waiver specific to the equivalent state rule to requalify joiners per 49 CFR192.285(c)? Please explain and provide citations or links to applicable stays of enforcement or waivers.

[121] Survey was completed in May 2022.
[122] 49 CFR 192.285(c) is the federal equivalent to 20 CSR 4240-40.030(6)(H)3.

Q6. Has your state taken any enforcement actions as a result of failing to requalify joiners per 49 CFR 192.285(c) since March 2020? If "yes", please explain what actions were taken and provide citations to applicable public documents.

Q7. Do you have any further comments regarding this topic?

Staff received 28 responses to its survey representing 27 different states and territories. In response to question two (Q2), 25% of respondents answered "yes" that prior to March 2020, their inspections found probable violations of 49 CFR 192.285(c). In response to question four (Q4), 7.14% of respondents answered "yes" that since March 2020, the respondent had observed instances of operators failing to requalify joiners in accordance with 49 CFR 192.285(c).

Enforcement actions described in response to question 3 (Q3) included:

- Issuing notices of probable violations and fines, (five states)
- Excavation and sampling a percentage of joints performed by unqualified individuals, (two states)
- Cutting out and replacing joints completed by unqualified individuals, (two states)
- Specific procedural revisions regarding joiner qualification, (two states)
- More frequent leakage surveys, (one state)
- Additional leak reporting requirements, (one state)
- More stringent leak repair requirements on affected joints (including removal of the affected joint and preservation of the joint and critical piping for one year), (one state), and
- Quality assurance improvements. (one state)

In response to question 5 (Q5), 11.11% of respondents answered "yes" that their state had a stay of enforcement or operators were granted a waiver specific to the state rule to requalify joiners per 49 CFR 192.285(c). One respondent indicated their state issued a stay of enforcement in line with PHMSA's (see discussion in Section IV.A.1. *Regulatory Requirements* of this report), and that any compliance issue arising from the pandemic had to be self-reported prior to the occurrence of the issue including a remedial plan, otherwise the state would issue a notice of probable violation. One respondent indicated their state also issued a temporary stay of enforcement in line with PHMSA's. Another respondent indicated that although their state did not issue a stay of enforcement, they would take enforcement discretion depending on the circumstances related to the pandemic.

Enforcement actions described in response to question 6 (Q6) included excavation and visual inspection of 10% of joints performed by unqualified individuals, and civil penalties.

2. Staff Analysis of Enforcement Actions as Potential Remedies

Staff reviewed the survey responses from other pipeline safety programs. Staff has analyzed the survey responses for the applicability as potential remedies in this case.

2.1 Issuing Notices of Probable Violations and Fines

Five pipeline safety programs stated that notices of probable violations and fines were issued as a result of operators failing to requalify joiners.

As discussed in Sections II. *Background* and III. *Subsequent Inspections* of this report, Staff has already notified Spire of some of the probable violations mentioned in this report subsequent to routine safety inspections, including:

- ** [redacted] ** and
- 20 CSR 4240-40.030(6)(H)3. for allowing employees to complete plastic pipe joints after they had exceeded 15 months for requalification on the applicable joining procedures.

As a result of this investigation case, sufficient information exists to assert the following additional violations of the Commission's pipeline safety rules:

- 20 CSR 4240-40.030(6)(H)4. for failing to ensure that individuals making joints in Spire's pipelines were qualified in accordance with 20 CSR 4240-40.030(6), and
- 20 CSR 4240-40.030(12)(C)1.[123] for failing to investigate the failure of the mechanical plastic pipe joint in ** [redacted] ** as required by Spire's procedure ** [redacted] ** for testing failed materials.

2.2 Excavation and Sampling a Percentage of Joints

Two pipeline safety programs stated that a sample of joints were excavated and tested as a result of operators failing to requalify joiners.

[123] 20 CSR 4240-40.030(12)(C)1. requires that each operator shall prepare and follow for each pipeline, a manual of written procedures for conducting operations and maintenance activities and for emergency response. 20 CSR 4240-40.030(12)(C)5. requires that the procedures required by 20 CSR4240-40.030(12)(L) must be included in the manual required by 20 CSR 4240-40.030(12)(C)1. Spire's procedure ** [redacted] ** is one of Spire's written procedures to address the requirements of 20 CSR4240-40.030(12)(L) which requires each operator to establish procedures for analyzing accidents and failures, including the selection of samples of the failed facility or equipment for laboratory examination, where appropriate, for the purpose of determining the causes of the failure and minimizing the possibility of a recurrence.

Staff agrees that in instances when the quality of work is unknown, selecting and testing a sampling of the work can resolve a number of unknown factors. This has applicability to the current situation, especially given that none of the joints which have failed to date have been tested to determine if the joints have been properly completed.

The removal and testing of a sample of joints that may have been completed by individuals with lapsed qualifications would provide information to evaluate the probably of failure of joints that are remaining in Spire's pipeline system. In order to be effective, a sampling program would need to define the parameters of the program. The program would need to specify the number or percentage of joints to be tested, how joints are selected for testing, and how failure is determined. Joints could be tested in accordance with 20 CSR 4240-40.030(6)(G), which provides the testing requirements for qualifying plastic pipe joining procedures.

The results of the testing would help identify joints that were improperly installed. Analysis of the testing results should evaluate common factors for joints that fail testing, such as the type of plastic pipe joint, specific crews, or specific employees, to more precisely determine affected joints at a higher risk of failure. The results of a sampling program would need to be analyzed and appropriate actions would need to be taken based on the results, such as immediate or earlier replacement of similar joints to those determined to be more susceptible to future failure resulting in the unintentional release of gas.

2.3 Removal and Replacement of Joints

Two pipeline safety programs stated that joints were removed and replaced as a result of operators failing to requalify joiners.

This is Staff's preferred remedy in most situations. Staff has agreed in this instance to evaluate other alternatives due to the large number of plastic pipe joints that may have been installed in Spire's pipelines by employees who had not been timely requalified. This would be a direct way to eliminate the risk associated with installation of joints by individuals who had not timely been requalified.

2.4 Procedural Revisions Regarding Joiner Qualification

Two pipeline safety programs stated that a specific procedural revisions regarding joiner qualifications were made as a result of operators failing to requalify joiners.

Staff agrees that in instances when a process is not properly implemented, such as timely requalification of joiners, it is prudent to evaluate potential shortcomings of procedures.

Spire has already updated procedures related to plastic pipe joining and Spire's OQ Plan to require that individuals be requalified on plastic pipe joining procedures once each calendar year not to exceed fifteen (15) months. However, Spire's OQ Plan does not require verification of requalification intervals each time Spire updates its OQ Plan. It would be prudent for Spire to verify that the requalification intervals used in its OQ program are correct each time that its OQ Plan (including Spire's covered task list) is updated to ensure that requalification intervals are accurate and comply with minimum code requirements.

2.5 More Frequent Leakage Surveys

One pipeline safety program stated that more frequent leakage surveys were required as a result of operators failing to requalify joiners.

Staff does not agree that more frequent leakage surveys alone is sufficient to properly assess the risk of failure of these joints. Leakage surveys are an important part of routine

maintenance, and often do detect previously unknown leak indications. However, a leakage survey does not provide any information regarding potential causes of leaks.

20 CSR 4240-40.030(13)(M) requires that leakage surveys of plastic distribution pipelines must be conducted once each calendar year but not to exceed 15 months for pipelines in business districts, and once each third calendar year but not to exceed 39 months for all other pipelines and yard lines. An increased frequency of leakage surveys would allow Spire to more quickly identify leaks on plastic pipe joints that may have been installed by individuals with lapsed qualifications. Staff believes that a leakage survey frequency of once each calendar year but not to exceed 15 months for locations where plastic pipe joints that may have been installed by individuals with lapsed qualifications may be beneficial in more quickly identifying leak indications in the event these joints are leaking.

2.6 Additional Leak Reporting Requirements

One pipeline safety program stated that additional leak reporting requirements were required as a result of operators failing to requalify joiners.

Staff agrees that additional reporting requirements may be beneficial in circumstances when there is no previous leak history that would allow for prediction of future performance. In the current situation, the risk of joint failures is unknown.

The tracking and monitoring of leaks on affected joints would allow Spire to determine if the frequency of leaks is increasing to a degree that would require additional actions to reduce the risks associated with the affected joints that are still installed in Spire's pipelines. Spire would need to pay particular attention to the cause of leaks that have been repaired or eliminated by replacement to determine the prevalence of leaks due to improper installation of the plastic pipe joints.

2.7 More Stringent Leak Repair Requirements

One pipeline safety program stated that more stringent leak repair requirements on affected joints were required as a result of operators failing to requalify joiners. This included expedited repair of leaks based on the classification of the leak, that all leaks on affected joints will be repaired by removal, and that the removed, affected joints and the associated critical piping must be preserved for one year.

The requirement to remove and retain critical piping would facilitate inspection and testing of the failed components.

Determining the cause(s) of failure for affected joints that have leaked would provide Spire and the Commission with information regarding probability of failure due to improper installation of the joint. The information from determining the cause(s) of joint failures could help Spire identify other affected joints that are at a higher risk for failure. The information Spire collects could be combined with a sampling program to determine appropriate actions to take with regards to affected joints that are still installed in Spire's pipelines.

2.8 Quality Assurance Improvements

One pipeline safety program stated that quality assurance improvements were required as a result of operators failing to requalify joiners.

Staff agrees that in instances when a process is not properly implemented, such as timely requalification of joiners, it is prudent to evaluate quality assurance measures.

Spire has developed a more formal Quality Assurance department since the opening of this investigation. Staff agrees that the changes to Spire's Quality Assurance department could be a potential remedy to preventing similar situations to this case, but Staff also has concerns

that Spire does not have written documents, plans, or procedures that cover the changes including the monitoring of Operator Qualification expiration dates or field audits.

2.9 Excavation and Visual Inspection of a Sample of Joints

One pipeline safety program stated that 10% of joints performed by unqualified individuals were excavated and visually inspected as a result of operators failing to requalify joiners.

Staff does not believe that visual inspection of joints would be sufficient. As noted in Section IV.A.4.2, *Probability of Joint Failure* mechanical joints may fail for a number of reasons, many of which may not be visible by external examination of the joint. For example, proper insertion depth of the pipe into the joint, and installation of internal stiffeners (required for some mechanical joints) could not be determined by visual observation of the external surface of the joint.

The visual inspection of plastic pipe joints at the time of completion can be helpful to determine if a joint has been properly completed, but this is typically combined with information observed during each step of the joining process. A visual inspection of plastic pipe joints after the joints have been installed for a period of time would not necessarily provide information on if the entire joining procedure was followed during the completion of the joint or otherwise provide information on if the joint is likely to fail in the future.

VII. VIOLATIONS OF COMMISSION RULES

As a result of its investigation, Staff found that sufficient facts/information exist to assert the following violations:

1. Failure to ensure that 431 individuals making plastic pipe mechanical joints and two individuals making plastic pipe heat fusion joints in the Spire Missouri East operating

area, and one individual making plastic pipe mechanical joints in the Spire Missouri West operating area were requalified under the applicable joining procedure at an interval not exceeding 15 months was a violation of 20 CSR 4240-40.030(6)(H)3.

(See Section IV.A. *Qualification Requirements for Persons to Make Plastic Pipe Joints*)

2. Failure to install mechanical joints in accordance with written procedures that have been proved by test or experience to produce strong gastight joints was a violation of 20 CSR 4240-40.030(6)(B)2. Specifically, ** [redacted] **

(See Section IV.B. *Requirements to Follow Joining Procedures*)

3. Failure to have adequate methods in 2020 to determine that each person making joints in plastic pipelines in Spire's system is qualified in accordance with 20 CSR 4240-40.030(6) was a violation of 20 CSR 4240-40.030(6)(H)4.

(See Section IV.C. *Method for Determining Qualifications*)

4. Failure to investigate the failure of the mechanical plastic pipe joint in ** [redacted] ** as required by Spire's procedure ** [redacted] ** for testing failed materials was a violation of 20 CSR 4240-40.030(12)(C)1.

(See Section IV.D. *Failure Investigation and Leak Repair Records*)

VIII. STAFF'S RECOMMENDATIONS

In summary, throughout this Report, Staff has identified several areas that either require improvement or are violations of Commission rules. Staff summarizes below its recommendations related to these areas requiring improvement and violations of Commission rules.

A. Recommendations for Remedies for Installed Joints

1. Staff recommends that Spire remove and that a qualified joiner replace the ** [redacted]. ** Staff further recommends that Spire provide documentation to Staff within thirty (30) days of completion of the removal of the mechanical plastic pipe joints.

   (See Section IV.B. *Requirements to Follow Joining Procedures*)

2. Staff recommends that Spire develop and implement a written plan for removing and testing a statistically valid sample of the plastic pipe joints were installed by joiners during a time interval in which the joiner had not been requalified within 15 months. Staff recommends that this sampling and testing plan includes at a minimum:

   a. A statistical basis for selecting the number of joints to be tested, including total number of joints, and number of each different type of joint installed using a different method,

   b. A method for testing the joints that will identify if the joint has been completed in accordance with the applicable requirements of 20 CSR 4240-40.030(6),

c. A method to evaluate the results of the sampling and testing program to determine the relative probability of each joint type failure,

d. Criteria for how the results of the sampling program will be used to evaluate the need for additional joint replacement, and

e. A schedule for implementation of the sampling and testing program.

(See Section IV.A. *Qualification Requirements for Persons to Make Plastic Pipe Joints* and Section VI.B.2.2 *Excavation and Sampling a Percentage of Joints*)

3. Staff recommends that Spire provide a copy of its written plan for removing and testing joints (Recommendation 2) to Staff for review prior to implementation. Staff further recommends that during implementation of the plan, Spire provide Staff with quarterly updates regarding the progress and results.

4. Staff recommends that Spire track and monitor 1) the total number of leaks eliminated or repaired on plastic pipe joints that may have been completed by joiners when requalification had not been completed within 15 months and 2) the number of eliminated or repaired leaks caused by incorrect installation of plastic pipe joints that may have been completed by joiners when requalification had not been completed within 15 months. To implement this tracking and monitoring, Staff recommends that Spire determine:

   a. The frequency for review of the number of eliminated or repaired leaks described above,

   b. A method to identify an increasing frequency of eliminated or repaired leaks that requires additional actions (above what is required by 20 CSR 4240-40.030) to mitigate the risk of further leaks on joints that may have been completed by

joiners when requalification had not been completed within 15 months, such as earlier repair or replacement of similar non-leaking joints,

c. A threshold frequency of eliminated or repaired leaks that requires additional actions (above what is required by 20 CSR 4240-40.030) to mitigate the risk of further leaks on joints that may have been completed by joiners when requalification had not been completed within 15 months, such as earlier repair or replacement of similar non-leaking joints, and

d. How additional actions will be developed and carried out (above what is required by 20 CSR 4240-40.030) to mitigate the risk of further leaks on joints that may have been completed by joiners when requalification had not been completed within 15 months, such as earlier repair or replacement of similar non-leaking joints.

Staff further recommends that in instances when Spire does not expose leaks on plastic pipe joints that may have been completed by joiners when requalification had not been completed within 15 months, that Spire attribute the cause of these leaks to be incorrect installation.

(See Section VI.B.2.6 *Additional Leak Reporting Requirements*)

5. Staff recommends that Spire perform leakage surveys at intervals not exceeding fifteen (15) months but at least once each calendar year at locations where plastic pipe joints may have been completed by a joiner during a time interval in which the joiner had not been requalified within 15 months.

(See Section VI.B.2.5 *More Frequent Leak Surveys*)

B. Additional Recommendations for Improvement

6. Staff recommends that Spire develop and follow written procedures that include a detailed summary of the processes put in place by Spire's Quality Assurance department for the purpose of monitoring of OQ expiration dates and conducting field audits to verify the qualification of individuals completing work in the field. Staff further recommends that Spire include the installation of service lines as a work type that is prioritized for periodic field audits in addition to those listed in Spire's response to Staff Data Request No. 0035.3.

   (See Section IV.C. *Method for Determining Qualifications*)

7. Staff recommends that Spire review its OQ Plan to verify that the requalification intervals used throughout Spire's OQ Program (e.g. in Spire's OQ software program) are accurate and comply with minimum code requirements. Staff further recommends that each time that Spire's OQ Plan is updated (including the covered task list), Spire conduct a review to verify that the requalification intervals used throughout Spire's OQ Program (such as in Spire's OQ software program) are accurate and comply with minimum code requirements.

   (See Section IV.C. *Method for Determining Qualifications*)

8. Staff recommends that Spire revise its procedure for determining leak causes ** [redacted] ** to include:

   a. When leaks must be exposed to determine the leak cause,

   b. When it is acceptable to not expose a leak,

c. Failure category and leak classification information consistent with the information for the leak causes in PHMSA's Instructions for Completing Form PHMSA F 7100.1-1,

d. Instructions for completing leak repair documentation and additional information for which "Leak Cause" and "Leak SubCause" field personnel should select for determining leak causes,

e. That field personnel must document leak repairs in sufficient detail to support the leak causes that are determined, and

f. That if a leaking facility is not exposed to determine the leak cause, the justification for that decision must be documented.

Staff further recommends that Spire train field personnel responsible for determining leak causes following procedure revisions.

(See Section IV.D.3.1 *Spire's Compliance with the Requirements of 20 CSR 4240-40.020(7)(A)*, Section IV.D.3.4 *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(L)*, and Confidential Appendix C)

9. Staff recommends that Spire investigate failures in accordance with Spire's ** [redacted] ** procedure, including testing of failed components to determine root causes of failures. Staff further recommends that Spire train Spire personnel who are likely to be involved in carrying out Spire's ** [redacted] ** procedure on the procedure.

(See Section IV.D.3.2 *Spire's Compliance with the Requirements of 20 CSR 4240-40.030(12)(C)1.*)

Staff recommends that the Commission order Spire to file an action plan, within 60 days, which addresses the recommendations (numbered 1-9 above). Staff further

recommends that the Commission order Spire to include in its action plan filing when it will effectuate that action plan. Finally, Staff recommends:

1. The Commission require that the action plan include Spire's proposed resolution for addressing each recommendation and the timeframe for implementing the resolution.
2. The Commission require Spire to file updates every six months as to how the plan has been effectuated.

If for any recommendation Spire believes no action is necessary, Staff recommends the Commission order Spire to explain, and provide supporting documentation as available, the reason(s) Spire believes no action is required.

APPENDICES

A. FACTS

B. COPIES OF REFERENCED DOCUMENTS

C. COMPARISON OF PHMSA INSTRUCTIONS TO SPIRE SOP

BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MISSOURI

In the Matter of an Investigation into Spire Missouri Inc. d/b/a Spire's Compliance with The Commission's Rules Regarding Natural Gas Safety Found at 20 CSR 4240-40.030	))))	Case No. GS-2022-0047

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 Report*; and that the same is true and correct according to her best knowledge and belief.

Further the Affiant sayeth not.

KATHLEEN A. McNELIS, PE

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Jackson, State of Missouri, at my office in Jefferson City, on this 13th day of November 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 an Investigation into Spire Missouri Inc. d/b/a Spire's Compliance with The Commission's Rules Regarding Natural Gas Safety Found at 20 CSR 4240-40.030	))))	Case No. GS-2022-0047

AFFIDAVIT OF CLINTON L. FOSTER

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

COMES NOW CLINTON L. FOSTER, and on his oath states that he is of sound mind and lawful age; that he contributed to the foregoing *Staff Report*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

CLINTON L. FOSTER

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Jackson, State of Missouri, at my office in Jefferson City, on this 9th day of November 2023.

Dianna L. Vaught
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 an Investigation into Spire Missouri Inc. d/b/a Spire's Compliance with The Commission's Rules Regarding Natural Gas Safety Found at 20 CSR 4240-40.030	))))	Case No. GS-2022-0047

AFFIDAVIT OF TREVOR RUCKER

STATE OF MISSOURI)
) ss
COUNTY OF COLE)

COMES NOW TREVOR RUCKER, and on his oath states that he is of sound mind and lawful age; that he contributed to the foregoing *Staff Report*; and that the same is true and correct according to his best knowledge and belief.

Further the Affiant sayeth not.

TREVOR RUCKER

JURAT

Subscribed and sworn before me, a duly constituted and authorized Notary Public, in and for the County of Jackson, State of Missouri, at my office in Jefferson City, on this 9th day of November 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