Missouri Public Service Commission

STAFF SUMMARY REPORT

Compilation of Best Practices for Locating Quality Assurance

Case No. GW-2021-0355

Industry Analysis Division

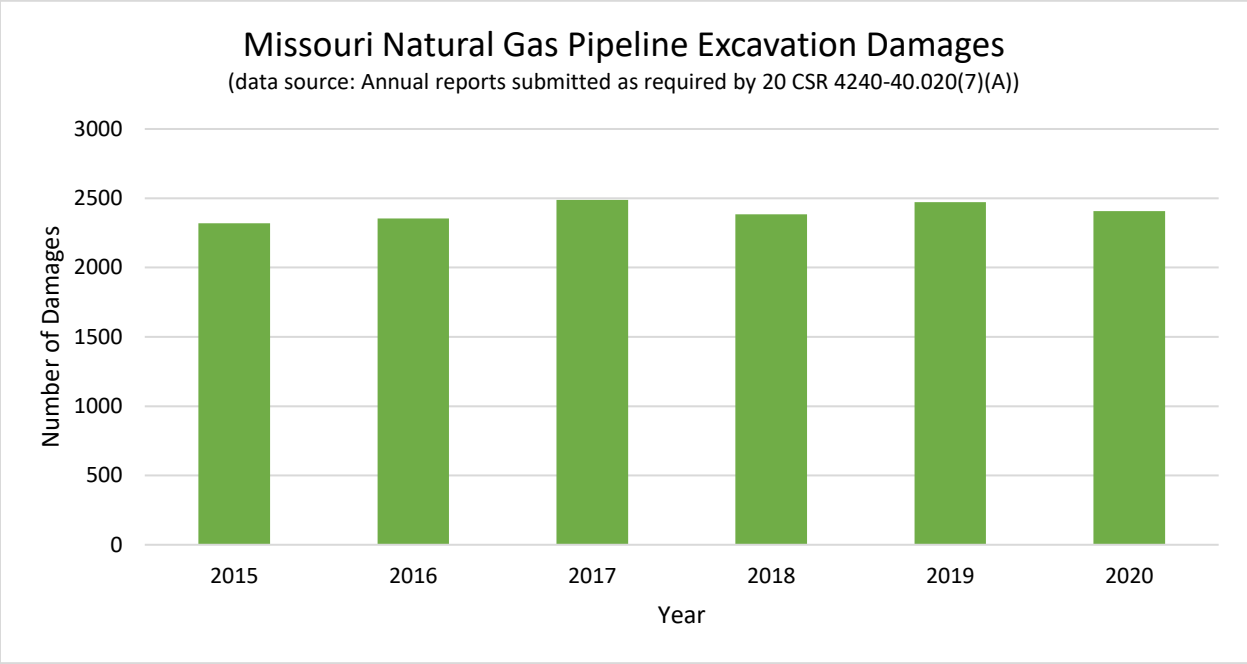
September 28, 2021 - Jefferson City, Missouri

Contents

I. Background

The Missouri Public Service Commission (MO PSC or Commission) has safety jurisdiction over intrastate natural gas pipelines in Missouri. This includes approximately 1,000 miles of intrastate natural gas transmission pipelines, over 28,000 miles of distribution main pipelines, and over 1.5 million natural gas service lines.

Each year, excavation activities result in thousands of instances of damage to underground natural gas pipelines in Missouri.



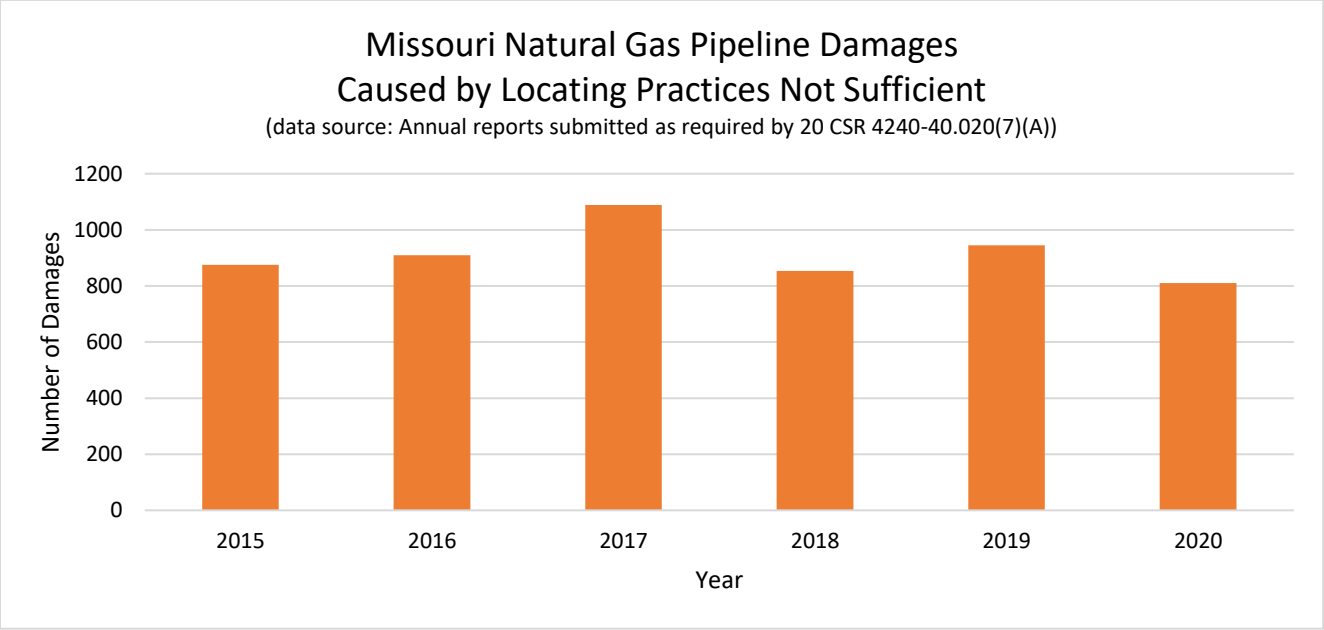
For purposes of reporting excavation damages,[1] natural gas pipeline operators investigate and classify the root causes of excavation damages according to the following categories:

- **One-Call Notification Practices Not Sufficient**: Damages resulting from no notification made to the One-Call Center; or notification to One-Call Center made, but not sufficient; or wrong information provided to One Call Center,
- **Locating Practices Not Sufficient**: Damages resulting from facility could not be found or located; or facility marking or location not sufficient; or facility was not located or marked; or incorrect facility records/maps,

[1] 20 CSR 4240-40.020(7)(A).

- **Excavation Practices Not Sufficient**: Damages resulting from failure to maintain marks; or failure to support exposed facilities; or failure to use hand tools where required; or failure to test-hole (pot-hole); or improper backfilling practices; or failure to maintain clearance; or other insufficient excavation practices, and
- **Other**: Damages resulting from One-Call Center error; or abandoned facility; or deteriorated facility; or previous damage or data not collected; or other.

Excavators are responsible for providing notification of planned excavation work to the one-call center,[2] and for exercising care and prudence while excavating.[3] Natural gas pipeline owners and operators are responsible for providing the approximate location[4] of its facilities to excavators by means of marking with paint, flags, stakes, or other clearly identifiable materials.[5] Data indicates that each year, insufficient locating practices result in hundreds of damages to natural gas pipelines in Missouri.[6]



[2] Section 319.026 RSMo.
[3] Section 319.035 RSMo.
[4] "Approximate location" is defined in Section 319.015 RSMo as a strip of land not wider than the width of the underground facility plus two feet on either side thereof. In situations where reinforced concrete, multiplicity of adjacent facilities or other unusual specified conditions interfere with location attempts, the owner or operator shall designate to the best of his or her ability an approximate location of greater width.
[5] Sections 319.030 and 319.015 RSMo.
[6] Based on aggregate data submitted by intrastate natural gas operators on PHMSA form F7100.1-1. Staff notes that individual results vary by operator, with some operators routinely reporting zero excavation damages each year.

Commission pipeline safety rules require that jurisdictional natural gas operators have and follow written programs to:

1. Prevent excavation damage to pipelines,[7]
2. Ensure that only trained and qualified individuals perform covered tasks on pipelines,[8] and
3. Monitor, evaluate and address the risk of excavation damage to pipeline systems.[9]

Based on discussions with natural gas pipeline operators and other stakeholders, MO PSC Staff believe that opportunities exist to reduce the occurrences of natural gas pipeline excavation damages with a root cause of "locating practices not sufficient."

To further explore such opportunities, the MO PSC applied for a grant from the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA) to fund a project to research best practices for pipeline locating quality assurance. PHMSA awarded partial funding of this project in July 2020.

II. Scope

The scope of this project included the following:

Phase 1: Review of published best practices regarding locating quality assurance programs and initiatives in other states.

Phase 2: Interviews with natural gas pipeline operators and other stakeholders related to individual practices for locator quality assurance programs.

Phase 3: A virtual public workshop to present preliminary findings and seek additional input.

Phase 4: Publication of summary results of study.

The results of Phases 1 through 3 area discussed in sections below.

The filing of this report in Case No. GW-2021-0355 completes Phase 4 of the project.

[7] 20 CSR 4240-40.030(12)(I).
[8] 20 CSR 4240-40.030(12)(D), "Covered Task" means an activity, identified by the operator that (I) is performed on a pipeline facility, (II) is an operations, maintenance or emergency-response task, (III) is performed as a requirement of 20 CSR 4240-40.030, and (IV) affects the operation or integrity of the pipelines.
[9] 20 CSR 4240-40.030(17) for distribution pipelines, and 20 CSR 4240-40.030(16) for transmission pipelines.

III. Literature Review

Sources:

- Common Ground Alliance (CGA) Best Practices, Version 18.0
- CGA Next Practices Initiative Report to the Industry, published February, 2021
- CGA 2020 White Paper, "Insights into Improving the Delivery of Accurate, On-Time Locates", published October 2020
- 2019 Damage Information Reporting Tool (DIRT) Annual Report, release date October 2020

According to the 2019 DIRT Annual Report, damages to buried infrastructure are on the rise for the fifth consecutive year. In that time frame, the percentage of damages attributed to locating root causes rose to its highest level, accounting for 28% of all damages. Locating remains a critical area for improvement as the industry looks to the next generation of damage prevention solutions. Facilities not marked in a timely manner and facilities not marked accurately are critical issues and top drivers of damage.

Best practices for improving locating accuracy and timeliness include:

- Establish Rules for 'Project Tickets'
- Increase Locate Technician Training
- Mandatory White-Lining
- Updated Maps & Visual Inspections
- Increased Communication
- Reporting
- Underground Electronic Utility Markers
- Quality Assurance Audits

Establish Rules for 'Project Tickets': Finding ways to control ticket volume and reduce the variability of tickets could be key to helping the industry more effectively reduce damages related to locating issues. Most states mandate short turnaround times for locates in the interest of getting projects started quickly. The current process does not consistently account for variability of locates such as job size or complexity of infrastructure. The use of design and planning tickets for large-scale projects and a more flexible ticketing process could help locating companies better manage staffing needs to accommodate influxes of tickets.[10]

[10] CGA Next Practices Initiative Report to the Industry, pg 5.

Increase Locate Technician Training: While 93% of technicians surveyed in the 2019 CGA Utility Locators Online survey[11] reported receiving training prior to going in the field, 94% said that more training would improve the accuracy and timeliness of locates. One way to give technicians more experience and draw them more deeply into the profession, according to the CGA White Paper, is improving the frequency of ongoing technician training, which could also help improve the speed and accuracy of the in-the-field workforce.

Mandatory White-Lining & Increase Implementation of Electronic White-Lining: Outlining the area of excavation with either white paint or white flags saves locators time and helps ensure that the entire excavation area is located properly. White-lining the area to be excavated is a CGA best practice, however according to the CGA Next Practices Initiative more than half of locate technicians indicate that their biggest challenge is the area to be marked is not clearly defined – something that could easily be resolved by electronic white-lining as part of an effective notification process. Limiting the scope of areas to be located through precise electronic white-lining can reduce the pressures on locators and increase the delivery of timely locates.

Corrections and Updates to Records:[12] During the course of a locating activity, a locator may become aware of errors or omissions. Methods are in place to notify a facility owner/operator of that error or omission. The corrections are submitted to the appropriate person or department in a timely manner. Omissions and errors may occur as a result of mis-drawn records, changes during construction at the job site, repair or abandonment of facilities, and delays in posting new records. Failure to note errors or omissions when found could result in damages to the facility at a later date. The 1994 NTSB Excavation Damage Prevention Workshop[13] stated that "facility operators should be required to update maps when excavation finds errors in the mapping system." The method of notification is determined by the facility owner/operator and includes the following information:

- Name (and company if contracted)
- Contact phone number of the individual submitting change
- Location (either address or reference points)
- Size and type of facility

[11] Survey was referenced and discussed in the CGA 2020 White Paper, "Insights into Improving the Delivery of Accurate, On-Time Locates", published October 2020.
[12] CGA Best Practices 4-2.
[13] Discussed in the Common Ground Alliance (CGA) Best Practices, Version 18.0

- Nature of the error or omission
- Sketch of the changes in relation to the other facilities

Visual Inspection:[14] A visual inspection helps determine if there are facilities placed that are not on record. It is very important that visual inspections be completed in areas of new construction, where records may not indicate the presence of a facility. The visual inspection is necessary because the time between placing a facility in the field and placing it on permanent records varies by facility owner/operator and location. Evidence of a facility not on record includes, but is not limited to, poles, dips, enclosures, pedestals (including new cables found within the pedestals), valves, meters, risers, and manholes. The inspection includes the following:

- All facilities within a facility owner/operator's service area (to evaluate the scope of the locate request)
- Identification of access points
- Identification of potential hazards
- Assurance that plant facilities shown on records match those of the site

Communication between Parties:[15] One Call centers, facility owners/operators, and excavators all have clearly defined processes to facilitate communication between all parties. If the complexity of a project or its duration is such that a clear and precise understanding of the excavation site is not easily conveyed in writing on a locate request, then a pre-location meeting is scheduled. This pre-location meeting is on-site to establish the scope of the excavation. Written agreements between the excavator(s) and the locator(s) include the following information:

- Date
- Name
- Company
- Contact numbers for all parties
- A list of the areas to be excavated
- A schedule for both marking and excavating the areas
- Any follow-up that might be necessary

Any changes to the areas that are to be located are in writing and include all parties responsible for the excavation and marking of the excavation sites. Locators also schedule meetings if the complexity of the markings requires further explanation.

[14] CGA Best Practices 4-7.
[15] CGA Best Practices 4-14.

97% of technicians surveyed in the 2019 CGA utility locators online survey[16] identified increased communication between themselves and excavators as an effective way to improve accurate, on-time locates. Whether via Damage Prevention Council meetings, Regional Partner summits, or even one call ticketing software, the industry should seek ways to enable direct communication between locate technicians and excavators.[17]

Reporting:[18] Timely and accurate reporting of excavation incidents is a critical component of the continual process. Facility owners/operators, locators, excavators, or stakeholders with an interest in underground damage prevention report qualified information on events that could have, or did, lead to a damaged underground facility. The requested data is standardized and consists of essential information that can be analyzed to determine what events could, or did, lead to a damaged facility. This means that collected data includes damage information, downtime, and near misses. All stakeholders submit the same damage, near miss and downtime data via simple answers and check boxes.

Underground Electronic Utility Markers:[19] The newly released CGA Best Practices 18.0 includes the new practice of using underground electronic markers as an effective way to enable accurate locating and verification of underground facilities. Underground utility markers such as electronic markers (EMs), RFID markers, ball markers and magnetic markers are devices that emit a signal to assist in the location of an underground facility. Underground electronic utility markers can be used to locate and identify an underground facility in two ways: (1) the underground utility markers can emit a signal that is a match to a predefined utility type, and (2) the underground utility marker signal can carry identifying data associated with the underground utility/asset type.[20]

Quality Assurance Program:[21] The process of conducting audits for locates is a critical component to the protection of underground facilities. The CGA recommended components which

[16] Survey was referenced and discussed in the CGA 2020 White Paper, "Insights into Improving the Delivery of Accurate, On-Time Locates", published October 2020.
[17] CGA White Paper pg 12.
[18] CGA Best Practices 9-1 and 9-2.
[19] CGA Best Practices 2-19.
[20] Common Ground Alliance (CGA) Best Practices, Version 18.0, Appendix B "Guidelines for Underground Electronic Utility Marker Technology" discusses the types of underground utility markers available, location and installation factors.
[21] CGA Best Practices 4-18.

are assembled from multiple sources and are meant to provide general guidelines for auditing the work of locators. The components recommended are:

- Conduct field audits and choose some locations to be audited/surveyed purely at random.
- Check accuracy to within, governed, contractual, and minimum tolerance levels.
- Measure timeliness, as defined by regulation/statute.
- Check completion of a request.
- Check evidence of accurate and proper communication.
- Check that proper documentation exists.
- Check that an audit/survey is documented.
- Communicate results to applicable personnel.
- Trace audits for trend analysis.
- Verify proper hook-up and grounding procedures where applicable.
- Verify the reference material used to document that the locate was up to date (electronic plans or paper plans).
- Verify that appropriate safety equipment and procedures were used by the locator.
- Verify that tools and equipment are in proper working order and properly calibrated.

IV. Initiatives in Other States

a. Background

States have addressed concerns regarding locating practices by enacting statutes, promulgating rules, and issuing orders by regulatory bodies. Some of the themes MO PSC Staff noted in reviewing other states' statutes, rules, and orders were additional reporting requirements for excavation damages, minimum requirements for training and qualifications for locators, and a few other noteworthy state requirements.

Additional Reporting Requirements for Excavation Damages

The New Hampshire Public Utilities Commission requires the filing of monthly reports that detail excavation damages.[22] The Maine Public Utilities Commission requires all reporting of excavation damages must be done using an Underground Incident Facility Incident Report Form.[23]

Minimum Training and Qualifications Requirements for Locators

[22] Puc 804.01 Reporting Requirements for Operators of Underground Facilities.
[23] Maine 65-407 Public Utilities Commission Rules, Part 4 Gas Utilities, Chapter 420.

The Maine Public Utilities Commission requires locators to have necessary knowledge and skills of the industry best practices developed by the CGA, or other recognized industry authority, for locating and marking pipelines, and knowledge of the State and local underground damage prevention regulations.[24] The New Hampshire Public Utilities Commission requires locators to be trained in accordance with the National Utility Locating Contractors Association (NULCA) standards.[25]

Other Noteworthy State Requirements

An order issued by the Kansas Corporation Commission (KCC) requires operators to notify the KCC within 30 minutes of all excavation damages that are reported by an excavator.[26] A settlement agreement approved by the New Hampshire Public Utilities Commission requires that locating be done by company in-house personnel and the use of contractors is prohibited.[27] An order issued by the Virginia State Corporation Commission requires that electronic marker balls must be installed when new service lines are installed.[28]

b. Surveys

To gather additional information on state requirements related to pipeline locating practices and quality assurance for pipeline locating, MO PSC Staff sent a survey, completed July 2021, through the National Association of Pipeline Safety Representatives (NAPSR) and posed the following questions:

Q1. Which state program do you represent?

Q2. Does your state have any statutes or administrative rules related to pipeline locating practices (e.g. locator training and qualification, required field audits, accuracy metrics), or making pipelines easier to locate (e.g. installation of marker balls)? Please explain and give citations/web links below.

[24] Maine 65-407 Public Utilities Commission Rules, Part 4 Gas Utilities, Chapter 420.
[25] Puc 804.03 Training of Locators.
[26] In the Matter of the General Investigation into the Operations of Kansas Gas Service, Inc., A Division of ONEOK, Edcom Inc., and the City of Wichita, Regarding Possible Violations of the Kansas Underground Utility Damage Prevention Act and the Commission's Authority to Impose Penalties and Injunctive Relief. 2013 WL 9575095 (Kan.S.C.C.). Docket No. 13-DPAX-250-GIV.
[27] NATIONAL GRID USA ET AL. Transfer of Ownership of Granite State Electric Company and EnergyNorth Natural Gas, Inc. to Liberty Energy NH. 2012 WL 2254207 (N.H.P.U.C.). DG 11-040. Order No. 25,370.
[28] COMMONWEALTH OF VIRGINIA, ex rel. STATE CORPORATION COMMISSION v. COLUMBIA GAS OF VIRGINIA, INC., Defendant. 2009 WL 3531847 (Va.S.C.C.). URS-2009-00041.

Q3. Has your state regulatory agency issued any Settlement Agreements, Consent Agreements or other orders to natural gas pipeline operators related to pipeline locating practices or making pipelines easier to locate? Please explain and provide any citations or web links below.

Q4. Please provide any further input on this topic, below.

MO PSC also reviewed the NAPSR One Call Locator Training Survey that was completed in November 2020. The questions in that survey were as follows:

Q1. Which state program do you represent?

Q2. Does your state have administrative rules or statutory regulations with training requirements for underground facility line locators? If yes, please provide the citation.

Q3. In addition to existing Part 192 Operator Qualification regulations, does your state have additional administrative rules or statutory regulations that require a mandatory Quality Assurance program or other qualifications for line locators? If yes, please provide the citation.

Q4. Does the One Call Center(s) in your state receive and log notifications for incorrect locates? If yes, please explain.

Q5. Does your state have administrative rules or statutory regulations that require training as a result of incorrect line locates? If yes, please explain and give the citation.

Q6. Do you have any further information to share regarding state administrative or statutory regulations related to line locating? For example, do you have legislation or rulemaking in process? Or do you believe such regulations are necessary in light of Operator Qualification requirements, etc.? Please explain.

Survey Results – July 2021

MO PSC Staff received responses to its survey from representatives in 24 different states. In response to Q2., 33.33% of respondents answered yes that their state had statutes or administrative rules regarding making pipelines easier to locate. Several respondents also provided citations to the administrative rules.[29]

Similarly, in response to Q3., 33.33% of respondents answered yes that their state regulatory agency has issued a settlement agreement, consent agreement, or other order, for natural gas pipeline operators that was related to pipeline locating practices or making pipelines easier to

[29] See Table 1.

locate. Many of these respondents also have further explanations of the agreements or orders and provided citations to them.[30]

There were a range of different responses to Q4. One respondent stated that an inspector in their state is used as a damage prevention inspector that rides with locators to monitor what the locators are doing. Another respondent stated that all facilities should be equipped with GPS, which would create better records and lead to better locating. Yet another respondent noted that that their state recently started a data base to track events, with the hope of eventually putting in place some new best practices for locating. This same respondent also noted that their state is looking at future fines for locating practices that are not sufficient.

Survey Results – November 2020

Thirty-one different entities or states participant in this survey. In response to Q2. 25.8% of respondents answered yes that their state does have administrative rules or statutory regulations with training requirements for underground facility line locators. Several respondents also provided citations to the rules or statutes.[31]

In response to Q3, only 10% of respondents answered yes that their states have additional administrative rules or statutory regulations that require a mandatory Quality Assurance program or other qualifications for line locators.

Regarding Q4, 33.3% of respondents answered yes that the One Call Center(s) in their states receive and log notifications for incorrect locates. Similarly, 32.3% of respondents answered yes to Q5 that their states have administrative rules or statutory regulations that require training as a result of incorrect line locates. Some of the respondents provided explanations or citations.[32]

For Q6, 34.5% of respondents answered yes to either having additional information to share regarding state administrative or statutory regulations regarding line locating, having legislation or a rulemaking in progress, or believing such regulations are necessary in light of

[30] Id.
[31] Id.
[32] Id.

Operator Qualification requirements. Some of the respondents provided citations to administrative or statutory regulations in their responses.[33]

Table 1 - Survey Response Citations (July 2021 and November 2020)		
State statutes or administrative rules related to pipeline locating practices	Maine	MPUC Rule Chapter 420 Section 3.B Pipeline Facility Locator Training and Qualification Operators must maintain documentation that each person utilized to locate the operator's underground pipeline facilities is properly trained and qualified. Such documentation must indicated the latest date the person completed or demonstrated: 1. The necessary knowledge and skills needed to use industry best practices developed by the Common Ground Alliance for locating and marking pipelines or other recognized industry authority; 2. Knowledge of state and local underground damage prevention regulations; and 3. Qualification in accordance with 49 C.F.R. Part 192, Subpart N. https://www.maine.gov/mpuc/legislative/rules/part4-natural_gas.shtml
	New Hampshire	New Hampshire Public Utilities Commission, Chapter 804.03 requires locators to be trained in accordance with the National Utility Locating Contractors Association (NULCA) Professional Competence Standards for Locating Technicians, Fourth Edition 2015. Training programs for locators shall include, at a minimum, the following competencies: (1) Electromagnetic locating; (2) Instruction in the use of transmitters and receivers; (3) Procedures for marking underground facilities; (4) Training in the identification of facilities; (5) Safety procedures; (6) Operator map and record reading; and (7) Familiarity with the rules in this chapter. https://www.puc.nh.gov/Regulatory/Rules/PUC800.PDF
		16-345-3(a)(7) Upon the exposure of previously unrecorded or inaccurately recorded facilities in the course of excavation or demolition activities and of which it has knowledge of such exposure, verify and modify existing records as necessary,

[33] Id.

	Connecticut	and promptly make all necessary modifications, if needed, within the standard mapping system maintained by the central clearinghouse. 16-345-3(a)(8) Maintain records of all existing underground facility locations, including without limitation, facilities abandoned in place and interconnections to all utility users. 16-345-3(h) For all new non-metallic utility facilities, the utility shall install a means of locating the facility using electronic locating equipment such as tracer wire. 16-345-3(i) Any person who locates and marks the location of underground facilities on behalf of a public utility shall be trained in applicable locating industry standards and practices equal or superior to the National Utility Locating Contractors Association's locator training standards and practices. Each person's training shall be documented, and such documents shall be maintained by the public utility.
	New York	16 NYCRR Part 753-4.6(a) accuracy of markings 16 NYCRR Part 753-4.6(b) and (c) staking and marking requirements 16 NYCRR Part 753-4.8 uniform color code 16 NYCRR Part 753-4.8 uniform lettering 16 NYCRR Part 255.614(b) inspect as frequently as necessary where damage could be done by an excavator 16 NYCRR Part 255.614(c) performing leakage surveys for blasting activities 16 NYCRR Part 255.604 training and qualifying individuals who perform locating-related covered tasks 16 NYCRR Part 255.321(e) installing tracer wire 16 NYCRR 255.303 compliance with construction standards
	Virginia	Chapter 10.3 Underground Utility Damage Prevention Act State Corporation Commission rules regarding non-gas utility operator qualifications to NULCA standards or equivalent; locating tolerances; mapping requirements; mapping of abandoned lines, etc. https://law.lis.virginia.gov/admincode/title20/agency5/chapter309

	California	The California Public Utilities Commission (CPUC) oversees the safety of natural gas infrastructure and propane facilities for compliance with the Commission's General Order (GO) 112-F, Reference Title 49 Code of Federal Regulations (CFR) Parts 191, 192, 193, and 199. Regarding pipeline locating practices, CPUC enforces CFR Part 192 ((§192.321(e), §192.614, §192.707, and §192.805, in addition to California Government Code (CGC), Section 4216. CGC 4216.3(a)(2) requires only a qualified person shall perform subsurface installation locating activities. The California Underground Facilities Safe Excavation Board (Dig Safe Board) oversees the excavation activities of all excavators to ensure compliance with CGC, Section 4216. https://www.digalert.org/pdfs/4216_2021.1.1.pdf https://www.digalert.org/calaw-full
State regulatory body actions related to pipeline locating practices, including Settlement Agreements, Consent Agreements, or other Orders	New York	For operators who fail to comply with certain regulatory requirements, or fail to comply with the requirements of its written damage prevention program (16 NYCRR Part 614(s), New York issues a violation for non-compliance(s). New York then pursues negative revenue adjustments for each non-compliance through the various operator rate proceedings which can be found on the Department of Public Service's website. https://www.dps.ny.gov/
	Indiana	Cause 44970, Northern Indiana Public Service Co (NISOURCE) Cause 45094, Vectren (now CenterPoint Energy)
	California	California reached a Settlement Agreement in 2020, in which Pacific Gas & Electric Company (PG&E) shall be liable for a total penalty of nearly $110 million including the obligation to undertake specified initiatives at stakeholder expends to address the problems with the Locate and Mark program. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M360/K518/360518117.PDF
	Connecticut	The Connecticut Public Utilities Regulatory Authority has included requirements for creating and following a plan to perform inspections in its Notice of Violation and Assessment of Civil Penalty actions. The plan shall include, at a minimum, the personnel responsible for the

		implementation of the plan, the level of inspection required based on the risks associated with the work being performed and the people performing the work, the qualifications of the personnel conducting the inspections, the expectations of the inspectors, checklists for each type of inspection performed, documentation of findings, analysis of the inspection results and continuous improvement of the plan based on the results. Select Docket (state.ct.us), Docket Nos. 15-11-01, 15-10-89, 19-07-14

V. Interviews with Pipeline Operators

A. Description

Based on findings from the literature review (Section III of this document), Staff developed a list of questions to discuss with operators of natural gas pipelines throughout the state. The intention was to discover best practices developed by local operators to address common locating issues in Missouri. Below is the list of questions discussed:

Figure 1 Questions Staff Discussed with Pipeline Operators

1. There is a trend of people not calling One Call because they don't believe there are any underground utilities in an area. What is the reasoning as to why they wouldn't call to make sure?
2. Is there a reasoning other than not wanting to wait the time it would take for them to be marked?
3. Do excavators in your area typically white-line proposed excavation areas?
4. What is the most common cause of excavator damage, and what could be done to alleviate this problem?
5. Does your company locate your pipes internally with employees, or are locates outsourced to a contractor? If outsourced, please identify the contracting company.
6. Does your company use paper maps or digital maps of its distribution system?
7. Is there an industry standard for the best equipment to use when locating underground natural gas pipes?
8. What equipment do you use for locating underground natural gas pipes?
9. How do you locate pipes that lack a tracer wire?
10. What is the average turnaround time it takes for underground utilities to be marked?
11. What is your company's procedure for handling large project locate tickets versus small project locates?
12. How does your company incentivize utility locators to accurately locate pipes?

13. What is the typical standard for excavating then using hand tools to uncover underground lines?
14. Do contractors in your area typically hand dig or pothole to find the pipes?
15. Is there a way you screen contractors to identify those that have caused the highest number of damages?
16. In the event of a damage investigation, who carries out that investigation and what are their qualifications?

The natural gas pipeline operators interviewed included publicly traded utility companies as well as municipal natural gas distribution system operators:

Figure 2 List of Natural Gas Pipeline Operators Interviewed

Company or City	Interview Date(s)
Ameren Missouri	May 13, 2021
Spire	May 11, 2021
Liberty Utilities/Empire District Gas Company	May 27, 2021 June 3, 2021
City Utilities of Springfield	May 18, 2021
City of Perryville	May 20, 2021
City of Macon	May 13, 2021

Additionally, Staff discussed this list of questions with personnel at the Missouri One Call System on May 27, 2021.

B. Best practices identified during interviews

The following common issues and best practices emerged as a result of these interviews:

1. Calling Missouri One Call prior to excavation

Some of the natural gas operators told Staff that homeowners do not call because they think they know what is underground, not taking the time to wait for the underground utilities to be marked, spur of the moment projects, and a lack of understanding of needing to call.

Best practices mentioned for increasing homeowner awareness were not mentioned when speaking with utilities.

2. Excavators use of white-line

A number of interviewees indicated that most local excavators will white-line, however out-of-state contractors typically do not.

Best practices mentioned for increasing excavator use of white-lining were:

- Meeting with excavator on the job site to white line while they are there to locate the underground utility lines.
- Putting white-lining requirements into contracts.
- Use of digital white-line on the Missouri One Call's website.

3. Excavator caused damages

Commonly mentioned causes that were excavators not being careful enough and hand digging, thinking underground utility lines are deeper than they are, and a failure to protect exposed underground lines during boring work.

A best practice mentioned was to keep maps of utility locations up-to-date and accurate.

Staff asked utilities about the mapping systems they use. Most of the larger natural gas operators have digital maps and update the maps of their systems on a routine basis (e.g. weekly or monthly). One utility said that they have a GIS system on tablets that allows for crews to perform updates in the field on tablets.

4. Difficult to locate lines

Staff was also curious about the practice of locating lines and if there was any standard equipment. The utilities indicated that there not industry standard, it is mostly utility preference. Although, several utilities that were interviewed indicated that Rycom or Subsurface Solutions are what the utilities use.

Figure 3. Line Locator

[34]

Staff also asked how utilities locate an underground utilities line so that it is not damaged if there is a lack of a tracer wire. One thing that several utilities identified as a best practice is the use of a traceable rodder (e.g. "Jameson tool")[35]. Others indicated that they use ground penetrating radar or a vacuum excavator to pneumatically excavate down to the pipe. Other methods also include using records, field sketches, service card drawings along with hand shovels and probes to locate the underground line. Another method that was mentioned was locating the wire from another point of the system from the street or neighbor's house. Utilities also used marker balls[36] in mains on service lines to help locate the lines in the future as well.

[34] Image is one example of a utility line locator, Image is of RYCOM Instruments, Inc Pathfinder PLS model that was taken from Pathfinder_PLS_2018_SpecSheet.pdf (rycominstruments.com).
[35] Jameson LLC is one of several manufacturers of traceable rodders (also referred to as duct rodders) that may be inserted into natural gas pipelines in order to provide a signal for locating the pipeline.
[36] Marker balls refers to type of underground electronic utility marker that may be buried in the vicinity of a utility to provide a signal for locating. The ball marker is typically buried over key facilities during construction or maintenance. Later, the utility can use a locator that transmits a signal to the buried marker. The marker returns the signal to the locator, indicating the marker's position.

Figure 4. Operator using Tracer Rodder

 [37]

5. Excavators causing recurring damages

There are many different ways that utilities screen third-party excavators that have repeatedly damaged facilities. These include:

- Tracking each damage by excavator name,
- Tracking the damages by excavation type, locations, and the history of the company to know the risk factor.
- In the smaller gas distribution systems, there may only be a couple of damages per year so able to easily track the excavator.

Best practices to address recurring damages by the same excavator include meeting with excavators to help find a solution to prevent the damage.

6. Investigating root causes of damages

When damage has occurred, investigations are done by Company or City employees, or in some cases by a third-party contracted to locate the underground facilities.

[37] Image an example of a traceable rodders. The image is one example of product manufactured by Tracer Electronics LLC. Image from Jameson Duct Hunter Locatable Rodders (tracerelectronicsllc.com).

A best practice related to damages investigations was the use of a kit containing portable signage indicating marked location and excavation damage, and large print yard-sticks. These kits allow for the field investigator to document locations where the underground utility was marked and where the damage occurred. The documentation is done by taking photographs of the entire area to clearly see where and how far away from the markings the damage took place.

7. Project size limitations

A struggle that owners of underground utilities face is when a request for locate for a large-scale project that may involve work in multiple city blocks over an extended time is made using a single ticket.

A best practice identified for these large projects is to have communication with the excavator from start to finish. Calling the excavator to see where they plan to work the next few days to mark the utility lines in the area where work is planned. This helps reduce the number of times marks must be renewed, as well as preventing damages. Breaking these projects into sections to have the underground lines marked every so many feet so that utilities are not coming out to have to remark lines. This helps to prevent damages, because there are times and occurrences that excavators do not wait for lines to be marked leading to a damage. The more information that is put on line locating tickets can help prevent damages.

One practice that may also help in the event of damage is for the utility to put a phone number to call on the line locate ticket in the event of a damage occurs. It should be noted that under Missouri Revised Statute 319.026, the person responsible for the excavation operations must notify the notification center (Missouri One Call) of all damages, and in the case of a pipeline damage resulting in release of gas or liquid, must also notify 911.

VI. Workshop Description

A. Description and Agenda

Based on a PHMSA grant awarded to the Missouri Public Service Commission to research best practices for pipeline safety that have been used by other entities, the Missouri Public

Service worked with several Missouri entities such as: Missouri One Call, Missouri Attorney General's Office, and other Statewide pipeline operators to put together a workshop with the ultimate goal of developing stronger state-wide practices for locating quality assurance by engaging with and hosting a best practices workshop for Missouri pipeline operators and other stakeholders.

This workshop was held via virtual platform (WebEx) on June 17, 2021 from 9:00am to 12:00pm. The agenda was as follows:

AGENDA

9:00am	**Welcome and Introduction**
9:05am	**Discussion of literature review and summary of results from meetings and discussions with operators and other stakeholders** Presenters: *Kari Salsman, Missouri Public Service Commission Staff*
9:45am	**Operators' presentations and panel discussion** Presenters: *Heath Silvey, City Utilities of Springfield MO; Keith Carter, Macon Municipal Utilities; Dennis Bennett, Ameren Missouri Gas* Moderator: *Jacob Robinett, Missouri Public Service Commission Staff*
10:45am	**Break**
11:00am	**Missouri Attorney General's Office and Missouri One Call perspectives on locating performance issues** Presenters: *Kaylee Sloan, Office of the Missouri Attorney General; Derek Leffert, Missouri One Call* Moderator: *Jamie Myers, Missouri Public Service Commission Staff*
11:50am	**Comments, Questions, and Suggestions**

Approximately 75 participants attended the virtual workshop. Several of the participants asked questions and provided additional thoughts based on their own experiences. A recording of

the virtual workshop and a copy of all presentations shared during the virtual workshop is available in Commission Case No. GW-2021-0355.

B. Best Practices To Improve Locating Presented in MO PSC Workshop

Recommended Best Practice 1: **Establish rules for "project tickets"**

Reason: Based on recent year surveys of locating technicians by CGA, the volume of locate requests and subsequent one call transmissions are rising. Based on the survey results from managers who supervise locators, it is clear that staffing needs relative to increasing ticket volume and variability remains a distinct challenge facing the industry. Most states mandate short turnaround times for locates to facilitate projects moving quickly. This can be very difficult for the locators as job size, variability of locates, and infrastructure complexity can all slow the process down. The use of design and planning tickets for large scale projects and a more flexible ticketing process could help locating companies better manage the staffing needs to accommodate continually higher ticket volumes.

Recommended Best Practice 2: **Increase locate technician training**

Reason: According to a 2020 CGA locator white paper, there is high employee turnover in this profession, due to a variety of reasons. Some of the reasons identified were: limited formalized training programs that contribute to a lack of awareness of important damage prevention practices, weak compensation plans or no retention programs in place to retain experienced employees, and new or inexperienced excavators being put into risky situations. In a 2019 survey of technicians in the field, 94% stated that more training would help improve the accuracy and timeliness of locates. Continued on-going training practices would help immensely with this issue.

Recommended Best Practice 3: **Making white-lining mandatory**

Reason: Local companies in Missouri typically white line, but it has been determined that out of state contractors typically do not. Some contractors will meet on-site and white line while there to do the locate. Sometimes companies are able to put white-lining in contracts.

Recommended Best Practice 4: **Updated maps**

Reason: Due to lack of detail and incomplete mapping, CGA has identified delayed updates and inaccuracy of maps a significant problem for locator quality assurance. Most companies have digital maps and systems updated on a weekly and monthly basis. Companies need GIS systems that allow crews to preform updates in the field on a real time basis.

Recommended Best Practice 5: **Increased communication between excavator & locate technician**

Reason: Recent surveys indicate that 97% of technicians identified increased communications between themselves and excavators as an effective way to improve accurate, on-time locates. Damage Prevention Council meetings, Regional Partner summits, and updated and reliable one call ticketing software were also issues suggested and identified to improve this issue.

Recommended Best Practice 6: **Reporting**

Reason: Timely and accurate reporting of excavation incidents is a critical component of the continual process with all Stakeholders reporting information.

Recommended Best Practice 7: **Quality Assurance Audits**

Reason: CGA Best Practices recommend various components when it comes to Quality Assurance Audits. Some recommended components are listed below:

- Conduct field audits and choose some locations to be audited /surveyed purely at random.
- Check accuracy to within, governed, contractual, and minimum tolerance levels.
- Measure timeliness, as defined by regulation/statute.
- Check completion of a request.
- Check evidence of accurate and proper communication.
- Check that proper documentation exists.
- Check that an audit/survey is documented.

- Communicate results to applicable personnel.
- Trace audits for trend analysis.
- Verify proper hook-up and grounding procedures where applicable.
- Verify the reference material used to document that the locate was up to date (electronic plans or paper plans).
- Verify that appropriate safety equipment and procedures were used by the locator.
- Verify that tools and equipment are in proper working order and properly calibrated.

Locates Without Tracer Wire

Discussion was had during the workshop regarding the use of any standard equipment that is utilized during locates. The consensus was that there is no standard of equipment used when locating. The equipment used for these purposes is typically determined by the utility or contractor. Several options to locate with a lack of tracer wire were discussed:

- Traceable rodder (e.g. Jameson tool)
- Ground penetrating radar
- Vacuum excavator to pneumatically excavate down to pipe
- Locate wire on another point from street or neighbor's house
- Shovels and probes
- Marker balls on mains and mirror surface indicators on service lines to help locate
- Records, field sketches, service card drawings

How to Handle Large Projects vs Small Project Locate Tickets

- Good communication from start to finish
- Break projects into sections
- More notes in tickets the better
- Phone number on tickets of someone to call
- Call excavators to see where they plan to work next couple of days
- Location of project is factor – locating in large projects in urban areas is different than in rural areas.

Screening Contractors

- Most utilities track each damage and save information for future use
- Create a list to break down damages to excavation type, locations, history to know the risk factor
- Smaller utilities have small number of damages per year so more easily able to track

- Screening based on information of previous damages maintained by each utility– but may not be aware of damages done by contractor in other parts of the state
- Meet with contractor if have recurring damage

VII. Summary

As described in the above sections this project was conducted in several phases. These phases included a review of published best practices regarding locating quality assurance programs and initiatives in other states, interviews with natural gas pipeline operators and other stakeholders, a virtual public workshop presenting preliminary findings and seeking additional input from stakeholder groups, culminating in the publication of this report.

The best practices identified by MO PSC Staff over the course of this project are summarized in the table below (Sources are identified by number in the table, and references are listed following the table):

Issue	**Recommended Best Practice (Sources in parenthesis are listed below table)**
High Ticket Volume	- Encourage the use of design and planning tickets for excavators on large projects, in order to better manage ticket load. (1) - Increase locator training to improve speed and accuracy of work. Training could include simulated locates. (Sources: 2, 7) - Increase communication between parties can lead to a better understanding of excavation area and timing of project. (Source: 3) - Timely, accurate reporting of excavation incidents can allow facility owners to better analyze the event in order to take actions to prevent recurrence. Investigations can be improved by the use of a damage investigation kit. (Source: 3, 4, 5) - Quality Assurance Programs can be used to audit work done by locators to aid in identifying improvements to the facility owner's damage prevention program. (Source: 3) - Ensure adequate workforce to meet locate request demand. (Source: 7)
Unclear and/or large excavation area	- Encourage the use of white-lining, both on-site and electronically on the Missouri One-Call website. Limiting the scope of areas to be located through precise electronic white-lining can reduce the pressures on locators and increase the delivery of timely locates. (Sources: 3, 4, 6)

Issue	Recommended Best Practice (Sources in parenthesis are listed below table)
	- Increase communication between parties can lead to a better understanding of excavation area and timing of project, could include meeting with the excavator. (Sources: 3, 6) - Timely, accurate reporting of excavation incidents can allow facility owners to better analyze the event in order to take actions to prevent recurrence. Investigations can be improved by the use of a damage investigation kit. (Sources: 3, 6, 7) - Have routine meetings with personnel from departments involved in damage prevention (e.g. locators, mapping, design and construction) to review damages and what actions can be taken to prevent recurrence. (Source: 7) - Quality Assurance Programs can be used to audit work done by locators to aid in identifying improvements to the facility owner's damage prevention program. (Source: 3) - Put white-lining requirements into contracts. (Source: 6) - Offer on-site safety education to excavators. (Source: 7)

Issue	**Recommended Best Practice (Sources in parenthesis are listed below table)**
Incorrect and/or incomplete records	- Create reporting process for locators to report errors or incomplete records, and correct. (Source: 3) - Ensure locator conducts a visual on-site inspection. Things to look out for include (Source 3): o Poles o Dips o Enclosures o Pedestals o Valves o Meters o Risers o Manholes o Staff also notes that pipeline markers and casing vents can be used as a visual clue that a pipeline facility is in the area. - Increase locator training to improve speed and accuracy of work, and to better identify inaccurate and/or incomplete records. Training could include simulated locates. (Sources: 2, 5, 7) - Underground electronic utility markers can be used to better enable accurate locating and verification of underground facilities. (Source: 3) - Timely, accurate reporting of excavation incidents can allow facility owners to better analyze the event in order to take actions to prevent recurrence. Investigations can be improved by the use of a damage investigation kit. (Sources: 3, 6, 7) - Have routine meetings with personnel from departments involved in damage prevention (e.g. locators, mapping, design and construction) to review damages and what actions can be taken to prevent recurrence. (Source: 7) - Quality Assurance (QA) Programs can be used to audit work done by locators and to aid in identifying improvements to the facility owner's damage prevention program. Program should include the personnel responsible for the implementation of the plan, the level of inspection required based on the risks associated with the work being performed and the people performing the work, the qualifications of the personnel conducting the inspections, the expectations of the inspectors, checklists for each type of inspection performed, documentation of findings, analysis of the inspection results and continuous improvement of the plan based on the results. (Sources: 3, 5) - Update records when inaccuracies are found. (Source: 5) - Maintain GPS records of facilities to ensure accurate locating accuracy. (Source: 5)

Large Project	- Maintain frequent communication with excavators to understand work location and timeline so locate marks can be completed accurately as needed. (Sources: 6, 7) - Facility owner placed marker identifying the Missouri One-Call System ticket that was located by the paint, allowing excavators to ensure their ticket was the one located. (Source: 7) - Require excavator to white-line the excavation area. (Source: 7) - Timely, accurate reporting of excavation incidents can allow facility owners to better analyze the event in order to take actions to prevent recurrence. Investigations can be improved by the use of a damage investigation kit. (Sources: 3, 6, 7) - Have routine meetings with personnel from departments involved in damage prevention (e.g. locators, mapping, design and construction) to review damages and what actions can be taken to prevent recurrence. (Source: 7) - Offer on-site safety education to excavators. (Source: 7)
Difficult to locate facility	- Make record of facility whenever exposed. (Source: 5) - Installation of marker balls when facility is exposed. (Sources: 5, 6) - Locate using facility owner personnel instead of contractors. (Source: 5) - Maintain mapping of abandoned facilities in order to prevent erroneous marking. (Source: 5) - Maintain GPS records of facilities to ensure accurate locating accuracy. (Source: 5) - QA/QC Programs to audit work completed by locators with a goal of ensuring compliance with written policies, practices, procedures and specifications; and with applicable codes. Programs should include the personnel responsible for the implementation, the level of inspection required based on the risks associated with the work being performed and the people performing the work, the qualifications of the personnel conducting the inspections, the expectations of the inspectors, checklists for each type of inspection performed, documentation of findings, analysis of the inspection results and continuous improvement of the program based on the results. (Source: 5) - Review of records, field sketches, and service card drawings to assist with locating facility. (Source: 6) - Attempt to connect to tracer wire from another location in order to locate a certain facility. (Source: 6) - Use of a traceable duct rodder. (e.g. Jameson tool) (Source: 6) - Use of ground penetrating radar. (Source: 6) - Use of vacuum excavator to excavate the pipe to verify location.(Source: 6) - Timely, accurate reporting of excavation incidents can allow facility owners to better analyze the event in order to take actions to prevent

	recurrence. Investigations can be improved by the use of a damage investigation kit. (Sources: 3, 6, 7) - Have meetings with operator personnel to review damages and what actions can be taken to prevent recurrence. (Source: 7)
Incorrect Locate due to Locator Error	- More training for locators and retraining locators who mis-locate lines to improve accuracy. Training should be equal or superior to the National Utility Locating Contractors Association's locator training standards and practices, and could include simulated locates. (Sources: 5, 7) - Improve locator employee retention in order to retain experience gained through work and training. (Source: 7) - Locate using facility owner personnel instead of contractor personnel. (Source: 5) - Maintain mapping of abandoned facilities in order to prevent erroneous marking. (Source: 5) - QA/QC Programs to audit work completed by locators with a goal of ensuring compliance with written policies, practices, procedures and specifications; and with applicable codes. Programs should include the personnel responsible for the implementation, the level of inspection required based on the risks associated with the work being performed and the people performing the work, the qualifications of the personnel conducting the inspections, the expectations of the inspectors, checklists for each type of inspection performed, documentation of findings, analysis of the inspection results and continuous improvement of the program based on the results. (Source: 5) - Timely, accurate reporting of excavation incidents can allow facility owners to better analyze the event in order to take actions to prevent recurrence. Investigations can be improved by the use of a damage investigation kit. (Sources: 3, 6, 7) - Have routine meetings with personnel from departments involved in damage prevention (e.g. locators, mapping, design and construction) to review damages and what actions can be taken to prevent recurrence. (Source: 7)

Sources:

1. CGA Next Practices Initiative Report to the Industry, published February, 2021
2. From Literature Review, Section III: CGA 2020 White Paper, "Insights into Improving the Delivery of Accurate, On-Time Locates", published October 2020.
3. From Literature Review, Section III: CGA Best Practices, Version 18.0.
4. From Literature Review, Section III: 2020 CGA Next Practices Report
5. From Initiatives in Other States, Section IV: NAPSR Survey

6. From Interviews with Pipeline Operators, Section V
7. From Workshop, Section VI: Missouri Public Service Commission Pipeline Locating Quality Assurance Workshop - June 17, 2021

Note: The best practices identified during the course of this project do not represent an exhaustive list of all possible approaches to address various issues regarding locating quality assurance, nor does MO PSC intend to limit or restrict utility owners from using other approaches.

MO PSC Staff would like to thank the various stakeholders for their assistance and input into this project. Staff hopes that this report will prove to be a valuable tool for the affected stakeholders that can be used to assist with identifying possible best practices for various issues regarding locating quality assurance.