April 6, 2020

DOT Docket Management System
U.S. Department of Transportation
Docket No. PHMSA-2013-0255
U.S. DOT Docket Operations Facility (M-30),
West Building, 1200 New Jersey Avenue SE,
Washington, DC 20590

Re: Pipeline Hazardous Materials Safety Administration (PHMSA), Department of Transportation; Notice of Proposed Rulemaking, Pipeline Safety: Valve Installation and Minimum Rupture Detection Standards Docket No. PHMSA-2013-0255, Comments of the Fiber Optic Sensing Association.[i]

Dear Administrator:

The Fiber Optic Sensing Association ("FOSA") appreciates the opportunity to submit comments to the Pipeline and Hazardous Materials Safety Administration (PHMSA) regarding the Notice of Proposed Rulemaking (NPRM) on Pipeline Safety: Valve Installation and Minimum Rupture Detection Standards Docket No. PHMSA-2013-0255, CFR:49 CFR Parts 192 and 195, Federal Register Number: 2020-01459, (February 6, 2020)

The Fiber Optic Sensing Association (FOSA) was founded in 2017 as a non-profit organization to educate industry, government and the general public on the benefits of fiber optic sensing technologies that enhance public safety, promote the security of critical facilities and infrastructure and protect the environment. Our 22 members include organizations that manufacture, install, test, evaluate, support, and/or use fiber optic sensing systems and equipment.[ii]

I. Technical Discussion - Distributed Fiber Optic Sensing (DFOS)

Distributed and quasi-distributed fiber optic sensors are systems that connect optoelectronic interrogators to an optical fiber or cable, converting the fiber to an array of distributed sensors. The fiber becomes the sensor while the interrogator injects laser energy into the fiber and detects events along the fiber. This technology can be deployed to continuously monitor vehicle movement, foot traffic, digging activity, seismic activity, temperatures, structural integrity, liquid or gas leaks, and many other conditions and activities. It is used around the world to monitor power stations, telecom networks, railways, roads, bridges, international borders, critical infrastructure, terrestrial or subsea power cables or pipelines and downhole applications in oil, gas and enhanced

geothermal electricity generation. Fiber optic sensing is not constrained by line of sight or remote power access and depending on system configuration, can be deployed in continuous lengths exceeding 45 km (30 miles) with detection at every point along its path. Cost per sensing point over great distances cannot be matched by competing technologies. Often existing fiber optic cables are used or sensing-optimized cables may be deployed. Fiber optic sensing measures changes in the naturally occurring "backscattering" of light in an optical fiber or designed in methods of controlled reflections such as Fiber Bragg Gratings. Measurable change is observed when the fiber encounters vibration, strain or temperature change. The fiber serves as a sensor over its entire length, delivering real-time information on physical surroundings and security. Furthermore, the data instantaneously pinpoints the precise location of events and conditions occurring at or near the sensor cable.

The main uses for DFOS in pipeline monitoring are:

- Detecting unauthorized or unexpected third-party interference near the pipeline;
- Detecting excessive strain being applied to the pipeline due to shifts in the soil caused by subsidence, landslides or other geotechnical reasons;
- Detecting soil erosion and water ingress as means of very early warning and prevention;
- Detecting pipeline leaks, ruptures or valve operation, whether liquid, gas or a combination of liquid and gas;
- Detecting negative pressure waves traveling inside pipelines; and
- Tracking the position of instrumentation and cleaning PIGs (Pipeline Inspection Gauges/Gadgets).

Monitoring these conditions is very important to pipeline operators. Third-party interference, whether intentional or not, as well as excessive strain, can lead to a potential pipeline leak, which needs to be reported to the pipeline operator as soon as possible. Tracking PIGs is important, as they can get stuck from time to time, and knowing the location of a stuck PIG quickens remediation.

DFOS methods provide significant advantage for pipeline operators, complementing traditional Computational Pipeline Monitoring Leak Detection Systems (CPM LDS) by adding prevention through very early detection. Additionally, DFOS instantaneously pinpoints sudden operating changes at all points along the asset and issues alerts/alarms to hasten responses and mitigate harm.

Distributed Acoustic Sensing (DAS) can monitor the vibration characteristics of the pipeline and quickly detect unauthorized or unexpected third-party interference or intrusion by monitoring the vicinity of the pipeline. DAS can go as far as to determine the potential cause of the vibrations, and therefore alert the pipeline operator of potential threats to the pipeline. DAS can also be used to detect leaks and associated events by sensing multiple effects on the fiber, among them:

- Changes in temperature;
- Subtle vibrations in proximity to the pipeline that result from product escaping under pressure into the surrounding soil, or into the air if an above-ground pipeline;
- Direct commodity release detection using changes in strain, thermal, and acoustic noise from the leak orifice; and
- Indirect sensing of the leak by observing the resultant negative pressure waves caused by the onset of the leak, as described in API 1130.

Distributed Temperature Sensing (DTS) is deployed to monitor the subtle temperature variations that occur on or around pipelines. From effects due to product escaping the pipeline to subtle changes to terrain in the vicinity of the pipeline, DTS is suitable to report absolute temperatures that help characterize events, pinpoint areas of concern, and track subtle changes occurring with time – providing alerts and alarms as appropriate.

- Escaping gas lowers temperature at the leak point, DTS pinpoints and characterizes this.
- Escaping oil increases temperature at the leak point, DTS pinpoints and characterizes this.
- Right-of-way erosion due to water ingress near pipelines creates a temperature profile that DTS can pinpoint, remotely monitoring magnitude and associated changes.

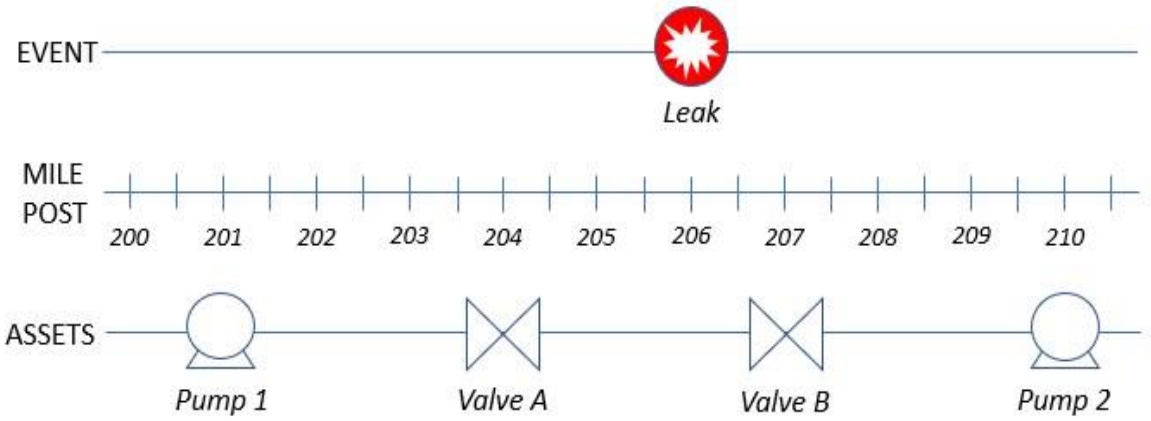
Distributed Strain Sensing (DSS) is deployed along or on pipelines to monitor changes in the strain that might be caused by shifts in the soil in the vicinity of the pipeline. If the strain from these soil shifts grows large enough, it can cause the pipeline to shift, buckle and even rupture, allowing product to escape. DSS is an ideal tool for use in prevention of the catastrophic events that are known to occur with aging pipelines.

- DSS supports preventative maintenance, reporting subtle changes in strain and compression on pipelines to which they are coupled.
- DSS is effective as it detects the very small changes that occur over weeks, months and years.
- DSS can also be used in the vicinity of the pipeline to monitor soil stability and the small changes in the supporting earthworks that, with change, can threaten the pipeline itself.
- DSS characterizes the nature of the threat, its location or expanse, and magnitude.

Distributed Fiber Optic Sensing's Role in Leak/Rupture Detection and Valve Monitoring

DFOS allows operators to immediately recognize and pinpoint leaks and ruptures and know the status of valves and other equipment operating on the pipeline. The diagram

below represents a typical software interface available to an operator using DFOS to monitor its pipeline.



In the diagram, as the sensing system detects a leak/rupture at mile 206, the system alerts the operator and indicates the precise incident location. The bottom horizontal line shows the nearest shut off valves at mile 204 and mile 207 and the nearest pump stations at mile 201 and mile 210. The sensing system can tell the operator if the pumping stations are active and whether valves are actuating, open or closed. The ability of DFOS to monitor hundreds - even thousands - of miles of a pipeline provides critical information in the case of an event. Without DFOS it could take hours to determine that an incident exists and more time to physically locate it. A DFOS system will inform the operator of an incident and pinpoint its location instantaneously so that immediate preventative remediation occurs.

II. Regulatory Discussion

1. Leak Detection

Although PHMSA is not proposing specific metrics to address smaller, non-rupture-type leaks in this rulemaking, the NPRM expresses PHMSA's expectation that the proposed rule regarding valve installation and minimum rupture detection standards can "drive further development and installation of leak detection technology and may help drive operators to make decisions to improve the capabilities of their leak detection systems to detect non-rupture-type events." FOSA applauds this aspiration and recent steps PHMSA and the Department of Transportation have taken to meet it.

In our view, the agency's recent announcement regarding the establishment of a national-scale pipeline safety test site at the Transportation Technology Center in Pueblo, Colorado is an extraordinarily important step toward the evaluation, validation and development of leak detection technologies and other safety technologies and

techniques. Creation of this asset would catalyze performance improvements and enable development of standards through scientific test results. FOSA applauds PHMSA for envisioning such a facility and the benefits it would bring for safer operation of pipelines.

FOSA is also very encouraged that the NPRM states that "PHMSA continues to address the effectiveness of leak detection systems for other non-rupture type leaks through its rulemaking on the safety of hazardous liquid pipelines; research and development projects, including work on external-based leak detection sensors and acoustic pipeline leak detection systems; and engagement in new or updated standards being developed by standard developing organizations, including API recommended practice 1130 and 1175."

FOSA is operating in close cooperation with API in these efforts and commits to supporting PHMSA and other interested parties to develop the most effective external leak detection standards possible.

Given that the PHMSA-commissioned Kiefner and Associates leak detection study (2012) is now dated, an opportunity exists for PHMSA to consider modern versions of leak detection technologies, including those listed earlier in the comments.[iii] In that regard, FOSA recommends that PHMSA consider field-proven commercially available leak detection technology solutions to improve response time through inclusion of critical leak parameters such as event location pinpointing and timing of detection**.**

2. Rupture Monitoring

The NPRM proposes to define a rupture as "an event that results in an uncontrolled release of a large volume of commodity that can be determined according to specific criteria or that has been observed and reported to the operator."

To mitigate the harmful consequences of a rupture, operators should rely on monitoring systems that alert them of significant events with immediacy and actionable detail. Consequently, FOSA recommends that PHMSA establish performance-metric-based standards including the following:

- Ability to detect ground movement that can cause dangerous levels of pipeline strain and predict the likely affected pipeline segment;
- Ability to alert to flooding, erosion or other conditions which endanger pipelines and predict the general area of endangerment;
- Ability to detect and locate various sizes of leaks and ruptures in a variety of different types of pipelines and different product types;
- Ability to detect intrusion (e.g., walking, driving, digging);
- Continuous monitoring of pipeline operations, integrity, severe weather, and other natural forces;
- Ability to report real-time data on a constant and long-distance basis; and
- Ability to operate above or below ground.

Such performance-metric-based standards should reflect the current state of commercially available technology.

3. Valve Monitoring

The "Distributed" nature of Fiber Optic Sensing means that the entire length of fiber is sensed in real time, facilitating the accurate location of any event detected by the system. Knowing immediately the precise location of the incident will help operators know which valves must be closed to protect against a release. Therefore, we believe the proposed standards for rupture detection described above will play a key role in the effective operation of valves and other equipment.

III. Conclusion

FOSA believes that systems meeting the proposed standards suggested above are technically, operationally, and economically feasible and that such standards support the critical public policy interests of public safety and environmental protection. Moreover, establishing such clear performance standards will assist pipeline operators by clarifying expectations.

Our association welcomes the opportunity to work supportively with PHMSA and pipeline operators to identify and test technologies that can achieve the policy objectives expressed by this NPRM. We especially commend the prospect of a PHMSA sponsored research and safety facility and applaud the agency's leadership on this initiative.

Sincerely,

/s/ Mark Uncapher

Mark Uncapher,
Executive Director

[i] Federal Register 85, no. 25 (February 6, 2020): 7162.
[ii] For more information regarding the Fiber Optic Sensing Association, see https://www.fiberopticsensing.org/
[iii] "Leak Detection Study—DTPH56-11-D-000001;" Kiefner and Associates, Inc.; Final Report No. 12-173; December 10, 2012. https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/technical-resources/pipeline/16691/leak-detection-study.pdf.