U.S. DEPARTMENT OF TRANSPORTATION

+ + + + +

PIPELINE AND HAZARDOUS MATERIALS
SAFETY ADMINISTRATION

+ + + + +

PIPELINE LEAK DETECTION, LEAK REPAIR, AND METHANE EMISSION REDUCTIONS PUBLIC MEETING

+ + + + +

THURSDAY, MAY 6, 2021

+ + + + +

The Pipeline and Hazardous Materials Safety Administration met via Video Teleconference, at 10:30 a.m. EDT, Sam Hall, Meeting MC/Host, presiding.

PHMSA STAFF PRESENT
SAM HALL, Meeting MC/Host
KANDI BARAKAT, Moderator
STEVEN FISCHER, Meeting MC/Host
DAVID LEHMAN, Meeting MC/Host
ALAN MAYBERRY, Associate Administrator, Office of Pipeline Safety
STEVE NANNEY, Senior Technical Advisor, Engineering and Research
SAYLER PALABRICA, Meeting MC/Host
ROBERT SMITH, Senior R&D Program Manager
MASSOUD TAHAMTANI, Moderator
SENTHO WHITE, Moderator

ALSO PRESENT

JAY ALMLIE, Satelytics
DOUG BAER, Ph.D., ABB Inc.
DIANE BURMAN, National Association of Regulatory Utility Commissioners
SEAN DONEGAN, Satelytics
DAMON EVANS, American Petroleum Institute
CARRIE GREANEY, Pipeline Research Council International
MATTHEW GRIMES, Siemens Energy
RANDY KNEPPER, New Hampshire Public Utilities Commission
STUART MITCHELL, ProFlex Technologies
ERIN MURPHY, Environmental Defense Fund
STUART RIDDICK, Ph.D., METEC
ERIK RODRIGUEZ, SoCalGas
FIRAT SEVER, Ph.D., QuakeWrap, Inc.
DIRK SMITH
SUSAN STUVER, Ph.D., Gas Technology Institute
PETE ROOS, Ph.D., Bridger Photonics
MARK UNCAPHER, Fiber Optic Sensing Association
BRIAN WHITE, Federal Energy Regulatory Commission

C-O-N-T-E-N-T-S

P-R-O-C-E-E-D-I-N-G-S

(10:30 a.m.)

MR. HALL: Good morning, Ladies and Gentlemen, and welcome to Day 2, of the PHMSA Pipeline Leak Detection Leak Repair, and Methane Emissions Reductions Public Meeting.

My name is Sam Hall. I'm a Program Manager, in PHMSA's Office of Pipeline Safety, and I'm serving, as your Master of Ceremonies. We thank you for your attendance and your participation and, we extend a special thanks, to our presenters.

I want to cover some housekeeping items, for your consideration. All of the audio is being handled, by AT&T. And you can see the audio line prominently displayed on the slide, on your screen, as well as, in the upper left-hand corner of your screen.

We strongly encourage you to dial into that line, if you're experiencing any issues with your audio, through your computer. If you are streaming the audio, through your computer, Bandwidth issues can impact the quality of the audio that you receive.

But, if you are dialed into that conference line, and I assure you, we have plenty of space for you to do that, your audio stream should be flawless. So I do encourage, all, who are attending, to dial into the conference line, if you experience any audio problems, at all.

The AT&T Operator will provide instructions, regarding how to make comments, at the appropriate time. And, until that time, all lines are muted.

If you wish to make a comment, with your voice, over the course of today's proceedings, you must be dialed into the conference line.

You do not have an option to make a comment with your voice, through the audio on your, on your computers. We will not be allowing you to unmute your speakers, or your microphones, on your computers.

So if you wish to speak, you must be

dialed into the teleconference. Again that teleconference line is in the upper left-hand corner of your screen.

If you choose not to dial into the teleconference line, you'll be able to hear the proceedings, but you'll not be able to make a comment, as I said, and in that case, you may make comments in the Q&A box, on the lower, left corner of your screen.

If you're having technical difficulties, please, ask your question in that same Q&A box, on the lower left of your screen, and we'll try to help you, as quickly, as we can.

We do intend to adhere to the Agenda, as strictly, as possible, today. We have not scheduled any breaks. We're all, either, at home, or in our offices, and are free to take breaks, as we need to, so please take your breaks on your own, as necessary.

The proceedings are being recorded, and the recording of the meeting and a transcript of the proceedings will be available, on the meeting Website, where you registered, in approximately ten business days.

The purpose of this two-day public meeting is to engage stakeholders on gas pipeline leak detection and leak repair issues, as an important step in fulfilling the requirements of Sections 113 and 114, of the PIPES Act of 2020.

During today's meeting, stakeholders, including environmental and public safety groups, federal and state governments and the pipeline industry will have the opportunity to share perspectives on improving gas pipeline leak detection and repair.

Topics discussed will include the scope of the current problem, as well as, advanced technologies and practices to address methane emissions from natural gas pipelines.

The Agenda, at the bottom of your screen, is available for your reference and a full Agenda is available at the meeting site, where you registered for this meeting.

With that, it is now my pleasure to

introduce Alan Mayberry, the Associated Administrator for Pipeline Safety, for some introductory remarks. Go ahead, Alan.

MR. MAYBERRY: Thank you, Sam. Good morning, everyone. I'm glad to see so many of you back, for a second day, discussing pipeline leak detection and repair and methane emission reduction.

Yesterday, we averaged in the mid to upper 300s, so very good turnout and, thank you, very much, for participating. There were a lot of positive -- there was a lot of positive dialog and feedback, yesterday, you know, during our panel discussions.

We heard a variety of perspectives on how various stakeholders, including federal and state safety regulators, advocacy groups, pipeline operators and technology providers, how they are addressing pipeline safety, leak detection, and methane emissions, as well as, their suggestions for policy-making.

Now, today, we have a full day and

we'll shift our focus to R&D and creating incentives and also technology. But, I wanted to reiterate that, addressing the opportunities before us, requires consideration of a variety of perspectives, methodologies, and implementation, and it requires an all-hands-on-deck approach.

So thank you, all, for engaging and participating in these discussions. Please, feel free to contribute and ask questions, throughout the presentation, as directed, by Sam.

Yesterday went very well and I'm eager to see what today brings. So with that, I will turn it back to Sam and, thanks, again, for being here and participating. Thanks.

MR. HALL: Thank you, Alan. We'll begin our first session of the day. It's my pleasure to introduce Sentho White, Director of Engineering and Research, who will provide a presentation on PHMSA's leak detection and repair research and development.

Ms. White, I'll turn it over to you and I will have your slides up, momentarily.

MS. WHITE: Thank you, Sam. Good morning, everybody. As Sam mentioned, I'm Sentho White, Director of the Engineering and Research Division, at PHMSA's Office of Pipeline Safety.

I'd like to take this opportunity to discuss PHMSA's Research and Development Program and highlight a few success stories on research projects PHMSA has funded, in the area of leak detection.

Current and active leak detection projects and PHMSA's future plans, in this topic area. Next slide, please. In a recent message from our Secretary, Pete Buttigieg, he said that, we, at DOT, are the stewards of America's infrastructure in so many ways and that means, we're all, sort of, stewards of the climate.

DOT's Federal Government Research Programs, such as PHMSA's Pipeline Safety Research Program, are instrumental in advancing innovation, technology development, and breakthrough technology.

Federal Research Programs also provide

decision makers with knowledge and data, to improve the safety, environmental protection, and sustainability, of our transportation system.

PHMSA's Pipeline Safety Research Program is committed to sponsoring research and development projects, focused on providing near term solutions for the nation's pipeline transportation system that will improve safety, reduce environmental impact, and enhance reliability.

This also includes a commitment to the Administration's priorities, through R&D investments that promote safety, climate change, economic recovery, and rebuilding and transportation, as an engine for equity. Next slide, please.

PHMSA's R&D Program is comprehensive in its research strategy and awards research through four subprogram areas, as shown, here, starting at the top of the slide and working down, the CAAP, also called the Competitive Academic Agreement Program, was established in

2013, assumed as partners, with universities, to fund research focused on those high-risk, high-payoff solutions to pipeline integrity challenges.

The CAAP exposes students to subject matter common to pipeline engineering, to encourage career placement within the pipeline industry.

The research outcomes from CAAP are intended to be handed off to, either, a small business, such as through the Department's Small Business Innovative Research Program, or, and through follow-up research that can be performed, through PHMSA's CORE Program, to develop more mature research and technology development.

PHMSA participates in the Department's Small Business Innovative Research Program, also called SBIR. There are two types of SBIR award, Phase 1 Award focuses on the feasibility and validation of the theory, through lab demonstrations.

And Phase 2 awards are by invitation

only and funded up to $1 Million dollars, over 24 months, with the focus on prototype development and a path to commercialization.

PHMSA's CORE Program funds research to technology providers and research entities, to develop ready-to-use pipeline safety solutions. Essentially, those tools in the toolbox and these projects run 12 to 36 months in duration and are funded between $250,000 up to $1 Million dollars.

PHMSA also collaborates with several federal agencies, including NIST, FRA, and a few of the DOE labs, on pipeline safety research projects. Next slide, please.

In 2002, Pipeline Safety Improvement Act gave PHMSA the authority to establish an R&D program. And, since then, we've received technical direction and input, through different vehicles that sponsor research-focused topic areas and have received millions, in appropriations, to perform pipeline safety research.

As shown, in the table, PHMSA has

invested a total of $160 Million dollars, in federal funds, and approximately $14 Million dollars on 29 leak detection projects.

Additionally, since 2013, our CAAP projects have involved over 200 students. PHMSA's R&D Program, currently, has 71 active projects and six, specifically, on leak detection.

Information on PHMSA's R&D Program and on all of our research projects can be found on the two URL links, in the table, below. Next slide, please.

The following three slides provides recent examples of commercialized technologies and informative decision making guidance, resulting from our leak detection research portfolio. Next slide, please.

This first tech transfer project brought in the industry's ability to better locate and quantify methane leaks in mobile application, by measuring and establishing a repair priority, based on leak rates versus overall concentration.

The research was conducted, by Physical Sciences, between September, 2015, and March, 2018, and was commercialized, by Heath Consultants, in December, 2018.

And, just to give some background, many current natural gas leak survey tools that are used, by the industry, identify pipeline leaks by, either, measuring the local methane concentration, typically, in parts per million, or the concentration integrated over a line of sight path, in parts per million, per meter, and lack the ability to measure the leak rate from a system.

By measuring a direct leak rate, versus concentration, this helps the operator prioritize repair. In current practice, leaks exhibiting high gas concentration, are given repair priority.

However, the concentration can vary, depending on the wind speed and direction. A small leak can lead to a locally high gas concentration, when there is little wind to disburse the gas and vice-versa.

Basing repair priority are leak rates, rather than local concentration, could one, enhance public safety, by identifying leaks that are continuously emitting gas volume that are potential explosion hazards, as well as, environmentally harmful.

And, two, reduce overall leakage, thereby, providing the economic benefit of reducing the cost of lost gas, as well as, the cost of a low-priority repair.

Physical Sciences and Heath Consultants conducted an R&D project to fill this technology gap and advance the ability to detect low-level leaks, by providing a direct measure of the leak rate.

If research project integrated advanced laser-based methane detection methods, with novel deployment configurations and wind measurement, to provide leak rate data, in a matter of seconds, during routine, mobile leak surveys.

Moreover, the technology was able to measure, both, ethane and methane, during leak surveys, to differentiate natural gas leaks from other methane sources, such as bio gas.

I think it, probably, is about ten percent of the natural gas composition, but isn't present in bio gas. This provided the ability to reduce false detections, during mobile surveys.

Geospatial map, with leak rate measurements and the corresponding location were also integrated into the technology, to provide better visualization for the end user.

Many of the developed technologies and lessons learned, from this project, have already been implemented by Heath Consultants into its commercial leak survey tool and has helped to improve existing methodologies and development of future leak rate sensors. Next slide, please.

The second tech transfer evaluated improving the speed, efficiency, and effectiveness of leak surveys, using a six-wing aircraft. This aerial survey application is, typically, used more often in rural environments and can survey a wider area, more quickly, than ground-based vehicle-mounted sensors.

The project was conducted between September, 2015, and March, 2018, and was commercialized in November, of 2018. The Project's key technology advancement was the increased sensor slot, or area of detection capability.

The Ball Aerospace Team increased walk width to approximately 300 meters, by increasing laser power output, laser pole repetition rates, and aircraft-flied altitude.

This technology now enables efficient area mapping of potential methane sources, effectively doubling flight altitude and increasing flock-width, by three times.

Aerial field demonstrations were performed with operators that included area mapping of natural gas storage facilities and gas-gathering-type systems.

Ball Aerospace also performed a survey of 400 to 500 miles of high-pressured natural gas transmission pipelines. Next slide.

Finally, this third successful tech transfer project, by NYSEARCH, validated a methodology to quantify methane emissions rates in a gas distribution system, particularly, for lower-grade three, which is the lowest severity-type leaks.

There are a growing number of technology providers approaching local distribution companies, with measurement equipment that needs to be tested and validated, to determine its efficacy of use, in the gas distribution environment.

Local distribution companies, currently, lack a standard test protocol, for whether technologies are capable of quantifying methane emissions.

The researchers selected three technology providers to test and develop a validation guideline. Each of the technology provider's equipment with tested sequentially, at different LDC host sites.

The validation process included a comparison of the metered methane emission, versus the quantified measurement, by the equipment of the technology provider. This demonstrated the actual accuracy, precision, and certainty of the instrument.

The research results concluded that, any technology provider's equipment to perform methane emission quantification can be evaluated. Furthermore, in using this new framework, the actual accuracy, precision, and certainty of the technology provider's measurement data can be determined.

NYSEARCH identified that, potential next step, for this validation test protocol, could include collaborating with national organizations, such as ASTM, or to prepare and publish validation standards that would be recognized, by LDC and potential technology providers. Next slide.

Now, moving on to these next set of slides, I'll describe PHMSA's current research portfolio on leak detection. Next slide, please. Currently, PHMSA is funding seven active research projects, at universities and with research entities.

We've invested $2.5 Million, in funding. Our current projects, include research that evaluates improved leak rate estimation models, portable technology to measure the concentration of mercaptan in gas and improving existing leak detection systems, by utilizing the computational pipeline monitoring data and machine learning to locate smaller leaks. Next slide, please.

These next two slides illustrate the seven recipients funding level and project summaries of leak detection-related research projects, in our active research portfolio.

I won't go through each project, but encourage you to go to the URL, at the bottom of the page, to find out more specifics about these projects. Next slide, please. These next three active projects --

(Simultaneous speaking.)

(Audio interference.)

MS. WHITE: Can you please mute your phone?

Thank you. These next three active projects, include research on combing multiple sensor types on an unmanned aircraft platform, evaluating ways to improve measurement of the concentrations of mercaptan and improving leak rate estimation model. Next slide, please.

So as we look towards the future, we have a few R&D Initiatives we would like to highlight that PHMSA will be undertaking. Next slide.

Leak detection has been a long-standing priority in PHMSA's research portfolio and we are committed to continuing to invest in research and support abatement of methane releases and the Administration's climate change initiative.

PHMSA has invested in a number of research projects, related to UAS drones and we plan to continue to expand our research portfolio, to improve pipeline safety and streamline certain aspects.

And, as an example, PHMSA has funded specific research on UAS leak detection and integrity threat monitoring, but we have, yet, to fund a more comprehensive project.

So what would that look like? A more comprehensive project could include utilizing UAS technology, to monitor pipelines for leaks and integrity threats, while also, providing a visual of a pipelines following an emergency.

The research would look to determine the ability of defensive platform to operate, during adverse conditions. A large research gap that has been identified, would be to investigate how this UAS system could be utilized, given a beyond visual line of sight waiver, allowing operators to routinely monitor large swaths of the right-of-way, with limited human involvement.

PHMSA is also considering research on advanced systems that can help with more real-time, or near real-time detection, such as detection through satellite.

We have not funded satellite research, in the past. We would look to address what is the current, available technology and how it can be utilized, to effectively monitor pipeline right-of-ways.

In addressing research, related to real-time applications, PHMSA has funded distributive fiber optics systems enable pipeline operators to continuously monitor their pipeline system, for leaks.

We're also looking to fund research that will assist PHMSA in meeting the congressional mandate, to require the use of advanced leak detection systems, such as continuous leak detection. Next slide.

In addition to continuing to seek R&D opportunities to advance leak detection technologies, we also plan to seek input from pipeline stakeholders, to inform our future R&D strategy, including hosting a climate change and alternative guild workshop, in fall, of 2021, and planning for an R&D forum, in spring, of 2022.

We also have an open notice, on our Website, where stakeholders can submit research gap and ideas, for potential future R&D safety topics. Next slide, please.

And, lastly, the success of PHMSA's Pipeline Safety Research Program could not be achieved, without the dedicated and hard work of the R&D staff, listed here. And so I just wanted to quickly acknowledge the great work that PHMSA's R&D Team does every day, to contribute to our safety mission. And, with that, I will hand it back over to Sam. Thank you.

MR. HALL: Thank you, Sentho. We'll now transition to the first of two technology research and development initiatives and panel discussions. We'll have one panel discussion before lunch and the second one after lunch.

The first panel will be moderated, by

Sentho White, Director of Engineering and Research, who just spoke. Back to you, Sentho.

MS. WHITE: Thanks, Sam. And so as Sam mentioned, I'll be the Moderator, for this panel. And, during our panel presentations, we plan to have Q&A for the vendors and organizations, following the four presenters.

Each presenter will have 15 minutes to present. And, just a quick note that, while vendors will be presenting on their technology stakes, this does not equate to any promotion, or endorsement, by PHMSA, of any vendor, on their respective technology.

Accordingly, PHMSA will not entertain any questions, as to the capabilities of any vendor technology, or the vendor's ability to assist pipeline operators in meeting regulatory requirements.

And, one additional thing. My apologies, as, while all of our panelists, have quite impressive bios, unfortunately, given the tight time line to get through today's agenda, we are, we're going introductory bio, for each of the panelists.

And, with that, I would like to introduce our first panelist, from PRCI, Carrie Greaney will be presenting for PRCI, and PRCI will be presenting on their greenhouse gas emissions leak detection and repair research portfolio. Handing it over to you Care, Carrie.

MS. GREANEY: Hi and good morning. Does everybody hear me?

Can you hear me okay?

MR. HALL: Yes we can. Yes, we can.

MS. GREANEY: Okay, great. Okay, good. Thanks. Hi, I'm Carrie Greaney, I'm a Program Manager, at PRCI, Pipeline Research Council International.

Today, I'm going to talk to you, a little bit, about who PRCI is, for those that don't know, and then, I'm going to go into a discussion of a portion of our research and development that, specifically, pertains to the topic of this meeting, which, again, is methane emission and leak detection and, and repair.

And, provide some additional resources, specifically, for our project and project results, since I'm not going to be able to get into detail for everything, today, we only have 15 minutes.

Great. So PRCI is a non-profit research and development organization focused on transition pipeline systems. Our mission, as you can see, there, is to collaboratively deliver relevant and innovative applied features to continually improve the global energy pipeline systems.

So when I -- when I think collaboratively, provide research, any peer review technical results, by subject matter experts, which include our members, which you can see, consists of the breakdown, there, which are transmission operating companies and technology providers, which are vendors, service providers, equipment manufacturers, and other organizations.

But, we do, also, look to collaborate

with other R&D organizations and government R&D programs, nationally and internationally, to leverage resources and avoid redundancy in those initiatives.

What you'll see, here, is that our organization consists of several committees. I have two slides, here, essentially. We have eight technical committees.

The project that I plan to talk about, more, today are highlighted there, for five of our committees and, as you'll see, I've, I've noted that we have, we have repair.

And then, the divide and kill construction, underground operations and monitoring where we look at leak detection for liquids and gas, compressor pump station.

Looking at greenhouse gas emissions mitigation, measurement looking at reducing loss and unaccounted for and underground storage, which, looking at general integrity, but again, we, we've been highlighting more technology specific to leaks and emission.

So PCRI's project focus is for immediate impact to work on reducing emissions and leaks in the areas of greatest impact, first, so the largest of measures, which I think we heard a lot about, yesterday.

I'm going to talk, first, about how we can inform actions, by discussing the recently completed work, which is our, kind of, one to three years. We have previous work, but again, I'll provide resources for those. And remission reductions from facilities, pipeline leak detection, underground storage and repair.

I mentioned, in our mission that, we're looking to provide relevant and applied research, which, to us, means that we're looking for the results to deliver data to inform best practices, provide software tools, or validate accuracy, reliability, and robustness of technologies, better being developed, or available commercially for a successful operational implementation.

So here's the breakdown on the

emissions practice that we have, several relevant projects that, that the group may be interested in, specifically, the greenhouse gas database, to support emission factor improvement.

The second project there that came up yesterday, during the EPA presentation, and that was specifically a project, where we did data mining on Subpart W data, to get back to EPA and, and give them that, that input on improving the emissions mitigation measure.

The next project that you -- that might be of, of specific interest, again, is looking at valve, valve leakage scoping. You know, valve leakage is one of the largest areas in which there, there's an ability to make improvement, so that project began, looked at evaluating options and feasibility on detecting those leaks, quantifying them, and that -- for, for those issues and repairs.

The first and fourth project are looking at efficient design, which, again, when you have the efficient design you're, you're reducing emissions, overall.

That last project that you'll see there, for compressor and pump stations, it's an interesting one. It was looking at the, specifically, the feasibility of, of, of using, or recompressing the emissions, or exhaust, to reduce the overall emissions, at compressor pump stations.

All right. Next, I'm going to shift gears, a little bit, to talk about gas leak protection, you know, recently completed projects. This is one that we highlighted in, it was in partnership, with NASA's JPL.

It was done under surveillance and operations which is a monitoring committee, which looks at leak detection, liquids and gas, from in-ground to fake applications.

(Audio interference.)

This project, itself, was a partnership, again, like I said, with NASA JPL and, and developed a hand-held and small UAV, or drone quad-copter-style application or open, the

OPLS technology, which, was the, initially, part of the Mars Rover.

It also included ethane detection, which we, which was mentioned, again, yesterday, during the Q&A, to avoid false positive rates, due to the (audio interference).

This one will be considered kind of an intermittent or non-24/7 monitoring and it's one of the many that would be a double operator.

Also, I'll mention, since this came up, yesterday, in regards to the UAV and drone use, it is an increasing application, but they're still not widely adopted, by operators in the U.S., because of current FAA requirements, for certification.

It can be done, but it's a long and intense process. Certification is very specific to the platform type and, areal detection, regardless of platform, is highly impacted by environmental dispersions.

So these types of technologies can be very helpful, but would have to be mindful of specific environmental and, and terrain conditions, when looking to utilize these types of technologies.

In our underground storage area, we had a recent project that was done with Colorado State's METEC facility. They're looking at evaluating two commercially-available technologies at a very, at a high level and what the project found was, there was a bit of a tradeoff between detection sensitivity and the false/positive rates for underground storage use.

In general, the conclusions, again, this project saw that the quantification, per imagery, under the study that that would benefit from additional work on algorithm, or machine learning, to reduce that false/positive rate.

In repair, which -- and, I don't think we've gotten into a lot, yet. We do have a divine mutual construction technical community that focuses on repairs.

We have a very widely-used pipeline repair manual. It fits editions, I think, originally, from 2006, for liquids and natural gas transmission pipe, metallic pipe.

And, again, it's something that's widely used, but we know that there's a need for an update, so it's currently going under a seventh edition update, which would include the composite repair best practices and guidance that has recently come out of several projects, specifically, looking at composite-type repair.

All right, so on to, kind of, what we have going on in our current portfolio. New and current projects that we have across the technical committees are focused on emission reductions and transmission facilities.

As well as, two projects that you'll see, there, to gather information on state of the art available technologies, for detecting and quantifying greenhouse gas releases, or fugitive leaks, as well as, for facilitating repairs, without requiring blowdowns.

While there are some well-known commercial technologies, these studies are specifically end up collecting and informing best available, as well as, identifying potentially new technologies that are not quite commercial and ready for validation in the old, or large scale testing.

So again, the, all of these projects, kind of, encompass those five technical committees that that I mentioned, there. So as I identify the next step, where, where we see technologies ready for implementation, we, we have continued data and demonstration studies that that, we think that are needed.

There's also mentioned, during some of the panels, yesterday, about that and, specifically, on the left there, you'll see that, they've identified six focus areas on the greenhouse gas emission reduction that are priority for PRCI.

What each of those topics have in common, which you'll see, they're highlighted in blue, on the right-hand side, is, is a common challenge for successful application of the technologies.

It's standardization of evaluating detection quantification in broader field of invalidation data. I, we, also, during the, either, comments, or Q&A, session, yesterday, this was mentioned.

There's really a need for protocol, or, and, as I mentioned, standards to reliably access sensor type to compare them, apples to apples, and ensure that they're validated for specific platform types and application types, rather than just in small scale laboratory situation.

Those field large scale validations are, there's less frequent data associated with that type of study, for many sensor types.

So I know I'm, kind of, blowing through this, trying to be conscious of, of the time that we were allotted. So I wanted to leave everybody, with some additional resources, engagement opportunities.

You'll see, under the compendiums,

there, those are all links to our catalog. And, each of those compendium documents is actually its own mini catalog of work that's been done, in the past, and it's completed work.

So, you know, the, some of them are, include those recent ones, which I've had completed in the last one to three years and some of them are, are even over the not informed of studies.

Many of the newer products also have on demand Webinars, so it, you know, if you prefer to listen to a one hour Webinar, rather than, you know, dive deep into the 300-page document, for some of them, we, we do have those available, for, for listening.

And, also, I'll mention our, our research exchange. PRCI hosts an annual research exchange and we welcome submissions of abstract, for the conference, which a call will go out for later this year.

I also want to talk about the additional next steps, for communication and sharing, which is our public research roadmap that will be published, later this summer.

We're hoping that this will allow us to show areas, across our committees and research focus areas that would identify opportunities for partnering with other organizations in Government R&D programs that have similar identified priorities and that's within the methane leak detection repaired emissions, but also, in, in other program areas and subject areas, as well.

So in closing, I just want to say, thank you, for everybody's time, listening to the much-abbreviated overview of what we have in this area, and thank, thank you, for presenting us with the opportunity to share what PRCI is doing, at this time.

MS. WHITE: All right, thank you, Carrie. And, we'll move to our next, second panelist, and that is with GTI. And Susan Stuver will be presenting for GTI and she will be presenting on their methane detection and remote sensing efforts.

DR. STUVER: Hi. Audio check, can you all hear me, okay?

MR. HALL: We can, Susan, thank you.

DR. STUVER: Okay. Great, thanks. All right. Hi, I'm Dr. Stuver, and I'm a Senior Manager, at GTI. I, currently, lead a number of various collaboratives that drive technology innovation towards the mission mitigation solutions.

So in other words, we want to advance beyond just incremental R&D projects and create new holistic solutions that support the energy landscapes that we envision, of the future.

And GTI has been getting technologies to the market, for about 80 years, or so and, as technology has advanced, over the last eight decades, it's really, really important that we work together.

So GTI, either, leads or participates in many collaborative and information sharing platforms to, kind of, keep the communication flowing.

And, I've only represented a couple of groups, here, on this slide. There are many more, such as public meetings, like these, that we frequently engage in.

However, in the essence of time, I am just going to focus on a couple of key technologies, in the methane detection space and we'll leave some of the collaborative discussions for another day.

Okay. So I think, this slide nicely summarizes the primary elements of what we do, in the technology space. We spend a great deal of time working towards solutions in technology development, technology evaluation, modeling, and proving methodologies for technologies used in a lab and in field and, of course, collecting data and field testing technologies, through measurement campaign.

The columns with the pictures break it down, down the right, even further. For example, if we're focused on technology, itself, we may be developing novel sensor types that can be designed to detect emission sources, quantify emission rates, analyze gases, or it's some combination of the three.

We, also, investigate the performance of methane sensors space on the platform, there are six cubes, such as, is it on a handheld device, is it on a vehicle, a robot, a drone, an aircraft, or is it on satellite?

We, also, need to be aware that the types of infrastructure being surveyed for emissions, or being include with new technology, will also have a bearing on the sensors that work best, or the methods that need to be deployed, for those sensors to work.

For example, a technology might work great, for a leak investigation of a pipeline, but it may not be ideal for measuring emissions at a compressor station, or at a meter deck.

And this leads us to understanding, in these cases, or our methods that might work best, based on the objective of the user, the kinds of sensors and platforms being used, as well as, the types of assets being surveyed.

So this, kind of, sets the stage for a couple of technology examples that I'm going to share with you, just for some context. Okay. So first off, here, we have a set of methane detectors, for first responders.

And these are demonstration platforms that we assembled, at GTI, but they contain, basically, off-the-shelf components. And so just to level set, we're defining a first responder, here, as a, the first person, from the utility that arrives on the scene, to make an assessment, if there is a potential issue, like a leak.

Other first responders, like, like, the fire department, may follow. And so these are designed to give the first responder a tool that allows them to monitor a wide area, with just one person. So they don't have to be in many places, at once.

What makes these different than some of the other types of technology like that's on the market, is that, these wirelessly connect to any device that has Wi-Fi.

So you can see concentrations of methane, at strategic locations, around the site. You can, also, see if the remediation that you're doing is making a difference and, more importantly, other responders that arrive on the scene and have an easy way to get into that mesh network and see what's happening.

And we got a number of different controlled-relief field campaigns to assess performance of these sensors in, both, cold and warm environments.

And the nice thing about this project was that, we involved our manufacturer, at the actual field campaign, so that engineering feedback received, during the performance testing, was directly fed to the manufacture, to again incorporate refined design into the product, which dramatically improved the efficiency of the design.

So this technology is a slightly different variation of the same concept.

Specifically, if a surveyor finds a hazardous leak, say, on a, on a buried pipeline, they need to stay with it, until the repair crew arrives.

And, additionally, they may have to go back, like, daily, to see if the repairs worked. These sensors are designed to stay behind, which frees up the surveyor to go elsewhere, if needed. And, as you can see, in the pictures, here, they're designed to go on barholes.

The dome, at the top, is the antenna, which can still work, even if it's covered with a bit of things like sandy flow, or snow, and the sensors and battery are actually in the stem and are under ground. It's, also, designed to handle a lot of weight, so they could be put in something, like, manhole covers.

This slide shows, how the data is pushed to a server, and then to a dashboard that reflects this. The battery life can range, at least, two weeks to six months, depending on your desired data transmission rate.

So basically, if you can get by with

less readings, like, say, one reading every five to six hours, it can go months, before you need to deal with the battery.

And there are some devices already out there that have modules, like these, but we found them to be expensive and you need to purchase their viewer bot, so you can't use whatever device you want, to see the data.

And both the sensors I just showed, were designed with open standards to avoid that, that kind of lockdown. And you can walk up to these sensors, with an App, on your phone, or tablet, and then you can access the dashboard.

Okay, I wanted to touch on some of the R&D that we're doing in the handheld sensor stage. This is a hot topic. Lots of our industry partners are interested in understanding how different types of handheld sensors perform, as this technology advances.

And so I'm just going to touch on a couple of projects that we're doing in this space. The first is how well sensors perform in finding small leaks, with various obstructions encountered in and around buildings, during leak survey, while the other focuses on performance of handheld sensors at gas-filled structures.

For example, some windows having coatings on them that reduce the performance of the sensors, if you're trying to, like, shoot a laser through a window, to see how much gas might be inside of a structure.

These two things, in the pictures, here, were tested at different angles and at different distances, from controlling leak point that were stimulated at, both, indoor and outdoor labs, located at GTI.

The new technologies were also incorporated, with additional leak survey instruments, so that we had a benchmark. The big takeaway from this performance testing is that, there's a tradeoff between beam size, so sensors with center beams have improved accuracy, at long distances, and can detect smaller leak sizes, but they don't perform too well, when obstacles are encountered.

And the lighter beams lose some accuracy, at shorter distances, but they perform better at indicating a leak, where there may be very obstacles between the leak and the surveyor.

And, on a related note, we're also testing a quantitative gas imager that claims to, both, detect and quantify a leak in a single instrument. And so maybe more to come on that, we'll see how that performs, as testing shakes out.

Okay, so along the lines of unmanned platform, we're also testing technical robots that can be used to enter a hazardous structure, and these robots are tested on their ability to perform, as a viable means of entering an unsafe building, to measure methane concentrations.

We looked at, how well they could get through the doors, climb over debris, climb stairs, et cetera. We discovered that the platforms perform pretty well. They were able to enter structures right up to 100 feet away and they could fairly, easily carry a variety of methane sensors.

And we, also, have numerous studies underway to test methane sensor performance on drones. This is a DOT sensor study aimed at predicting a drone platform that's ideal for transmission pipeline leak protection and pipeline integrity threat monitoring, in a single platform.

And we're exploring the performance of the system in a variety of (audio interference) types that are difficult to access by motor vehicle. A situation, for which drones would be a useful alternative, when serving pipelines.

The performance testing includes large scale field laboratory trials, as well as, field campaigns, at operating sites, located in towns and terrain, like, eco-forested areas, or wetlands.

And we're, also, exploring air base sensor solutions, for distribution line surveys that combine GPS, or Global Positioning Systems, with INS, which stands for Inertial Navigation System, that provides orientation, velocity, and position, and it also combines meteorological sensors with FMCW LiDAR, which stands for frequency-modulated-continuous-wave spectroscopy, with light detection and ranging.

It's a bunch of big words, but it, basically, is what gives you the 3D topography, like, what you see, in that picture, up there. It, also, has georegistered sensors for gas mapping overlay capability that you can get in real-time.

And this particular technology that we're testing has been used quite a bit, by upstream oil and gas producers, who have mounted it to a six-wing aircraft. Their results there were quite promising in, both, surveyed and controlled relief field testing.

And so we're testing it, for its performance for use in utility distribution systems that have more complex surroundings, like, busy streets and tall buildings, coupled with much smaller leaks, a combination that had limited leak surveys to ground base survey platforms, like, vehicle mounted, or a handheld platforms, in the past.

So it's the hope, with this technology that it can, not only, find large leaks, but it can also be able to find small underground leaks, as well, in an urban environment, with real-time mapping. And you're, actually, going to be able to hear, I think, a bit more about this technology, in the next panel.

Okay, so I want to move on, real quickly, to some direct abatement technology. This first piece of tech is called the Methane Mitigation Thermal Electric Generator, or what we call MMTEG, for short.

Sending it through a cooperative agreement with the Department of Energy, National Energy Technology Lab, or NETL, and it began back in 2016.

So a pneumatic controller, are you, all of our production and at facilities along gas delivery systems, for a variety of reasons, but it's usually to move liquids, at the wellhead, or during gas separation, at gathering (audio interference) stations.

Many pneumatic controllers are run using natural gas and they vent regularly, or they get stuck open and they vent even more. An individual pneumatic controller may not emit very much, but together they're among some of the largest sources in production gathering and processing.

And so this technology explores a way to retrofit pneumatic controllers, such that they're powered, by air, in a more cost-effected way than your traditional instrument air systems, you might see in the field.

It takes a small amount of gas in the line, it combusts it, and it uses that heat to charge the battery. A power store in the battery is then used to run the small compressor, so that air is used for pneumatic, versus natural gas.

And we're beginning full-scale pilot

testing and anticipate having a commercially viable product, by year's end. We, also, have been approached, by several manufacturers, who are interested in (audio interference) for processing plants, as well as, several oil and gas majors, who would like to put systems, like these, at their remote sites.

Okay, the last technology I'm going to highlight is the linear compressor technology, it's also funded by DOE NETL. So the natural gas industry has about 10,000 compressors moving gas through transmission system and storing it underground, in high-pressure formation sites, salt caverns.

And, decompression continued about 20 percent of the total emissions from the entire value chain, costing about a billion dollars in loss gas, every year, just a very large and expensive store.

In fact, compressors leak, or vent, so much that compressor stations have engineered vents, to direct emissions out of compressor buildings, to prevent the possibility of gas from building up.

And it's, at that gas vent, where this technology captures, compresses, and puts that gas back in the line. And it's just a single moving part and it's all sealed up, so it doesn't leak, or vent.

There are other types of small crude compressors on the market that do the same thing, at separation tank, but those compressors are only designed for a low-pressure off-gassing, like, a 100, or so pounds, per square-inch, so they're not suitable for taking low-pressure vented gas and injecting it into a high-pressured pipeline that can exceed something like several thousand pounds, per square inch, whereas, this technology can.

And, if you plan enough, in advance, you can actually catch a blowdown, with a linear compressor, and direct that gas back into the line, as well.

The CORE technology has been

demonstrated and we should have a full scale prototype in the next year, or so, continuous (audio interference) compression with the industrial scale deployment.

And that is about all the time I have, so I'm going to wrap it up, there. Thank you, all, very much, for your time, and I'll be around for questions.

MS. WHITE: Thank you, Dr. Stuver. Nice presentation. And I'd like to introduce our third panelist, from METEC, and that is Stuart Riddick.

And, METEC will be presenting on their Upstream Pipeline Safety Inspection and Detection Project. Handing it, handing it over --

DR. RIDDICK: I --

MS. WHITE: -- to you, Stuart.

(Simultaneous speaking.)

DR. RIDDICK: Thank you, very much. Good morning, everyone. My name is Stuart Riddick, I'm a Research Scientist, with Dan Zimmerle's group, at METEC, as described, before.

I'm here to talk to you about the Upside Project, which is a new project that we've got to measure and to look at the Upstream Pipeline Safety Inspection and Detection.

This is a collaborative -- oh, a collaborative project, between Colorado State University and the University of Texas at Arlington and the, the PI, Dan Zimmerle and Kate Smits, down in Arlington, and you can see, here, we've got quite a big group of scientists and grad students working on the project.

So the Upside Project objective, this is, this is a project that somebody, by Mark Martinez and Joy Irwin, Memorial Public Project Fund that was -- that's run through the COGCC, so the Colorado Oil and Gas Conservation Commission.

And, what we're interested in doing is we're looking for leaks in the Upstream Pipeline leakage, so that's flow lines to the well path lines and the gathering lines, for the produced gas and from the well pans to the compressor stations, for example.

And the objection of the project, or its investigative the -- and document, currently, protection practices, for flow and gathering lines, investigate the fact that there are hydrocarbons and proves the understanding of the existing and emerging leak detection methods and develop recommendations, for flow and gathering, gathering line monitoring.

Now, the difference between the Upstream lines and something distribution network is that this is preprocessing, so the gas doesn't have mercaptan in it, so it's, it's more difficult to detect on the, on the fly, so walking past you wouldn't, necessarily, detect it.

And, as it says there, it has heavier hydrocarbons in it, so sometimes the leaks are first detected, as a pool of oil comes up to the surface, so relatively speaking, versus the distribution lines, these are a bit more difficult to detect and identify what's going on.

Now, the rationale behind this is

that, currently, there's no simple method to estimate leakage rate from pipelines. So I -- a difficult process and some, before, there, there are a lot of technologies that measure high concentrations, or their concentrations, but it is the, the use of these concentrations to a foreign emission rate that's quite difficult to do.

Advanced instrumentations not readily-available for routine field applications and advanced instrumentation requires that they skip the measurement processes.

They, both, got the problem that the flow lines and gathering lines are very, very long and, generally, in quite remote areas. So the proposed -- the approach is to develop something that's relatively easy to calculate the emission, right, based on easily measured field parameters the industry are already taken and estimate well-enough to engage level of concern, we'll see later in the presentation that relying concentrations doesn't necessarily give you very good understanding of the emission rate.

And, what we want to do is make this approach applicable to a wide range of some surface conditions and surface -- surface conditions.

And so our overall plan is to use our controlled release test beds, at METEC, and try and characterize the size of concentration of the 3D plume, above the leak to the high-precision ethane analyze it.

And then, once we've got this baseline measurement, we can then investigate the variability leak characteristics, caused by gas composition, and it meets it again, we can, we can add heavier hydrocarbons to our, our gas being emitted and see what effect that has on there.

Then, what we'd like to do is, we'd like to take this -- or, what we're going to do is take this out into the field and have a look at the effect of different subsurface conditions, so measure different soil types, and then, lastly, to look at solution testing.

So we're going to be looking at four, no more than four technologies, including some that are industry standards and we're going to test these, at METEC, given the normal flow rates and, potentially, go out into the field and see if we can detect some, some leaks from gathering lines and be able to perform, find the emissions from them.

I believe, the main idea is to develop assessment tools, or guidance, on new methods of detection and, perhaps, to inform current message on best practices, or how they can best detect leaks and in what conditions they may have to change their, their current measurement approaches.

So for those people that don't know METEC, this is the METEC site and what we have a, Dan likes to call this the Hollywood well pad. I'm sure people have heard this before.

And this is an example of, I think, we've got five well pads on here and these, there's no oil and gas underneath these, these are all fed from gas houses, with flows, gas flows of known emission rates.

And these can be -- emissions can be positioned anywhere, and one of, I think, it's running up, between five and the thousand, 500 and 1,000 emission points.

And, if you come to METEC and you do some ad hoc testing, you can ask, where you want the, the emission rate to be and how large it is.

So if you're, you want to see the effect of a condensate tank on the down-flow of gas, we can release an emission rate, from the top of the, the tanks that you see, there, on the right-hand side, and you can drive around, in the background, and see if you can estimate an emission from that, from that release rate.

Now, for our -- what we're, currently, doing, at METEC, is we're developing two new tests. The rural tested, by which, it will be at the top, left-hand side, of the screen, you see, there, and the urban tested, is going to be developed from the south -- that's the road to the south side of METEC.

So we -- what we're going to have is we're going to have a rural test bed which is effectively very much for the Upside Project, which is looking at emissions in undisturbed environments from the subsurface, and we're going to create leak points at three and six feet.

And we have an array of instrumentation below the surface, on the surface, and above the surface, in order to see what the -- to investigate the methane plume below the ground, how it appears on the surface, and then if you were to be moving through it with a detection solution, what you would actually see.

And to compliment that we have an urban test bed, which is made to represent an urban and suburban environment with an asphalt road that's going to be laid and underground infrastructure, which mimics or simulates gas, water, and communications lines, moving in the environmental area, and in the environment.

So for the rural test beds, we've got, as I said, we've got above-surface measurements. These above-surface measurements will be at -- currently we're thinking at eight points, these are the blue circles and the green circle, green circles we're going to have measurement points for the surface.

So this -- these are just going to measure the standard concentration. And our aim is to see how the plume, the 3D plume, changes, as the -- as the environmental conditions change.

So if you have a very windy day and you might see a very thin plume that isn't very high, but if you see a, if you have a lot of solar radiance and not much wind, what you're going to see is you're going to see the plume being lofted and not traveling very far.

So hopefully, we're going to capture these images. And the way you these are different from point source is we know from experiments done before is that emissions from the subsurface are emitted over an area.

So instead of a point source, you have an area source, and we know from the ethane migration project, which is a project we just finished with UT Arlington, this area changes relative to the environmental conditions.

This is just an image showing what the subsurface measurements are going to be, so it's 3, 4, 6, 15, 60, and 90 feet from the emission point, we're going to have five sensors below the ground at different depths, and this is going to enable us to see how quickly the gas moves through the ground and the furthest extent of the gas.

And this is just a picture of the -- what's going to happen at the, in the urban test bed, so we're going to have three houses, which are effectively garden sheds, which are going to represent houses and aerodynamic obstructions and we're going to see how the gas released at different points is affected by these obstructions.

So the experimental approach, we're going to use long-term methane releases at the urban and rural test beds, so as I say, long-term releasing anywhere from three days to a week and it's going to establish itself in the above surface plume.

The release rates are going to range from four to 300 standard cubic feet an hour. And once the plume has reach steady state, so we've done measurements before at METEC, and between 12 and 24 hours, the plume -- reaches a steady state.

And we're going to measure the above surface plume, how it changes in the changing environmental conditions, the surface concentration and the below surface concentration.

And we're going to repeat experiments in different environmental conditions, such as the meteorology, so you get wind speed, you've got the stability of the air, you get temperature, atmospheric pressure, the depth of the release.

And, as I said before, the gas composition to reflect the fact that we're measuring flow lines and gathering lines, which can re-condensate, as well as gas.

So our working hypothesis, from previous work that we've done, is that flow line gathering lines looking, you know, in Google Maps, you see these are generally located in rural areas.

On leveraging our previous -- our previous work, we know that surface concentration, and hence the surface emission, changes with environmental conditions.

And the group have a paper in review at the minute describing the ESCAPE model, which is a dynamic process-based model that estimates the surface concentration, or the changes in the surface concentration, with changes in environmental conditions.

And the top right panel there shows an example of what happens if you look down on a release, and so this release was one meter, or three feet, below the surface, and the yellow shows high concentration and that runs to percent methane.

And then, as low, as little distance as five meters from the surface we can see the concentration at the surface, so that's measuring the gas (audio interference) disappears down to background.

So this gives us an idea of what one might observe if you are on a walking survey if you miss, or if you walk ten meters without taking a measurement, you perhaps miss the surface concentration that you're looking for to detect the plume.

And these are very much affected by the surface conditions, so if you're measuring -- here, we've got a measurement on the 21st of March, last year, and the measurements were done in cold, snow, and wind, and the surface concentration was around 40,000 PTM.

However, the next -- or two days away,

Colorado being Colorado, it was hot and sunny, and the concentration dropped below 10,000 PTM, for exactly the same leak in exactly the same position.

So you're almost halfing the concentrations that you identify at the center -- at the center of the -- or directly above the leak, so that's the center of that square there.

So we can see here if you're doing a walking survey that between two days, you've got a detection of almost half, just purely on the surface concentrations.

And what we're hoping is to, as I say, to take this information and move it forward to the leak detection solutions. And I think it can demonstrate it best with what we -- what we have here.

So this is looking side on in three different situations. So we have windy conditions, so when it's sunny and, sunny and dull, you know, it doesn't matter, but when it's windy, the gas will move quickly from the surface, surface concentrations become -- smaller, and the plume is more difficult to detect.

And this is especially true if you're flying, for instance, a drone, and it's very windy, the best place to measure if you're flying a -- hoping to catch the gases measured by a drone is to measure downwind of the leak and that will be dependent on the wind speed.

If you have sunny, low conditions, the gas generally will move vertically, and the surface conditions will be much larger.

So in sunny, low wind conditions, you might see something better if you were to fly your drone through the plume, you're more likely to detect something, or if you're doing it -- doing the ground survey.

But if you were to do a driving survey and you were driving next to where you imagine the pipeline would be, you may completely miss the plume.

And in dull, low wind conditions gas

gets trapped at the surface. The surface concentrations are much higher, so it's easier to detect with a walking survey, but if you're flying a drone through this, the plume might actually be below where you're flying it.

So what we're trying to tease out here is, you know, how can we, as atmospheric scientists, help identify which is the best method, given the best wind conditions or the best atmospheric conditions, and we'll do this with measurement as well as a bit of modeling, as well.

So we're going to review leak protection solutions, and if anyone is out there and wants to get involved in this, in this project, we'd love to hear from you.

We're going to perform literature studies and identify the minimum quantification limit and quantification ranges of several leak detection solutions. Methods will include industry standards, such as walking surveys with gas sniffers, and if anyone's got a dog that detects gas leaks that would be fantastic to do, as well.

We expect to test no more than four technologies during this project, and that's -- that's just in the proposal, and establish an unbiased selection criteria to detect -- test detection methods and technologies. And so we obviously want to identify with industry partners which technologies would be the most interesting to test.

And that brings us to thanks to our advisory boards, and we're working with industry partners, such as ConEd, SoCalGas, PG&E, Western Midstream, and DCP Midstream.

And we're also working with first responders, such as Poudre Fire District and Fort Collins and White Plains Fire District in New York, and thanks obviously to the COGCC. And we're also working with PHMSA as a regulator.

Thank you very much, and if you've got any comments, or you'd like more information, if you contact Dan Zimmerle or myself at Colorado

State, and we would love to hear from you. Thank you very much.

MS. WHITE: Thank you, Stuart, for your presentation.

DR. RIDDICK: All right.

MS. WHITE: And our -- yep. And our fourth and last panel, at least for this morning's session, is from QuakeWrap. Firat Sever will be presenting on QuakeWrap's no-dig leak repair technology. Handing it over to you, Firat.

DR. SEVER: Good morning. Thank you, Sentho, for the introduction. Yes, again, my name's Firat Sever, I'm the Pipeline Division Manager at QuakeWrap.

And today I would like to do a brief presentation on a new technology that we are developing for trenchless or no-dig point repair of gas transmission pipes.

Let's take a quick look at the contents of the presentation. I would like to start with giving you some background information about QuakeWrap. The company has been in the industry for decades and performing all kinds of infrastructure rehabilitation.

And then we're going to move on to the SuperLaminate Technology. That's the brand name for the no-leak point repair system.

And after a brief introduction on SuperLaminate, we're going to get to the specifics of the U.S. DOT PHMSA Small Business Innovation and Research Program that is, that has been funding the SuperLaminate project for the past year.

And then we're going to talk about the next phase of that program, which is Phase II, which is going to start in about a month or so.

QuakeWrap was founded in 1994 by Professor Mo Ehsani, who is a retired professor from the University of Arizona, where he developed the first applications of using a carbon fiber-enforced polymers to rehabilitate bridges, mainly, after a major earthquake in California in the '80s.

Then he founded the company, and upon his retirement he shifted his entire focus to QuakeWrap, and after that point the company has seen steady growth. Now they have more than 60 employees in our construction arm, FRP Construction.

We are proud of our innovations. The company has more than 20 patents and six of which are on pipelines. QuakeWrap also received a congressional recognition about, for being a U.S. exporter. That has contributed significantly to the infrastructure safety around the globe.

In addition to myself, the key team members of the SuperLaminate project include the company president, Dr. Ehsani, Dr. Owen Yan, as Technical Leader, Mr. Matt Winn, who's our lab manager. Owen leads the land tests, and Matt leads the testing protocol that we implement in our R&D lab here for this project and others.

We are forming an Industry Advisory Board that includes Mr. Jerry Rau, who was also quite instrumental in Phase I, and introducing us to the pipeline integrity industry.

In addition to Mr. Rau, there are four others, highly-seasoned veterans of pipeline and (audio interference) markets, from condition assessment, engineering, and -- as well as testing prospectives. We are constantly looking for new advisory board members, particularly from operators, so if anyone is interested, please feel free to contact me anytime. Actually, there are a couple of other pending members, as well.

So that industry feedback is quite important for us, and that is essentially based on a recommendation we received from Foresight Science and Technology, as them being our advisors on the commercialization side of things in Phase I, and we are -- we are planning to continue on working with them in Phase II, as it has been quite fruitful to collaborate with them.

Throughout this workshop, there have been many good presentations that laid out extensive data on problems with pipelines and leaks and methane emissions.

And I am -- we all understand that the main focus of this workshop is reducing leaks on methane emissions, but on the other hand, these leaks, also -- and failures can be catastrophic.

The data from PHMSA suggests that hundreds of people died over a period of 20 years and, in addition, to billions of dollars spent on mitigating efforts after pipeline failures. Deterioration and corrosion of these pipelines, to my understanding, is the second lead cause for those failures.

There's potentially a large market for pipeline rehabilitation and repairs, which has been performed by conventional means, although it -- use of advanced materials has taken place in the oil and gas industry, but the overall method is dig and replace, or dig and repair.

Large operators have been allocating a good deal of money in their, for their capital projects, which include a good deal of repairs and rehabilitation in their -- for their transmission pipes, as well as distribution pipes.

And there are 300,000 miles of gas transmission pipes in the USA. And that market, by third-party studies, is expected, the pipeline integrity market, is expected to grow at a rate of about three percent.

So what actually is SuperLaminate? It is a carbon fiber reinforced polymer lining system. Carbon fiber is the strongest material used in the construction or infrastructure industry that enables making really thin laminates as liners to rehabilitate pipelines and other infrastructure.

SuperLaminate project started, actually, about a decade ago with compressed and pre-cured liners for point repairs, and that idea was received well, by PSE&G of New Jersey, and it has been used to span gaps and drip pots in gas distribution systems.

However, that system, as we call, the first wind fitch (phonetic) SuperLaminate has mutations in terms of being deployed through --

for water mains, fire hydrants, or for launch pads for gas transmissions mains because of the unlimited flexibility.

As such a couple of years ago, we started to entertaining the idea of using uncured laminates. That is fabric saturated with resin, so it -- which will be wrapped on a packer, the ability to inflate and deflate and deploy to the repair point, through, you know, traveling through a fence in a pipeline.

And the concept is, again, launching this assembly through launch pads in gas transmission mains and utilizing a single access point, multiple repairs can be performed by taking the laminate to the repair points and then inflating the packer and deflating. The inflation and deflation part can be done with air or steam, should an accelerated cure is sought.

We have been testing the system for the past three years, and last year, those testing efforts and proof of concept for PHMSA SBIR project Phase I, was intensified and we performed a high-pressure test on a 24-inch steel pipe that was -- the wall of which was ground down to 25 percent of the original wall thickness, leaving only about two millimeters.

And we installed the SuperLaminate system in the lab and pressurized it to 670 PSI, and no apparent deformation or failure were observed.

We also performed some chemical resistance tests based on the feedback we received from industry professionals through a workshop we implemented at the initial phase of the project.

We dissolved samples in -- into a 20 percent methanol solutions, so methanol was regarded as a potentially harmful chemical to this material that can be found in gas transmission lines.

The exposure period was for 1,000 hours. The results were inconclusive. Some of the samples did demonstrate some degradation in terms of tensile strength.

So in Phase II of the Program we are planning to implement longer term chemical resistance tests, up to 10,000 hours, to get more conclusive results, thereby determining whether there's a need to improve the resin formula for better chemical resistance.

The picture on the right here shows what a lined pipe with SuperLaminate looks like. It's hardly discernible. The laminate, after it's cured and also compressed against the inside interior of the pipe is of negligible thickness, about a millimeter or maybe one-and-a-half millimeters.

The edges are smooth, so there are no concerns about reducing the cross section of the pipe or impacting hydraulic capacity, or conveyance capacity. And also pipe system repair with SuperLaminate would accommodate cleaning and inspection devices, as well.

So in Phase I, the proof of concept was achieved by installing the liners and pressurizing it and testing it. And the technology assessments, we receive the technology assessments from Foresight, which really encouraging evaluations based on interviews conducted with pipeline integrity professionals.

In Phase II, our main tasks will be further in-house testing for chemical resistance, third-party testing and certification to be conducted by ABB Integrity, in Houston.

And deployment system design and testing is another quite important task that we are, we have been talking to (audio interference) robotics firms in terms of (audio interference).

I apologize about the background noise. So I moved close to a military airport and I -- turns out that there are fighter planes flying over me at this time.

So that Phase II part will include the deployment design and testing at the robotics firm. Commercialization efforts will be intensified after a few months into Phase II, and we are planning to continue on working with Foresight, and we are expecting that it will be more exciting in Phase II, as we get more close to deploying the system for actual applications.

The design of the SuperLaminate system in Phase I essentially was based on ASME's PCC2 Part 4, which is essentially written for external wrapping of pipelines with composites, mainly carbon fiber reinforced polymer. Based on the test result we have received to date, we have learned that that approach is actually a little bit too conservative for SuperLaminate.

The main reason for that is the main model failure, particularly for leaking pipes, is separation from the host pipe, for external repair, which is not -- which is not the case for internal lining.

We utilized computational modeling with the finite element method. And not only, this method enables us to explore limit states for failures, but also the distribution of stress, strain, and deformation throughout the pipe wall and the lining system, inside.

We completed a conceptual design for

the deployment system in Phase II, test protocol. We're going to start building it a couple of months into Phase II, and we are trying to fine tuning the design and, also, in the contracting phase with U.S. DOT Volpe, for the Phase II part.

And that system will, essentially, mimic a launch pad with bends up to 90 degrees and, again, working with a robotics firm, we will perform some mock installations in our backyard before we, you know, conclude that the system is ready for an actual application.

The idea's also utilizing the launch pads in tandem with cleaning and in line inspection efforts, so that condition assessment and repair potentially can be performed within a short time frame.

Phase I commercialization efforts were limited because we focused on testing and proof of concept, however we did receive a quite useful evaluation from Foresight Science and Technology, with the feedback they received, from us and industry professionals they made quite encouraging statements.

Also state -- pointed out that this technology could actually be disruptive and could be -- the best evolution for certain type of repairs in gas transmission pipes.

And I keep emphasizing gas transmission lines. In fact, the technology's applicable to -- gas transmission lines is our main focus because a little bit larger pipe is easier to accommodate the assembly, but there is a great potential to reduce the deployment assembly and use the same repair system for distribution pipes as well.

Foresight also looked into competing technologies, and there appears to be no technology ready, on the market, to repair long-range transmission line, transmission lines, with that no-dig technology.

FRP Construction is QuakeWrap's installation arm. It was founded about a decade ago, and performed hundreds of projects on all types of infrastructure.

And the reason why I'm emphasizing FRP Construction is that it also -- having an in-house installation capability gives us the leverage to conduct the very first projects on our own, where other contractors, which we'd prefer to work with down the road, might be reluctant to get into a new technology at -- that might have high-level of liability issues.

So what's next is completing the Phase II contracting with U.S. DOT Volpe, and we expect that to happen probably around mid-June or end of June time frame, and then Phase II will officially start and, upon some further design efforts, we're planning to start building the test set up in a couple of months.

And then the third-party testing center, of course, we would prepare and then a team from QuakeWrap will travel to Houston to install the system at the lab for third-party testing, and those tests will run parallel to each other, the deployment and mechanical strength test, also including cracks and holes on pipes, with respect to sealing leaks.

The overall commercialization efforts, we expect them to intensify about three, four months into Phase II when we have a better idea about overall test protocol and how things are rolling out at that point.

And the overall project, Phase II project, is expected to take less than two years. And at that point, our goal is to make the technology ready for the first part of the installation in the field.

I would like to, again, extend my appreciation to U.S. DOT Volpe Center and PHMSA for supporting the project. Our partners to date, particularly Mr. Jerry Rau, who provided a great deal of help in Phase I, in introducing us to the pipeline integrity market in the oil and gas industry.

And Dr. Sherry Borener of PHMSA, who has been very supportive as our technical point of contact. Also, Mr. Robert Smith and Chris McLaren provided through the good feedback throughout Phase I. With that, I'm going to conclude my presentation. Thank you, again.

MS. WHITE: All right, thank you, Dr. Server, and thank you for your presentation. And just a big thank you for -- to all the presenters, and I will turn it back over to Sam.

MR. HALL: Thank you. Ladies and gentlemen, we are going to extend this session by about ten minutes into the lunch break, so that we can take question and answers, or questions, so they can answer your questions.

We do have several calls -- several questions in the Q&A box in the lower-left, and if you wish to make a comment over the telephone line, if you're dialed in, dial 1-0 on your telephone and you'll be placed in the queue.

First question that came through was from Mr. George Ragula. Let's see, for R&D being performed by universities funded by PHMSA, what is the mechanism for providing technical advisory input from the industry?

MS. WHITE: Thanks, Sam, and --

(Simultaneous speaking.)

MS. WHITE: -- thank you.

DR. RIDDICK: Hi there, it's Stuart Riddick here. I assume that's directed at me. Just get in touch with either myself, Stuart Riddick, or Dan Zimmerle.

If you just Google METEC, you should be directed to all our contact information, METEC and Colorado State University, you'll be directed to all the -- all our contact information. It'll give you an overview of the projects we're doing as well.

So we've got a lot of different projects there as well. So anything you would like to get involved with, please get in touch with us and we'll -- we'll get back to you as soon as possible. Thank you very much.

MS. WHITE: Thanks, Stuart. And I -- and I'll follow up to that, as well. We're currently exploring opportunities to assist universities with partnerships with industry.

And on past CAAP solicitations, we've

encouraged universities to partner with pipeline operators or industry providers to increase research applicability to pipeline safety, and our CAAP review criteria also includes consideration of those partnerships.

So I encourage all attendees to go to our website and -- where that actually provides all of our research projects, including CAAP projects. Thank you. Next --

(Simultaneous speaking.)

MR. HALL: All right, our next -- thank you, Sentho. Our next question comes from Lindsey Fitzgerald, and this is a question directed to Carrie.

Can you speak more to what additional research is needed for leak detection surveys, identification, and quantification? Your presentation briefly touched on it. What specifically needs to be looked at, and why?

MS. GREANEY: Yeah. Thank you, Lindsey, for that question. So I'm speaking from, I guess, the perspective of the transmission sector of the pipeline industry and also from kind of our experience in trying to complete some of these large scale testing opportunities.

Typically, we've seen that the large scale or field application has been limited because they release the product and they're done, relatively, in a singular technology testing opportunity.

So standardized tests for repeatability of detection, side-by-side comparison of sensor type to understand limitations or reliability of detection quantification are kind of what we're looking to do on a broad, more broad basis, to expand that data set.

And, again, I'll say this is -- this is especially true for pipeline right-of-way, where we're looking at longer range, so kilometer or miles of pipeline-type applications and, you know, again, that might be true for what you saw like the UAV methane detection.

Typically, we're seeing, kind of, small areas for which we're doing the detection, and we don't always get a true understanding of how the application might be over long range because of the beyond line of sight limitations from the FAA.

But, again, those are some of the types of specific projects that we've looked to try to have expanded or done in a more standardized manner, so that there's an understanding if -- if there's universities or there's other technology providers that are doing research outside of PRCI, or within the government, or joint industry groups, trying to be able to compare the data sets, would be helpful, as well.

Hopefully that answered the question and if, if it didn't, you can follow up with me directly, or you can follow up in the chat here, as well. Thank you.

MS. WHITE: Thank you, Carrie. And back to you, Sam.

MR. HALL: Paul Espenan asks how will the impacts of your planned release be mitigated? I believe this was directed to one of the presenters, but I can't tell from the question which one.

MS. WHITE: I believe that was to Stuart at METEC.

DR. RIDDICK: Excuse me, how will -- I didn't really understand the -- how will the --

MR. HALL: How will the --

(Simultaneous speaking.)

DR. RIDDICK: -- mitigated?

MR. HALL: Yes, how will the impacts of your planned release be mitigated? That's the question, and I don't have further context.

DR. RIDDICK: The environmental impact -- oh, I see there. Well, what we -- well, this is -- this is effectively what we do at METEC, is we release gases of known rates and they go into the atmosphere.

And it's for the different technologies in order to quantify them, so it's proof of different methods. So the idea is actually to detect it and not to mitigate it.

So that they're all controlled releases over a short period of time. And relatively speaking, they're -- they're quite small emissions, so they're not actually mitigated at all.

MR. HALL: All right, thank you for that answer. That concludes the questions in the Q&A box. Operator, do we have anyone queued in the -- on the phone call?

OPERATOR: No questions from the phone at this time.

MR. HALL: Okay. Sentho, would you like to close up the session? And then I can provide some instructions for lunch.

MS. WHITE: Sure. Well, again, I just want to say a big thank you to all of the presenters, and please join us after lunch as we continue our technology and R&D Initiatives Panel, where Kandi Barakat will be moderating. So again, thank you, all.

MR. HALL: All right, thank you. I'll reiterate Sentho's comments. Thanks to our panelists, and certainly thanks to those of you who have provided comments and questions.

At this time, we're going to break for lunch. We appreciate your patience in letting us run about ten minutes over for that question and answer session.

We will -- the proceedings will resume promptly at 12:45, so please be sure to come back by then so as not to meet -- miss any of the proceedings.

The web meeting and the conference line will stay open, so there's no need to hang up or reconnect, if you wish to just stay on the conference. With that, enjoy your lunch and we'll see you back at 12:45 p.m. Eastern.

(Whereupon, the above-entitled matter went off the record at 12:07 p.m. and resumed at 12:45 p.m.)

MR. HALL: Ladies and gentlemen, welcome back from your lunch. I hope you had a good break.

I want to cover some quick housekeeping items for those of you who may be joining us for the first time.

All of the audio in this call is being handled by AT&T. The AT&T operator will handle all of the voice calls for you.

Audio is best through the AT&T line and you can see the audio information, the toll-free telephone number and the access code on the welcome screen, as well as in the top-left corner of your screen.

When the time comes for question-and-answer and you wish to make a comment with your voice, you must be dialed into the teleconference. We are not activating microphones on your computers, so if you wish to make a comment with your voice, you must be dialed in to the teleconference.

If you're not dialed in to the conference call, you'll be able to hear the proceedings through your computer speakers, but you won't be able to make a comment, as I mentioned.

And in that case, you are welcome to make comments or ask questions in the Q&A box on the lower-left corner of your screen.

If you're having any technical difficulties, please ask your question in the Q&A box on the lower-left of the screen, and we'll address IT issues as quickly as possible.

We do intend to adhere to the agenda as strictly as possible, and therefore we have not scheduled breaks. So, please take breaks on your own as necessary.

The proceedings are being recorded. The recording and a transcript and the presentations will be made available on the meeting website where you registered, in approximately ten business days.

It is now my pleasure to introduce Kandi Barakat, Operations Supervisor in PHMSA Engineering and Research Division, as the moderator of our next session, which is the second of two Technology and R&D Initiatives Panel discussions. Ms. Barakat, go ahead.

MS. BARAKAT: Thank you, Sam. Good afternoon and welcome to our second panel on leak detection technology. It is my pleasure to be here today to moderate this session.

Now, we will have four speakers. Each presenter will have 15 minutes to present. Following the presentation, we will have Q&A.

Please note that while vendors will be presenting on their technologies today, this does not equate to any promotion or endorsement by PHMSA of any vendor on their respective technologies.

Accordingly, PHMSA will not entertain questions as to the capabilities of any vendor technology, or the vendor's ability to assist pipeline operators in meeting regulatory requirements.

And while all the panelists have impressive bios, we won't be able to share those at this time, due to limited time.

Now, I would like to introduce our first panelist, from Bridger Photonics, Dr. Pete Roos, who will be presenting on Bridger Photonics gas mapping LiDAR solutions. Dr. Pete, handing it over to you. Thank you.

DR. ROOS: All right, thank you very much. Thank you, Kandi, and sincere thanks to PHMSA for the opportunity to speak, and call out to Susan Stuver and GTI for the plug earlier. Really appreciate that.

I'm excited to talk today. Our company is Bridger Photonics. My name is Pete Roos. I'm the President and CEO of Bridger Photonics.

And what we do really well in our company is develop advanced laser sensors and analytics to solve impactful industrial challenges.

Now, we've done that -- let's see if I can get this pointer to work. There we go. We've done that in the industrial metrology space and I'll be describing how we're doing that for the oil and gas industry as well.

Okay, we've developed gas mapping LiDAR, which the goal is to make emissions reduction simple.

What we do is we take this advanced proprietary laser sensor and we stick it on the underside of an aircraft, and we've also deployed on drums, and we'll talk about that in a bit.

But we scan oil and gas infrastructure throughout the entire natural gas (audio interference). So, some of these slides at the first, a lot of our businesses in the production sector, so assume that, but we do a lot of business in the transmission sector.

And finally, there's a large announcement coming out, hopefully today, about some partners in the distribution sector as well. We're actually scanning entire metropolitan basings from the air to uncover leaks in the distribution sector as well. And I'll show you a little bit about that.

So, what value do we bring? And

again, some of this is focused on the production sector, but it applies equally as well to the transmission and distribution.

While the plumes catch our eye and attract our attention, as they should, so much of the value that we bring in the production sector is all these sites that don't have emissions.

Because those are sites that our clients no longer have to visit with ground crews. We typically save our clients between 60 and 90 percent of their ground crew visits. They no longer have to visit those sites.

And when they do have to visit a site, we provide extremely actionable data, and I'll show you that in a second, to direct crews straight to the source of the problem.

There it was, actually. Okay, somehow it managed to do the animation. Great.

Okay, the second value we bring is reduced emissions. In the production sector, we use and we select a sensitivity that allows us to catch greater than 90 percent of the emissions in typical production basins.

And moreover, to be published, third-party research shows that we're actually catching more emissions. Think ground patrols with OGI cameras in the production sector.

Now, this is a single study and it was not a large sample-set, so -- that was Matt Johnson's group up at Carleton University in Canada. We're looking forward to actively doing a much larger scale study to confirm that and we're looking forward to those results.

This next value we bring is increased safety. I mean, at the end of the day, everyone wants our clients' crews to get home safely to their families at night. So, obviously, number one, we find leaks.

But then, because you don't have to visit sites as often, we reduce field crew exposure to onsite hazards and windshield time.

And finally, when you do have to visit a site, again we provide advanced awareness for you and your crews.

The final value we bring is simplification to regulatory compliance. In the transmission sector, we are used regularly for compliance with PHMSA, both in the US and in Canada, and more recently in 2020, a number of operators submitted us as the first-ever applications for Directive 060 Alt-FEMPS.

So, that's the alternative methods for digital reduction in Canada. And just three weeks ago, ExxonMobil announced that submitted us as the first-ever alternate method for the EPA's OOOOa regulation. So, we're active in regulatory approval in all sectors.

Okay, this gives you an example of actual data products. We typically work with our clients to -- oftentimes our clients use some sort of GIS software, whether it's as simple as Google Earth or ArcGIS, and then sometimes even our transmission clients literally take a pdf of our imagery and check off every event that they find.

And in addition, we provide

spreadsheets in Excel format. They're also very useful.

Just to take you through our data products, everything flows into satellite imagery, whether it's through ArcGIS or Google Earth, or it can flow through.

We also provide aerial photography that's geo-registered at the time of our flight, so you knew exactly the state of your assets at the time of our flights.

We can identify equipment from the aerial photography on your site. And then, of course, we have the plume imagery, which is in path-integrated gas concentration.

We have algorithms to backtrack to drop a GPS pin, typically within 60 of the emissions source. And then, we have extremely accurate algorithms to calculate the emission rate, or flow rate, of the emission event as well.

In the end, the goal here is to simplify the process of taking that information in, and our hope is that anyone on this call today could view our data and immediately know where to send the crews to solve a problem, and simplify that process to generating the work order.

Last year we performed a number of studies. We aggregated results from these studies.

So, we were able to generate a distribution of the percentage of emissions that are caught in the Permian Basin. This was two thousand site emissions distribution.

Percentage of emissions that are caught as a function of the detection sensitivity that wouldn't be needed to detect that percentage of emissions.

And while I'm not showing the actual emissions distribution here -- contact us if you want to see that -- but here are the results.

At the far end, the satellite companies are installing solar infrared spectrometers. And they typically would catch between ten and twenty percent of the emissions that were caught from this study.

Now, you might say that's fairly low, but man these satellites with solar IR cameras serve a very valuable purpose, because they're able to scan the entire basin, right now, I believe, on the order of a few weeks, and ultimately, when they increase their fleets, they're going to be able to do that on the order of a few days.

And so, they're able to catch these large emissions very quickly. So, they have great value.

And there are other technologies that they compete with, but that's the general -- they're catching the super-emitters really quickly, which is great value for emissions reduction efforts.

All right, there are also folks that take those same solar infrared cameras and put them on aircraft. And these folks -- the solar infrared does have its challenges.

First of all, you need the sun to be at certain altitudes in the sky. You can't handle shadows, you can't measure in shadows. When there's clouds, it challenges reliability of your measurements, and ultimately, the sensitivity is challenged also.

On aircraft, using third-party data, the sensitivity would have gotten the aircraft solar IR. It would have caught between 30 and 40 percent of the emissions that we measured.

So, we ended up developing a LiDAR solution. So, LiDAR, meaning instead of using sunlight to measure the existence of methane, we bring our own light source. We bring a laser.

And so, we shine a laser down and see how much the light gets absorbed, and we can determine how much methane is there.

We choose to use a sensitivity for the production sector, that catches greater than 90 percent of the total emissions in the production sector.

Now, we could go further. And we do.

For distribution sector, for instance, we're all the way down. We're typically 95 percent. Probability detection is around 25 SCF, or 50 kg per hour, right now, and our next-generation sensor should get us down to ten SCF.

But if we did that for the production sector, we would absolutely bury our clients. And so, this is the key, is a thoughtful plan. And you really need those emissions distribution to be able to thoughtfully plan out how we're going to both policy and argue moving forward.

Okay, those were some production slides. Here's a few slides, we're very active also in the transmission and distribution sectors. Here's an example of data for the transmission sector.

Obviously, our spatial resolution is sufficient to oftentimes distinguish and resolve between multiple pipelines on our right-of-way.

And then, we provide this auditable swath, which is really valuable for us, because we can audit what our light providers cover, and it's valuable to our clients because they can audit us on what we cover.

And it's going to be valuable for the regulatory bodies, because they can regulate and audit the operators to make sure that their sites were covered.

And I'll point out that while we flew this section, this was a pond. And our laser light just bounced right off the pond, and we don't get signal from standing water.

And so, you see the out in the swath coverage. Well, we want our clients to know that. So, we want you to know what we got and what we didn't get. And that's important for all sectors, actually.

And I'll point out for the transmission sector, yes, we cover subsurface assets like pipeline right-of-ways. But also, we found a lot of emissions in the transmission sector are coming from the compressor stations.

And so, we, of course, also scan the surface assets as well, right in line with our pipeline scans.

The distribution sector, similar. As I said, there's going to be a public release, hopefully today, on very large effort with a major gas utility that we're working on.

And similarly, we increased the safety of the distribution sector. I won't comment today on how many leaks per square mile we're finding, but it's significant, and both from a safety standpoint and for reducing emissions.

And, of course, we provide actionable data so our clients can direct the crews straight to the source. And this is important across all sectors.

And finally, my last slide, in the end, we've been hearing this and getting a lot of pull from the industry to certify the emissions of operators. And so, to do that, we really need to nail quantification.

And so, this shows our measured emissions rate versus what was measured on the ground for controlled emission rate for our blind study.

And so, you want everything to fall on this one-to-one line. And as you can see, the correlation of our data is extremely good.

And over here shows a similar, it's just percent error now, as a function of the emission rate. And you can see there's a spread for each measurement. And for a single measurement, that spread is about plus or minus 15 percent.

But all we have to do to beat that single measurement uncertainty down is to make multiple measurements, measurements of many different leaks along a pipeline, for instance, or upstream.

Once you start making many, many measurements of multiple leaks, then we're able to average that down and you can approach our bias, which in this study was just plus-three percent.

So, in terms of certification and to check inventory throughout the value chain, the aerial LiDAR technique can be very valuable and accurate for certifying.

Okay, that's it. And thank you for your time. I really appreciate it.

MS. BARAKAT: Thank you very much, Dr. Roos. Now, I would like to introduce our second panelist from Satelytics, Sean Donegan, who will be presenting on Satelytics' methane detection capabilities.

MR. DONEGAN: Thank you, Kandi. Welcome, everybody. And thanks for the opportunity to present. I do need to be able to be made the presenter. I was going to show software live. Nathan?

MR. HALL: Oh, I'm sorry. Let me stop what I'm sharing. And you should now be able to share your screen.

MR. DONEGAN: Super. Thank you. Okay. Are you now seeing my screen, Nathan? Can I just get a check?

MR. HALL: Yes, we are.

MR. DONEGAN: Okay. So my name is Sean

Donegan. I'm from a company called Satelytics. We're based in Perrysburg, Ohio. We're a software company. We're based in the 751st most visited city in the nation, hoping for people to visit to raise that number, come visit us.

We're a software company with a very unique set of data. We have over 36 algorithms. They're based on a convolution on Euro network, so artificial intelligence, which in layman's terms means the more data is held, the smarter and more accurate it becomes.

And we have three real goals in life, and that is to minimize consequences, detect events early, so that you can deal with them, and in the case of methane leak you're not losing revenue for those oil and gas companies.

Number two, minimize cleanup costs, because they escalate quickly. And number three, very simply, to minimize the court of public opinion. Because, of course, when there are events, they tend to have a very negative event in the press on the oil and gas and the pipeline community.

So, our goal is to get out ahead of that and minimize any of those consequences, or all of them.

Software. All of those algorithms can run independently. We are agnostic to the data source and we use a series of data. Practically speaking, most of it comes from satellite.

And there's a real practical reason, back to the minimizing of consequences. Pretty straightforward.

If we gather the data today from a satellite and we're pointing it over a specific area, that's referred to as tasking. Today, you can revisit anywhere in the world, in some cases multiple times a day. But let's say, to be conservative, four to five times a week.

And literally within a couple of hours, using the Satelytics data and analytics, you have the answers in your hand. So, there's no weeks or months or days. You'll literally have it within a couple of hours.

And that's true whether we're looking for methane, liquid leaks, arsenic and heavy metal concentrations in water, geohazards like landslips and landslides.

But of course we are agnostic from the data source. So, it could come from a satellite, a drone, a plane, a stratospheric balloon, or all of the above.

Today, you can revisit, as I said, four to five times a week anywhere in the world with a satellite conservatively, but the billions of dollars that's being spent above the Earth's surface will mean that in years to come, the next five years, you will be revisiting anywhere in the world with a satellite within minutes.

So, we're using the power of the sun, which shines on the Earth's surface or a body of water, and to see below the surface we're using corroborating factors, or surrogates.

So, the old tradition of a canary down the mine. There's no better an example of, if you have a methane leak or you have a liquid hydrocarbon leak below ground, vegetation's incredibly sensitive. And it is one of many ways that we can detect what's going on below grade.

But our main goal is to look at the spectral signature. The DNA, if you will, of the target. So, methane has a unique spectral signature and absorption feature.

And unlike any other software company that you're going to hear, we want to get very specific. So, not only do we locate and identify the constituent, but we quantify it.

We feed to a low of nine kilograms an hour on flow rate, and we feed to a low of ten parts per million in the plume. And it's being applied in industries, whether that's your local distribution gas company, or whether it's the traditional oil and gas footprint.

And literally within a couple of hours, we can see buildings, structures, salinity, liquid hydrocarbon, methane, all from the same set of data.

And we're using very high resolution

data so that we can get to the granularity. Not the big emitters, or, let's look using 20 meter by 20 meters on the ground and guess, or 400 meters by 100 meters and sort of pinpoint, here's the state of Florida, and try and guess where the emissions are. We want to base it on true, tried and tested facts.

The software itself, every algorithm is groundproofed before it's put into commercial operation. We started life on Lake Erie, looking at toxic algae blooms. That in the other 35 algorithms take about three to four months to develop, including the groundproofing.

But with methane, it's complex. It took us 18 months to develop, because the three factors that you have to account for is close to the location, as you're seeing those methane escapes in the plumes, is wind velocity, wind direction, and relative humidity, all factors that need to be screened in at the current time.

But literally, once you've set up the capture mechanism using a satellite, the data is then caught on a frequency that you determine. So, you're pointing it over an area on a frequency.

As that data is gathered, in our particular case we make use of the amazon cloud extensively, because clearly we don't ever delete any data, because we want to keep on learning from that data.

And then, within a couple of hours, whether you're using a tablet, a browser, or a smartphone, that data is available. Nothing to install, no user licenses -- because we want to make it very easy -- nothing to install because we don't want any threat to any corporate network, in the day of ransomware and malware, etc.

And then, literally you're looking at those results. And of course, we don't work in isolation. People use Ezri, GIS systems, reporting systems, audits.

All of that data, any of the imagery, any of the analytics, any of the results that we produced, can be output in a number of different ways.

Simply, you can select a group of records and download them, if that's your preferred method.

Or, for the propeller heads in the room, we could be using anything from the APIs or the web services, to take a look at that data.

So, let's take a look at some of those live. Nathan, could you help me out? You're now looking at my software screen, sir.

MR. HALL: Yes.

MR. DONEGAN: Okay, thank you. So, what you're now looking at is the data's been collected by Satelytics' process through the engine, and you're now logged on to Satelytics' two-factor authentication. And you can see on the left-hand side of the screen we've got a little menu that we can hide and pull right.

And then, I thought I'd show you the full cycle. So, one of our largest customers in the world, they have put Satelytics through many blind studies and many tests in many different locations around the world.

And I'm literally going to show you a forward operating area. They always say never work with animals, CEOs, or software live, and here we go. Here's two of them.

And literally, we can look at the plume and pick out any of the pixel values where we're measuring that methane in parts-per-million, or indeed what sets us aside is we can also look at the accurate flow rate that may be coming from that particular area.

We make it very simple to use. So, we've got a little feature called jewel maps. It defaults to being synchronized. Literally, you can turn off the synchronization and say, show me a different location on a different date, zoom into the area, pick out any of those particular pixels, and of course look at the flow rate if you so wish.

Well, that's one aspect. But in your local neighborhood, you could also be looking at methane that's closer to home, that's literally on a distribution network. And in this particular case, again, same sort of granularity where we want to get to.

You can see this is a very suburban setting. We can pick out any of the point values on the methane itself, or indeed, if you wish, you could look at those flow rates by simply clicking on where we see the source.

Same feature, jewel maps. Look at the other side of the coin. You can unsynchronize this. And all of this is real customer data that I've been permitted to show you. So, it's real live, it's in operation, and it's data that's relatively recent, so you can see. And there, of course, you can see the flow rates on both sides of the equation.

Any of the data you've selected could be literally downloaded by hitting the little button.

Now, let's take it full circle. And then, I'll stop if there are any questions and answers.

But the full circle, as one of our largest customers, has got Satelytics in its drive to net zero, but also it's looking at the other side of the coin, and in this case is looking at the carbon offset.

So, that all becomes part of that methane equation. And in years to come, maybe we'll be looking at forestry as part of oil and gas as any other.

And here, what you're looking at is from the same set of data. Satelytics is telling this particular customer all the tree speciations from above the Earth's surface, literally from the same set of data.

And then, this particular customer overlays it with a grid. And I'm not sure the relevance of the size, but each one of these grids are 16 meters by 16 meters on the ground.

And if you click on any one of them, it will give you not only the exact or the average -- excuse me. It will give you the average tree cover, or give you every tree that's in that particular area, and the tree height.

We measure tree heights within six to eight percent of the accuracy. That's what the groundproofing has shown. And with methane, just to finalize that, while we measure nine kilograms as the flow rate and ten parts-per-million as a low from a plume capture, in the blind studies that have been conducted, and some of the sites like METEC and VIVER in Spain, we have been within six to eight percent on the flow rates.

But conservatively, if you put it at ten percent to either side of the number, that's where we are.

So, everything you see here is real. That's a little snapshot on Satelytics. And I'll stop there and hand it back to the moderator.

MS. BARAKAT: Thank you, Sean. Very interesting presentation. Now, I would like to introduce our third panelist from ProFlex Technologies, Stuart Mitchell, who will be presenting on ProFlex continuous leak detection technology. Stuart, I'm handing it over to you.

MR. MITCHELL: Hi. How are you doing? Thank you so much. Just to introduce myself, my name is Stuart Mitchell. I'm one of the managing partners over at ProFlex and I'm going to be talking through our partnership with Siemens Energy for spontaneous leak detection.

So, today we're going to be talking about spontaneous leak detection. What this really means is that any breach within a pipeline that produces a liquid or gas creates a extra pressure wave in the pipeline.

This is basically and simply a wave that travels up and downstream in the fluid in the pipeline, and can be detected by a system.

This is not to detect creasing leaks, such as weeping seals, or a leak in a valve or anything.

So, why have we done this? A lot of people talked about either detection and how fast the systems can go pick up new leaks in pipelines.

So, for us, anything that's longer than five minutes in being able to detect and notify a leak, is more around leak confirmation than leak detection. It's like shutting the stable door after the horse is already gone.

Our system has also been designed to pinpoint leaks in that time frame locally. The round about plus or minus 20 to 50 feet. What this does for an operator, it enables those to go and be able to confirm the leak, but also significantly reduces their explanation time in going to repair that leak.

So, the other thing, people talk about product loss. Obviously, you reduce loss identifying a leak very quickly. And small leaks may be half-inch to two inches in diameter.

Helps you reduce the amount of product that you lose, but also allows you to take action on the pipeline before you cause a massive release.

We'd like to think of our system as being really beneficial in terms of lead security. So, what this means is that you might have other systems already in your pipeline.

We can use our system, the ProFlex sealing system, to supplement your existing leak detection system, for critical pipeline segments, or even the whole pipeline system.

And we specifically designed the system to be able to respond to new and pending regulations. So, where you have to have particular reaction times to a leak and be able to shut valves, etc., we're not relying on outside sources, photographs, satellites, people on the ground, or particularly the amount of the product that's released.

We can react, as I say, in probably less than five minutes, to get a notification to the operator that a leak has occurred. So, this system represents proved 24/7 monitoring and fast response for small leak sizes.

So, how does it work? We're working up a variation of negative pressure waves. So, what this actually means is when you get a small hole or rupture in a pipeline, you get a local pressure change.

That local pressure change permeates through the gas or liquid, up and downstream to the pipeline, and what you can see here is, with the pointer, a couple of sensor sets representing.

So, the wave is propagating up and downstream along the pipeline, hits the sensors. From there, what we're doing is we've got hardware locally along the pipeline that can process that data in real time.

And what we're trying to achieve here is we're trying to remove background noise and highlight the leak event. So, by employing engineers, algorithms that are able to filter the signal along the pipeline, we're able to take out what is normal, in terms of pipeline pressure response, and highlight exactly what you need to see. A leak has occurred.

What then happens is, the local buses that you see here under the pointer, they're able to transmit a small section of data. So, each of these boxes or nodes, through pressure and temperature sensors, detects a leak has occurred. We transmit a small packet of data to a cloud location. In this case, the Siemens Energy Cloud.

And that each time a sensor picks it up, it has a different timestamp that that has occurred.

So, what then happens is, when we've transmitted that data, we're able to use location algorithms to accurately locate where the leak has occurred. And we can do that within maybe 20 to 50 feet of accuracy.

The interesting thing about the system that we've worked, probably over the last nine months in partnership with Siemens on, but probably the last three years now in developing, is the range of applications.

So, people have mentioned sometimes about needing to go play over cities, towns, and different areas, to give you coverage.

Whatever system that we're on, we can detect leaks on. So, whether it's long transmission lines on pipelines, whether it's down to gathering systems, we've got a system working upshore already, process plants, anything. The system is able to be designed and specifically engineered to suit those systems.

And as I say, that allows you to pick up a leak within five minutes of it occurring, and notifying the operator where it is accurate to plus or minus 20 to 50 feet.

Technology is applicable to a range -- I mean, we've mainly talked about gas today, but whether it's water, gas, oil, or mixtures, and things like NGLs as well, we're able to detect leaks within all types of media and all types of pipeline consideration.

So, little case studies, kind of getting into the meat of how we do this. We've got pressure sensors on the pipeline that are sampling roundabout a thousand samples a second. And what you see here is the blue trace, is raw pressure data.

So, this was from an actual pipeline that we are monitoring. And what we're actually doing here is we're gathering live data, maybe for up to one to two weeks.

And why we do that is, we're trying to establish what is normal operation for that pipeline. And by normal operation, for an operator, that could mean opening and closing valves, shut-ins, shutdowns, heating pumps up, shutting them off, turning them back on. We count that as normal. We gather all that data.

What we also do is we introduce leak events after the same time, through simulating them through a small bore opening in the pipeline, open a small valve, release a tiny amount of fluid -- maybe -- or gas, five to ten seconds, and that's enough data for us to be able to process that.

What we then do is design filters to turn this blue line here into this yellow line, which is our filtered signal.

What we're trying to do is when we release the leak events, which is shown by the small green dotted lines, this was the timing when we released the leak on this line.

It's a very small leak, maybe a quarter-inch in diameter, and for only five to ten seconds.

What you then see is a filter here, as we move along, is removing all of this normal operation.

This is quite dynamic. The line that you see there in blue is changing maybe from 145 to 185 PSI, and is varying quite significantly.

We'll turn that into a flat line, and then what you see just after the green dotted line, which is the pining of when a leak was released, the simulated leak, you see this yellow line here spiking.

And in each case, we're able to filter out what is normal operation to a flat line, and the very, very obvious spike, which was the leak event.

We then set thresholds -- a leak section threshold. We have this red line compared to the yellow line. Not the blue, the yellow.

And what we're doing here is giving you a great deal of margin against normal operation. So, effectively, we're taking maybe two weeks a month of normal operating data, designing filters, simulating leaks to your leak threshold side as an operator, and then we're putting a threshold to make sure that you minimize or remove entirely false positives from the system, but get notified, as I said, in well under five minutes -- typically, a minute of when the leak event has occurred.

So, the system. A leak detection system with Siemens is an engineered solution. So, it's tailored specific to your pipeline. And that's where we differ from, I guess, a lot of providers that we are specifically looking at -- what is happening in your pipeline system -- and then tuning the hardware you see over here, which is common hardware, we're using the software to tune that system specific to your pipeline.

So, how we do that is pretty straightforward. So, we take a couple of field test units to field, and we determine feasibility.

And what we're doing here is we're connecting pressure and temperature sensors onto the pipeline, any small bore branch from a quarter-of-an-inch upward, we can connect our sensors to it.

And then, what we're doing is we're sampling normal operations in the pipeline, and we're introducing small bore, maybe a quarter-inch, half-inch, eighth-inch even for some clients, size of leak, and we're catching those on our boxes that are separate. Typically, anything up to 20 to 30 miles apart on the pipeline.

So, we use that data to determine the number of nodes on the pipeline. And then, we tune our algorithms based on that data. We're writing specific algorithms for your operations in your pipeline.

What we're also able to do is adjust those algorithms, or response to them, in real time, depending on change in pressure, temperature, or the fluids that you're pumping, or gases through that pipeline.

A great example of this when we're going NGLs, for example, they can bear intensity massively, and therefore the propagation rate changes.

Our system is able to update in real time, in the event of a leak, to accurately adapt to those changes and find out where the leak has occurred.

Once we tune the system, we drive on it for you, and then give you an operational handover once everybody's happy, and then provide ongoing maintenance and support as a complete package.

What I'm going to do here is hand over to my colleague Matthew Grimes over at Siemens, and he's going to talk you through the more interesting part, which is a video capture of a site demonstration of our system.

MR. HALL: And this is Sam Hall. Please stand by while we load the video.

MR. GRIMES: Sure. And thank you, Stuart. Like Stuart said, my name is Matthew Grimes. I'm with Siemens Energy.

What we're seeing here is two of the edge nodes that Stuart was showing you on the pipeline. They are collecting this data at the edge. We simulate a leak up here, and you can see that data on the edge node, that this is the filtered data that Stuart was talking about in the slide a couple of slides back.

That data is captured. Down here, you can see that each edge node is registering that as an incident, so there's a timestamp and an incident that's associated with those two different nodes.

That data is collected -- it collects about a minute before and a minute after the event is detected. It sends that data up to the cloud, and then the cloud uses that data to compare with one another and decide, is this an incident? Is this a leak?

The spike you're seeing here at the end, that is actually closing the valve. You wouldn't normally see that on a leak but we do on our loop.

This is our test loop cloud software. So, these are two different sensor nodes that show up there. And they're the ones that's collecting the data and sending it up to the system.

After the cloud has had a chance to review the information, this will be the software that the operators will use. And they will get either a text message, an email, however they want to be alerted that there was an incident. That will give them a link that will bring them into this software.

Once the cloud is done reviewing all the information, it will send them an alert and

-- there we go. So then, you'll get an alert saying you have a leak on your line.

That will give you the exact GPS within 20 to 50 feet of where the location is, and you can send that out to your boots on the ground that can go out and start working on it.

Like I said, they will also be forwarded an email with the information about the leak, links to where it is in the map, and here again we just have an additional one, just in case you missed the first one, water coming out of the pipe.

And this whole system's set up here in Houston, and we have different variations of demos and options that we can do.

And that's the demonstration on this end. Can we go back to the slides? I believe there might be one or two more.

MR. HALL: Please stand by.

MR. GRIMES: Thank you. Oh, I guess that was it. Thank you guys for your time, for listening.

MS. BARAKAT: Thank you, Stuart. And thank you, Matthew, for that presentation.

(Simultaneous speaking.)

MR. MITCHELL: Yeah, thank you so much for your time.

MS. BARAKAT: And now, I would like to introduce our fourth panelist from ABB, Inc., Dr. Doug Baer, who will be presenting on ABB's leak detection technologies. Dr. Baer, handing it over to you.

DR. BAER: Great. Super. Thank you very much. So, I greatly appreciate the opportunity to present an overview today of ABB's comprehensive line of advanced leak detection solutions.

My name is Doug Baer. I'm the Global Product Line Manager for Laser Analyzers, within the Measurement and Analytics Division at ABB, a leading provider or natural gas and methane advanced leak detection technology. The same technology is used in our industrial and scientific analyzers used by companies and leading scientists worldwide.

Since Congress last reauthorized PHMSA, gas leak detection technology has advanced dramatically. Today, commercially available technology can find, map, locate and quantify natural gas leaks and emissions with higher reliability, faster speed, and lower costs, than ever before.

Advanced leak detection technology provides decision-makers with the best, most accurate, reliable, cost-effective, and timely information, so that they can make the most informed decisions possible.

In the next 14 minutes, we will present a brief overview of ABB's innovative and advanced gas leak detection solution. These solutions combine leading-edge technology, based on cavity-enhanced laser absorption spectroscopy techniques, with recent advances in software, that describes gas plume dispersion, and with cloud-based data analytics cannot only detect, but define, locate, attribute, and quantify, leaks as well, to reduce risk, increase safety, and decrease weight, throughout the natural gas infrastructure.

So, there's been many excellent talks given to motivate the development of advanced leak detection technology, so I'll simply throw up this slide and say essentially, we're talking about the ability to improve health, improve safety, and save money, and while decreasing waste.

ABB features one gas measurement technology, which is patented, that we use in all of our analyzers, for detecting, finding, mapping, and quantifying, natural gas leaks, while driving, using MobileGuard; walking, using MicroGuard; flying, using HoverGuard; or stationary, using EverGuard.

These are commercially available solutions that were designed to operate independently as standalone products. But together, they can even provide better data.

All of these individual advanced leak

detection solutions, one, respond accurately to local changes in background methane and ethane concentration in ambient air, as small as a few parts per billion.

High sensitivity methane and ethane measurements allow faster, more reliable detection of large, small, and even hidden, leaks far from their sources.

They respond quickly to dynamic changes in gas concentration, and report data rapidly, to enable operators to find more leaks in far less time than conventional methods.

They require virtually no warmup time, so users can start collecting data essentially anytime, and within one or two minutes after power-on.

They generate quantitative digital reports automatically that summarize results, that include leak location, size, and attribute, obtained over a particular time interval, or during a survey.

These reports can be available,

essentially immediately, to a cloud-based server, always controlled by the customers, and thus to anybody anywhere with granted access.

Importantly, all solutions have passed rigorous cybersecurity testing and reviews, to assure data, security and full system integrity.

The schematic diagram in the left illustrates the principles of conventional diode laser absorptions technology. This technology has been around for many years, but lacked the speed and sensitivity to detect leaks fast.

ABB's patented LGR ICOS technology provides that extremely long -- on the order of several kilometers -- closed obstacle path within a compact package.

As a result, these analyzers, based on extracted sampling of local air, report local point-wise measurements of methane and ethane concentration, at rates up to ten times per second, with high sensitivity, on the order of PPB; high precision, on the order of 0.05 percent of reading and accuracy; and a wide dynamic range from PPM level all the way up to percent level; yet are also rugged, safe, and simple to service, essentially anywhere.

The operational lifetime of these analyzers exceeds 15 years, as all of our original batch of scientific analyzers produced in 2005 are still in operation.

These solutions that I present are commercially available -- not R&D. But we still have a vibrant team of scientists and engineers who continuously improve our hardware/software and analytical capabilities, and we are hiring.

So, let's first review MobileGuard, ABB's driving-based ALD solution, which is used by many utilities, LDCs, and oil and gas operators throughout the US, Canada, China, Europe, Australia, and South America.

The MobileGuard driving-based solution consists of four physical subsystems, and can operate in almost any vehicle, and include an analyzer capable of methane and ethane measurement, which is generally placed in the cargo area; a GPS or GNSS antenna and receiver, to geolocate the car and measurement location; a sonic anemometer, to measure local wind velocity, required for indicating leak origin and emissions rate; and a proprietary air inlet, mounted on the front bumper, designed to allow operation, even during rain and snow.

The fifth subsystem involves innovative software and communications, to analyze data quickly, to detect leaks in real time, predict their origin to within a narrow search area, and quantify their size in units of volume metric emissions rate, typically standard cubic feet per hour, meters per minute, or kilograms per hour, and present the detailed result immediately to the user, in a rich, quantitative graphical interface, and securely share the results to the cloud, if desired.

By measuring both methane an ethane specifically, we can attribute the emissions source properly, to either natural gas or biogas from a landfill, animal, or another source.

MobileGuard can record data while driving at highway speed, although 20 to 25 miles per hour is typical.

Unlike less effective, older mobile methods, which requires a vehicle to operate very near the source or drive slowly, MobileGuard requires no warmup time or compressed gas cylinders to operate, and can detect leaks hundreds of feet away from the source.

The software incorporates the measured data recorded continuously while driving, and utilizes advanced analytics based on complex fluid dynamic model of plume dispersion, and sophisticated analytical techniques, to quickly ascertain the likely locations of the leaks, the leak attributes -- like I said, natural gas or biogenic source -- the effective area surveyed upwind, and a quantitative estimate of the emissions rate, or leak size for each indication, and displays this information clearly, in real time, in a visual, detailed, easy-to-read yet graphically rich, user interface to the operator that include geospatial maps, whether on Google, OpenStreetMap, ASSURE, or whatever; and continuous data time chart and detailed system health metric.

This is just a brief slide to remind me to say that the data is recorded continuously, at a rate of typically between 1 Hz and 10 Hz, depending on the application.

In order to make the data maximally actionable, the data and detailed reports can, at user discretion, be securely uploaded to, and downloaded from, the cloud for sharing with stakeholders.

The cloud has user-access settings to allow re-drive by the user. It is also regularly audited to ensure it is secure, and 27001-certified.

Moreover, ABB Software offers a set of comprehensive capabilities dedicated to big data analytics, such as filtering, trending analysis over time and space, as well as asset class and pipe material, etc.

File system semantics, file-level security and scale, essential user management, and cohesion across all our leak detection solutions. All ABB solutions have been thoroughly and extensively tested for cybersecurity.

Conventional technology, based on infrared sensing or imaging, cannot deliver the results necessary to quickly and reliably pinpoint leaks, as we've heard already in earlier talks.

So, we invented MicroGuard, our handheld ALD solution, to complement MobileGuard, or as a standalone solution.

The MicroGuard solution incorporates the same technology as MobileGuard, to precisely pinpoint leaks quickly while walking. This novel solution incorporates a lighter, battery-powered analyzer, proprietary air sampling wand, along with sophisticated software that operates on a smartphone.

The MicroGuard software serves as a

wireless -- via a Bluetooth connection -- user interface that is simple and easy to use, downloads, reads, and views, geospatial maps generated and shared to the cloud by MobileGuard, allows users to incorporate notes -- whether they be written, audio, photos, and video -- into a live report during and after each walking survey.

It generates comprehensive, detailed, and digital reports summarizing the results automatically after each survey, and shares those digital reports to a cloud-based server after each survey.

MicroGuard's precision, better than 1 PPB, or 0.05 percent of leaving; fast response, around 3 Hz; and data rate, around 10 Hz; enable surveyors to quickly, reliably, and precisely, pinpoint leaks from a distance that may be missed by older, slower methods (audio interference).

Moreover, MicroGuard provides a digital workflow and enables users to monitor their overall performance and efficiency in finding leaks.

MicroGuard is an extension of ABB's renowned Micro-portable Series of Greenhouse Gas Analyzers, used by leading scientists on all seven continents.

ABB developed a handheld methane/ethane analyzer in response to industry demand, because walking surveyors, using technologies, typically require 45 minutes or longer to pinpoint leaks, if, in fact, they are successful at all.

Due to the high precision and time response of MicroGuard, the same as that in MobileGuard, walking surveyors can now find leaks within less than five minutes.

Since MicroGuard provides the same measurement sensitivity as MobileGuard, when walking surveyors and investigators arrive onsite, they can immediately start honing in on the source, rather than wandering around hoping to find it with far less sensitive conventional sensors, whether they be electrochemical, traditional, tunable diode laser, infrared camera, etc.

This diagram summarizes the result described in a walk package report generated after a walking investigation with MicroGuard.

In this investigation, a walking surveyor first downloaded from the cloud a map and data from a recent MobileGuard investigation, which indicated a gas leak emission source within the yellow shaded area.

The MobileGuard drive package was shared with and downloaded to the MicroGuard android app prior to the start of the walking investigation.

The path driven by the car is drawn in a color that corresponds to the methane level shown in the color scale on the bottom-left, that was recorded while driving MobileGuard, from right to left on the map shown. The investigator started the route near the bottom-center of the map shown.

Using our novel search strategy, the investigator was able to pinpoint the precise location of the leak in less than five minutes, despite the presence of several obstacles; namely fences and barriers.

Many other investigations have yielded similar results, but time does not permit me to describe that today.

Not all measurements can be performed while driving or on foot. To address applications requiring measurements in locations inaccessible by road or walking, we've reduced the weight of MicroGuard analyzer, in order to operate on commercial, unmanned aerial vehicles, or drones, to create HoverGuard.

This allows surveyors to investigate, find, map, and quantify, a leak while flying, near bridges, storage tanks, and locations with right-of-way restrictions, or otherwise difficult to access.

HoverGuard subsystems are like those in MobileGuard. They offer the same performance advantages, as well as mapping and reporting capabilities of MobileGuard and the entire platform; namely, speed, sensitivity, selectivity, time response, and environmental ruggedness.

HoverGuard has been validated in independent tests and field evaluations, in the US, Canada, UK, France, China, the UAE, and Singapore.

The bullets lists are essentially the same performance attributes for MicroGuard, which is not surprising since the obstacle configurations of HoverGuard and MicroGuard are similar.

Unlike other UAV-based systems based on open pathways absorption or infrared imaging, or LiDAR, that essentially recorded path average column density, HoverGuard measures gas concentrations and wind velocity at its location, and thus allows it to record three-dimensional, geospatial concentration and wind velocity distribution continuously, in real time during flight.

This allows it to effectively map the

evolution of the gas plume over time and our innovative plume dispersion model, to re-create the gas trajectory from which the origin and the magnitude of the leak source can be determined.

Early versions of HoverGuard participated in blind evaluations at the Methane Emissions Test and Evaluation Center that Stuart Riddick described -- or METEC -- in Fort Collins, Colorado.

As Stuart mentioned earlier, METEC is a controlled-release facility designed to simulate real world natural gas infrastructure, and was used in this case to evaluate the effectiveness of various leak detection technology.

During these tests, HoverGuard always operated at a safe altitude, five to ten meters above the top of all assets. The HoverGuard result, when properly analyzed, demonstrated a 100 percent detection efficiency for leaks larger than three standard cubic feet per hour, and over 90 percent detection efficiencies for smaller leaks, down to one SCF, or standard cubic feet per hour.

I have time for two applications to highlight. HoverGuard has been deployed over a river in New York State, to detect potential leaks in an underwater pipeline unintentionally subjected to overpressurization.

Conventional methods for leak detection in those situations involve looking for bubble.

Using a methodical and rapid rasser (phonetic) flight trajectory, HoverGuard rapidly confirmed the underwater leak, in agreement with the bubble method, and identified another node leak nearby.

In collaboration with researchers at Lawrence Berkeley Lab -- part of UC Berkeley -- and funding from the California Energy Commission, HoverGuard was deployed recently above an abandoned, uncapped, undocumented, and uncharacterized, gas well in the Sacramento River Delta region in California.

During this investigation, HoverGuard was able to find the location of the known Artesian well, and characterized the side, and showed that the well is still substantially active, spewing methane into the atmosphere.

What's even more interesting, is that HoverGuard was able to detect and estimate the location of a larger, previously unknown, emissions source located deeper into the marsh, in addition to several other peripheral, previously unknown, sources.

The three-dimensional plume data shown in the Google Earth figure on the left, were obtained from the MobileGuard fence-line flight pattern, flying at altitudes up to 33 meters high, as well as large, predicted emissions source location regions, in yellow.

This site was between several old oil exploration fields, and maybe an abandoned, undocumented well.

The diffuse nature of this source has made it difficult for other technologies to locate the finding, until now.

The figure on the right is a plot of the detection density conducted in March of 2021 for all flight.

And various sources pinpointed with the MicroGuard handheld sensor are clearly highlighted by the data collected by HoverGuard.

And if I have time, I'd like to play a video of the pool that is shown here.

MR. HALL: Please stand by while we load that video.

DR. BAER: So after traipsing through the marsh and the wetlands, we eventually found the large leak source indicated by HoverGuard within a bubbling pool. The video shows a large leak source found at this pool by HoverGuard. Look closely at the bubbles in the water. Note the size of the numerous methane bubbles emanating from this previously unknown large distributed source, which may be due to many underwater feet or broken wells that can be heard from many locations within the reed.

It is suspected that there are tens of thousands of undocumented leaks and feet throughout the United States.

That's enough of the video.

So to briefly summarize, ABB offers a wide portfolio commercially available, high performance advanced leak detection solutions that address the PIPES Act of 2020 by detecting, mapping, quantifying, and finding natural gas leaks wherever they may be for practically any application. Utilities and pipeline operators no longer have to use outdated equipment to ensure the safety of their assets and their customers.

At a high level, we believe minimum performance standards and a definition of advanced leak detection should be based on four key elements. One, detect leak emissions with high precision and thus at very low concentrations which, on the face of it, may appear to be small leaks but in fact may be large leaks that are hidden and/or distant. Two, estimate their locations. Three, estimate their size for volumetric emissions rates; and then four, complete these tasks and securely share the results in minutes, not days.

At ABB, we seek to provide our customers with the best product available. The customers using our technology tell us that they love it because it offers the most accurate, up-to-date, and cost-effective information on the size and location of leaks. This allows important decisions to be guided by local and up-to-date facts rather than broad or general assumptions.

With the widespread adoption, these commercially available, market proven, advanced detection tools will enable the oil and gas industry to discover and fix natural gas leaks quickly, maximizing safety and minimizing greenhouse gas emissions quickly, reliably, and cost effectively.

We look forward to working with PHMSA and the oil and gas industry, utilities, and the public to craft smart, sensible, and safe rules to ensure the safe and best commercially available technology in the marketplace.

My contact information may be found by searching online for my name, Doug Baer, B-A-E-R, and affiliation, ABB, and I would be happy to answer any questions. Thank you so much.

MS. BARAKAT: Thank you, Dr. Baer for the presentation. This concludes the four panelists' presentations. I want to thank you all. I will turn it to Sam Hall for questions and answers.

MR. HALL: Thank you, Kandi. We have just a few minutes for questions and answers for this panel, and we do have several queued up in the Q and A box. If you're on the telephone line and you wish to make a comment with your voice, dial 10 and you will be placed in the queue.

The first question comes from Paul Espenan from Bridger Photonics. What work are you doing to increase the size of the swath?

DR. ROOS: Yeah, that's a great question. We already have a proprietary scanner that gives us 40 degrees field of view if we want it. And so that, our swath is designed to capture the vast majority of typical well sites and right-of-ways. So if -- for us to increase the swath size right now buys us very little, because we don't catch any -- once we're covering your typical well pad and right of way, it really doesn't do us much good to increase our swath further. So we can but we don't have much incentive. We kind of hit that sweet spot for our swath size.

MR. HALL: Thank you. Pam Lacey, L-A-C-E-Y, from the AGA says, question for Dr. Roos. You said you can calculate flow rate. Have you tested this plane-based laser technology on known emissions from a flow rate at METEC?

DR. ROOS: Yeah, we have tested it at METEC, and we've tested it many times with industry as well. So I'm happy to share those results with you. Just come find us, but kind of typically, on a single measurement basis, under favorable conditions, a single measurement is plus or minus 15 percent.

There was a third-party, completely blind study recently that was performed by Matt Johnson's group up in Canada. We didn't even know we were being tested. And that was the other end of the spectrum, challenging conditions, and it was plus or minus 30 -- about 30 -- plus or minus 30 percent uncertainty. But again, I'll emphasize that when we scanned for an operator, their inventory includes many, many emissions. And so that single measurement gets beaten down so we end up approaching our bias, which is very small single digits. So that's -- as long as you have many leaks that we're scanning, or if you don't, if you only have a few leaks, we can scan them multiple times, but we end up approaching our bias, which is very small single digits.

MR. HALL: Thank you for that. We have a question from Nikos Salmatanis. This is a question for ProFlex. Has your technology been tested for multiple -- excuse me -- for multi-phase pipeline operations?

MR. MITCHELL: Hi, Nikos. This is Stuart from ProFlex. Yes, it has. And usually, that's quite a complex thing for making pressure wave based systems to do. With our system, we're able to cope with that through continuously measuring density, pressure, and temperature and varying propagation rate based on that. One great example of working with multi-phase was for a client with quite a complex salt water disposal system where we had events such as column separation and static lines, and by working out accurately where you need to place the sensors to ensure that you not isolate for any part of the system, our system can still work with multi-phase lines even in events where we get column separation, etcetera.

MR. HALL: Thank you for that answer. We have just about three minutes left in the session. Operator, do we have anyone in queue?

OPERATOR: No questions in queue at this time.

MR. HALL: Thank you. A follow-up question for ProFlex Technologies. What pressure was the case study operating at, and what size pipeline; what pressures does the technology work on, and what is the distance monitoring station can cover -- what is the --

MR. MITCHELL: So --

MR. HALL: -- distance that the monitoring station can cover? Excuse me, sir. Go ahead.

MR. MITCHELL: Sure. Knowing that we are probably a little bit short on time, the demonstration was a functional demonstration we did for clients. That was only a 4-inch line with pressures around about 20 to 30 PSI. The technology works on a range of pressures, anything probably as low as 10 to 15 PSI up to high as you want really. In fact, the higher the pressure, the better the system will function in terms of detecting leaks.

Distance between monitoring stations, that's just a function of, as an operator, what size of leak you want to detect and also, what's the pressure within the pipeline. So the smaller the leak size that you want to detect, the lower the pressure, closer together the monitoring stations have to be, and the reverse is true: higher pressure, pick a leak size, more separation. We like to define it typically between sort of 15 to 30 miles between stations, but you can go, maybe if you're looking for a very, very small leak at low pressure, down to five miles and anything up to even 100 miles in between them.

MR. HALL: Thank you for that answer. One moment while I modify my screen. George Ragula makes a comment. We've heard from a number of technology providers of significance as how their results have been validated by an independent source. From direct experience with the evaluation/validation of evolving ALD systems several times validated by independent sources, the actual results in practical field applications have always yielded different results. Unsure if terminology is part of this issue. A leak indication is not a leak until it is confirmed by boots on the ground that have barholed it out as part of the pinpointing process using a combustible gas indicator in order to properly classify the leak and hazard level. When collecting vast amounts of data under dynamic conditions such as varying wind conditions, directions, and speed, the likelihood that multiple leak indications are coming from the same leak source is a real concern.

That is a comment. Would anyone like to address that in our final minute?

MR. MITCHELL: Yeah. Stuart here from ProFlex Technologies. Just from the point of validation, actually, our technology is currently undergoing a program with DNB to have our results validated, the use of the software, use of the hardware on pipelines with real applications validated by DNB. So for us, that's a yes.

MR. HALL: Anyone else wish to comment?

DR. ROOS: I'll add that, you know, comparing to ground crews, it's challenging for a lot of our technologies, because we move so much faster than the ground crews. So for instance, we can scan up to hundreds of sites per day, and ground crews typically can cover three. So it's really hard to get apples to apples comparison for those. My -- I always advocate for completely blind testing where we're doing jobs and someone unbeknownst to us goes out on the sites and performs controlled releases. Then you get someone in their actual operations, and they don't know they're getting tested. I think that's the best way to go.

MR. HALL: Thank you --

MR. DONEGAN: This is Sean Donegan with Satelytics. We, for the last four years, every week have been part of a group consortium called iPipe in North Dakota. And that was part of putting real technology through its -- through field operations, and it was quite a process to get selected. And we've been collecting data every week, and we collected 3000 square kilometers up there and within a few hours, these folks were out groundproofing to validate what we were finding as well as blind studies at METEC, VIVER, and other places in the world, because it's not just about the volume of leaks, it's also about the environment in which you're trying to detect them. So they're very much a part of, I think, probably all the folks here who've presented concerns, what we develop in the petri dish matches in the real world and works.

MR. HALL: Thank you, Mr. Donegan. Quickly, to the gentleman who spoke just before Mr. Donegan, could you please identify yourself for the record?

DR. ROOS: Yeah, that was Pete Roos with Bridger Photonics.

MR. HALL: Thanks, Dr. Roos.

DR. ROOS: Happy to provide some of those blind third-party studies if you're interested.

MR. HALL: Very good.

DR. BAER: And I'd like to add something. Doug Baer from ABB. So George is totally right. A lot of these emission indication search areas need to be validated by boots on the ground. And in fact, every one of our many customers throughout the world now has tested the ABB's and vast leak detection solution, namely MobileGuard, for several months before finally purchasing it. And they looked at these things, and they assessed the ability for the technology to identify the estimated location and then turn those into actual leaks and then ultimately save time in finding the leaks. And of course, they always do. Otherwise, they wouldn't be our customers.

So the point is that the advanced sensitivity and precision that we're talking about -- and I want to take this opportunity to address some of the comments regarding the need for ppb or ppm or things like that -- what we're really talking about is not just the ppb sensitivity part, but because there's a background level of methane in the air that's typically about 2 ppm -- and I say about 2 ppm because it moves around a little bit -- what the instruments allow us to do is make very precise measurements on the order of better than .1 percent of reading because of the background level.

So because of this high sensitivity, the ppb sensitivity, we also can constantly get a high precision measurement. And that high precision measurement allows us to identify the presence of these little tiny blips in the background levels that allow us to accurately project the emissions location from great distances.

So it's not just about sensitivity, but it's about high precision. And moreover, it's about time response. And of course, we can't locate the actual leak location in terms of what fitting, but we can minimize the search area dramatically and allow, you know, on foot, you know, on the boot -- on the ground with boots to enable them to find these leaks in just under a few minutes. So that's the value of this advanced leak detection. It saves enormous amounts of time. It identifies leaks which previously, because of their hidden nature, go undetected until we get real problems.

In fact, if I can take the opportunity, there's one of these situations where we were actually testing the system. We did -- we -- an indication of a leak came up. We were a block-and-a-half away. We drove to the present -- to the location where we thought the leak was. We got out of the car and we're looking around with our MicroGuard, and we identified a crack in the road. And the crack was emanating on the order of 5 to 10 ppm. Now unless you've got a very sensitive and very fast responding instruments, 5 ppm signals can't be readily detected by a so-called ppm-level sensor.

So the people that we were with, our customers, were able to dig a hole, because they were qualified to do that, they dug a hole in the street and sure enough, under the street, there were combustible levels of methane generated from a large pipeline that was broken.

And so because of the nature of the way the methane was seeping out, it seemed like a quote, unquote, small source or small leak. But in fact, it was actually a very large hazardous leak that was, in fact, hidden. And of course, they fixed the leak and it was a big success.

But I hope that illustrates the value of these so-called high-sensitivity, fast-responding instruments to identify the presence of the leak and to find them fast, even though they might appear to be small leaks.

MR. HALL: Thank you all for your comments. We certainly appreciate your answering those questions. For those of you who are not able -- were not able to get your comments read or your questions read, we do apologize. Due to time limitations, we do need to move on to our next panel, but we do record your comments and questions on the Q and A board, and they will be entered into the record.

And I'd like to take this opportunity to remind everyone that you can submit public comments -- or excuse me -- submit comments to the public docket by May 24th on this meeting.

Kandi, do you have any closing comments?

MS. BARAKAT: I just want to say thank you very much to all the presenters. You provided very informative presentations and valuable knowledge with respect to leak detection technologies. Thank you very much.

MR. HALL: Thank you, Kandi. And I'll echo Kandi and thank our panelists and those of you who have provided comments and questions.

We'll now move on to our next panel. It is my pleasure to introduce Massoud Tahamtani, Deputy Associate Administrator for Policy and Programs in the Office of Pipeline Safety. He'll be moderating our next session, and the panel is focused on creating incentives to minimize methane emissions. Massoud, the floor is yours.

MR. TAHAMTANI: Thank you, Sam, and good afternoon, everybody. Exciting discussions and presentations on a number of promising technologies. Clearly, proven technologies will play a critical role in continuously advancing pipeline safety and reducing emissions from our pipeline system.

As Sam indicated, our last panel for today is a discussion involving possible incentives to help minimize emissions. And we have three very qualified individuals to help us with that discussion. First, I'm pleased to introduce Commissioner Diane Burman, who serves with the New York State Public Service Commission. She is a member of the National Association of Regulatory Utility Commissioners serving on a number of committees. She is the Chair of the NARUC and Department of Energy Natural Gas Partnership Initiative. Commissioner Burman was recently appointed by the NARUC President as Co-Vice Chair of the Select Committee on Regulatory and Industry Diversity, and to the task force on emergency preparedness, recovery, and resiliency as well as a task forces special subcommittee on lessons learned from COVID-19. Commissioner Burman also serves on PHMSA's Gas Pipeline Advisory Committee and we thank her for her service there. Commissioner Burman, the floor is yours.

MS. BURMAN: Great. Can you hear me?

MR. TAHAMTANI: Yes.

MS. BURMAN: Great. Thank you. I'm really happy to be here today. I'm going to talk a little bit on these issues. I know we're also going to have, hopefully, time for Q and A, and we do have other panelists. I'm going to give a short overview of current status of things. I'm going to talk a little bit about what NARUC is doing and has done, and I'm going to get under the hood a little bit very specifically to New York State. And then I'm going to look at other things to think about and some concerns and priorities.

For me, it really is important that we

underscore that the challenge and the goal of state energy policy, at least as I see it, is to balance reliability, environmental sustainability, and the cost of energy supply to meet the needs and demands of consumers and to support the growth of our state's economy.

That's why when, through listening yesterday and today, I really felt that that's sort of my understanding of what state energy policy is really resonated with what we heard, especially when there -- we talked about earlier today the mission of PHMSA pipeline safety research program, R&D program. And talking about that and focused on sponsoring R&D projects that were focused on near term success to improve safety, reduce environmental impacts, and enhance reliability. And it really does complement sort of my thought process.

The current administration is targeting carbon emissions from electro-power sector by 2035 and a carbon neutral economy by 2050. Many states, my state included, are looking at the role of gas in going more towards a decarbonized future. And analyses show that natural gas in particular is likely to continue to play a central role in global energy production even if human-induced global warming is held to the under 2 degree Celsius and that expanding and upgrading natural gas infrastructure may indeed be necessary to meet the big task of decarbonization. So it's really important for us that we do look at -- and this is a very important topic on creating incentives to minimize emissions -- it's timely and important that we make sure that we're fortifying and upgrading the system, because it could actually help prepare the existing infrastructure to transport zero carbon fuels as they become available, and in the meantime, focus on reducing harmful methane leaks from natural gas.

As I look at it since over the course of being involved in NARUC, we've done a number of things very complementary to this and actually, on our website at NARUC, there's a section for the Center for Partnerships and Innovation, which lays out under there a subheading on natural gas. And this does go into what the Natural Gas Infrastructure Modernization Partnership, which I'm chairing through NARUC and DOE, is doing, which is really also focused on learning about emergent technologies pertaining to critically important issues around enhancing infrastructure and pipeline safety.

But it has a bunch of links there that I think are really relevant for folks including past videos and presentations and reports on artificial intelligence for natural gas utilities, natural gas distribution infrastructure replacement and modernization, which has a reviewed state program, a whole host of information on the renewable gas workshop summary that goes into some safety issues, sampling of methane emissions, detection technologies and practices for natural gas distribution infrastructure handbook for state energy regulators, and it also goes into some of the activities we did with the U.S.-Europe Methane Strategy in January of this year and looking at Con Edison's AMI-enabled natural gas protector program briefing. It has a reporting and presentation on that as well as ARPA-E REPAIR.

So for -- in terms of going back, looking at some of that information, if you are interested in getting under the hood, I think that's a really good resource and can give you a lot of detailed information on what NARUC is currently doing and would be helpful.

For me, in New York, I've always been focused on the importance of the integrity of the natural gas system and safety is paramount to that. We in New York do have a gas safety performance measure report that we look at. It actually comes out every June. In that report, it focuses on three things; damage prevention, emergency response, and leak management. Under the leak management, we look at the LDC's performance to effectively maintain leak inventories and keep potential hazardous leaks to a minimum. We look at year-end backlog of leaks requiring repairs, and we look at incentive programs to reduce safety risks and to help in that.

I really feel very comfortable in saying that New York continues to do really well. We have a success story. And I'm going to list out a number of -- eight things that I think that we have done well. Some focus on where we can continuously improve on substantial reductions in leak backlog and what we're doing.

So one, initially, with repairable leak backlogs, we started highlighting repairable leak backlogs, particularly those associated with leaks that our regulations require to be repaired. So these are Type 1, 2a, and 2; in other words, all but the Type 3. And we did this in our annual gas safety performance measure report which, again, gets presented every June to the Commission. And that's significant because it makes sure that every commissioner needs to focus on this. We get a lot of information that comes to us. Having something annually reported to us really makes sure that we are taking a critical look at that -- that each commissioner is, and not just someone who might be focused on it as a specialty.

And this essentially highlights the number of repairable leaks each utility had at the end of the year. Now this report has morphed over the years, and it's morphed into also reporting total leak backlog. So this includes all leaks including Type 3.

And at the same time, we also instituted performance metrics for each company that instituted a regulatory liability in NRA for each LDC if they do not meet thresholds for total leak and repairable leak backlogs. What's important to us is that the thresholds are focused on continuous improvement, and that's a constant theme that I think is really important in regulation, but especially in safety. I've learned a lot over the years in terms of the need for us to be focused on continuous improvement. I do point out that I really do believe that API 1173 and pipeline safety management systems can be a really helpful tool for us and something that we should really take a look at how we can do it even better.

And so then the second thing is we instituted -- so we instituted a performance metric also that included positive rate adjustments in addition to the NRAs. This allows the companies to earn a positive rate adjustment for superior performance.

The third thing is we instituted a performance metric through incentives to address and eliminate the highest volume emitters from the leak inventory. Typically, LDCs are able --- were able to earn an incentive for fixing the highest 25 to 50 emitting leaks per year even if they were only a Type 3 leak.

The fourth is our leak survey and investigation regulations in New York require each survey to be conducted with an approved device. That's something I just want to point out is that this is different as opposed to the 192 requirement of a leak detection device. We looked at this as an improved device. It ensures the technology used for leak surveys and investigation meets expectations and increasing the likelihood that existing leak will be discovered. I point out this because I see this also as something that we can do working with more R&D and other collaborators and stakeholders on what we can do in terms of having more approved devices and getting technology engaged more in these issues.

The fifth is we had an aggressive leak-prone pipe replacement program where we expected companies to replace all leak-prone pipe within 20 years. We started this in 2014, the end of 2014, the beginning of 2015 and under this, we went from a 50-year replacement strategy to a under 20 years replacement strategy. I will point out that this is something that I'm really concerned about. It really is important that we have a lot of support for our leak prone pipe replacement program. It has been difficult in the current environment, and it's really, really important to safety, reliability, and resiliency, and I really get back to the importance of fortifying and upgrading that system to help us prepare for the existing infrastructure for the new future as well. And so it really is very important.

The sixth is new technologies. We are really receptive to new technologies. I believe that our approval process tries to be as straightforward as possible. And our expectation, really, is that new technology must perform at least as well as the plain ionization devices. And if it does, if we find the same leak in a double blind study, it's likely to receive approval. Again, we can always do better on what we're doing with technologies and how we're helping to streamline that process.

The seventh is -- and this is one that I think is the signature thing for us. I do point out NARUC does have it on their website, the video and the presentation on this program. We have supported wide-scale rollout of residential methane detectors to the point that I strongly believe that New York is a leader with this deployment. We have worked with Con Edison in particular to support their development in deployment. At first, we did this through a pilot program and then system wide of AMI-enabled residential methane detectors that instantaneously alert gas control of the presence of methane so that service personnel and 911 can be deployed. Con Edison is on schedule to have an AMI-enabled detector in every building in their gas service territory within the next three to five years.

And I point this out because the importance of this is this came after a horrible event that helped us all to refocus and learn, and it helped us to, with the support of important R&D as well as collaborating with many different sectors, it helped us actually achieve something that I think is really important to future safety and really is a great model.

The eighth thing is we supported increased leakage services surveys throughout New York. In New York City, Con Edison conducts -- for example, Con Edison conducts a monthly driving leakage survey in addition to the mandated annual survey. These driving surveys are intended to monitor the cast iron network for cracks and leaks. In Upstate, we have had companies transition to the annual leak survey as opposed to 3-year and 5-year surveys. Now initially, there was a spike in leaks found from doing these surveys annually, but over time, the leaks found have fallen dramatically. So bottom line, in New York, I think our progress has been made by shedding light on the leak issue through these performance measure reports; two, instituting metrics geared at continuous improvement; three, rewarding superior performance; four, being open to new technologies like AMI R&D; and five, targeting enforcement dollars towards programs that benefit rates payers and safety initiatives.

I will say I recently voted no on some enforcement dollars, and part of the rationale for me was that the dollars were not going back to the gas safety issues that we were trying to target. And for me, it's really important that our enforcement dollars need to go to benefit the rate payers in the safety initiative and working with the companies and other stakeholders to do that.

The other thing for our progress has been made by supporting leak-prone pipe program replacement. It's really important for us to have support with that, especially because there is a lot of opposition to doing that.

We are also supporting increased frequencies of leakage surveys. And then I think our progress has been made because there's a lot of leadership support. We get a lot of ability to also lean into the support we've had from our federal regulators and others to say that we're doing things that are helpful.

So that's New York specific. It talks a little bit about NARUC. I gave you an overview of different things. I do want to just mention some things that I see, a couple of observations. Some of these observations are just kind of looking at it in general. But also, some of these come directly from what I heard yesterday and earlier today.

So one thing, yesterday a lot of the presentations were focused on that methane emissions have increased steadily and noticeably since the 1990's. I just want to push back on that a little bit, just because I think it's important for us to really understand exactly what we are saying, because as I see it, I think that it can be said that it is true that CO2 levels have dropped substantially during that same time period. And so I think that for me, it's important for us to fully understand, have the CO2 levels fallen more than the natural gas levels have risen, and really look at that.

We also have to understand and recognize the role that the increased use of natural gas in the energy sector has played, especially in the conversion from coal to gas, so the coal to the methane may skew some of those numbers. And I really would be concerned if the focus were then not on focusing on the importance of going from coal to gas or from fuel oil to gas and actually discontinuing important conversions during this time period.

The other is I think we need to look, at when we talk about methane emissions, how the U.S. emissions of CO2 and methane compare to other industrialized countries such as China and India.

Another important aspect is we have to keep in mind that we do need to talk about the elephants in the room, or I should say the dogs in the room, because some of you may be hearing my dog barking as my son gets ready to leave for soccer. There has been talk about the fact that infrastructure needs to -- there's going to be a lot of infrastructure that's needed to electrify heating loads, especially in cold weather climates. And there's going to be a massive need for increases in upgrades in the electric transmission and distribution systems to carry this load even with energy efficiency measures. And again, as analysts are showing, natural gas is going to play a large part -- a large role, and we really should be cognizant of what we need to do to support the safety and reliability and resiliency continuing in that.

The other is we should be really careful we do not inappropriately prioritize emission concerns over safety concerns when it comes to leaks. And then I think it's important when we look at incentives and emission rates that -- and this is something -- you know, default emission rates are generally used to estimate the emissions from the natural gas industry. Operators are required to submit their estimates, I think, to the EPA. And I've heard several times that emissions are higher than previously thought, and this is based on, in part, allegedly by data that's submitted by operators.

So I kind of would push back and say maybe we should really examine this and test its accuracy, because is it possible that what the actual data is showing is that the operator's estimates are because it's based on the use of the default value. Perhaps the actual rates may actually be lower than the default value estimates. So I say this because technology used to measure actual emissions are sometimes cost prohibitive, and those expenses are not always recoverable. So I think a policy focus should be based on actual emission rates rather than theoretical emission rates. And also, what are we doing to help promote the technologies that can give us the tools to more accurately account for things?

Next, we need to be sure that emission models accurately account for cast iron that has been rehabilitated either through aligning or having joint fields with technologies such as this spot. I'm not sure that currently they accurately account for advances that states and operators have made in overall leak reduction. for example, states like New York that have odorization requirements that exceed federal requirements, therefore, leaks from the states that are doing things for leak -- overall leak production advances, their leaks may actually get reported more quickly, and we want to encourage that rather than discourage that.

The other thing is we need to think of ways to make advanced leak protection methods more affordable, especially for smaller gas operators with fewer customers to spread costs out among such as municipalities.

Then I have two more things. One, I think it's really important that the pipeline safety staff are directly involved in state rate cases and even the rate cases that go on at FERC. I think that for me, I've seen firsthand the important role that safety staff take in these --

in having an active role in rate cases. And sometimes I think, especially as we look at new technologies and associated expenses with that, if you don't have the safety staff there looking at these issues and it's left strictly to an accounting staff, they may not be approved.

Safety staff being involved in many of our rate cases have shown that for the case, that the expenses for the technologies and associated expenses are more than offset by leak and risk reduction. If someone was to ask me what are the top pipeline safety issues that we should be looking at in creating incentives, I would say, again, number one is pipeline safety management systems and helping in this area can be huge. The other is operator qualifications and residential methane detectors really need to be at the top of the list. And, you know, I really think that we can all go a long way working together in helping in this area.

With that, I'm going to wrap up. I know we're going to have some questions, and I look forward to engaging with the other panelists as well as those virtually in the audience. Thank you.

MR. TAHAMTANI: Thank you, Commissioner Burman. Appreciate your remarks and your observations.

Our next speaker, who will not have a PowerPoint presentation either, like Commissioner Burman, is Brian White. Brian is the Deputy Director of the Division of Pipeline Regulation at the Federal Energy Regulatory Commission. He joined the Commission in 2006 after working for eight years in the Regulatory Policy Group for the Columbia Gas System. Previous to that he worked for eight years in the Policy Analysis Group for AGA. Brian, the floor is yours.

MR. WHITE: Thanks. Can you hear me?

MR. TAHAMTANI: Yes.

MR. WHITE: Okay. Let me turn my speakers off. Thank you. So yes, I apologize I don't have a set presentation, but I thought I'd talk a little bit about first, how pipeline rates are established; second, our modernization policy statement which is the regulatory vehicle the Commission created a few years ago to try to help pipelines upgrade their systems, and then a little bit about how pipelines recover fuel today. And I apologize, too. I'm upstairs hiding from our animals, too, so I apologize for any background noise.

So in terms of how pipeline rates are established, pipelines currently recover their cost through two basic charges. All fixed or most fixed costs are recovered through a reservation charge, so shippers, customers that use the pipeline systems pay a reservation fee for the right to use that capacity on a firm basis. And then the variable costs the pipelines incur are recovered through what's called a usage charge. When you actually move gas through the systems, you pay a predicative rate, and these rates or charges are set in what's called a general section flow rate case. The pipeline comes in and all of its costs are examined across the board over a set time period. These tend to be kind of complex cases. They're assigned to an administrative law judge. They go on for a while. Parties file testimony and eventually, the rate cases usually, not always, but usually, result in a settlement where the parties agree basically to compromise and agree to rates that everybody can live with going forward.

These settlements usually have a couple different components to them. One is a rate moratorium. So the pipeline will agree when it enters into the settlement with its customers not to file another rate case for a time period going forward, say three or four years. At the same time, the customers also will agree not to challenge the pipeline's rates for a set time period, three or four years. Customers are allowed to petition for -- the Commission on its own, can open up an investigation on pipeline rates, but often the settlements will have this type of rate moratorium where the rates are set and then they stay fixed for a certain time period.

The settlements also usually, not always but usually, have some type of comeback requirement where the pipeline will agree to come back and file another rate case at a future time period, say three or four years down the road, they come back in with another rate case.

So the rates that are established in the settlements are fixed. They're set, they're there for a time period. They're not chewed up. They don't change each year, that kind of thing. They are set in time and they stay that way until either the pipeline or the Commission does something further down the road.

There are other cost recovery mechanisms that some pipelines have for certain costs, and these are what we call trackers. And for example, the Columbia Gas System has certain contracts on other pipelines that it recovers through these trackers. They're not part of the base rate. They're just passed through to its customers, it's contracts that the pipeline needs to maintain service. So it's not part of a rate base. They don't return, but it's a different mechanism that can be used by pipelines to recover certain costs.

The Commission does not like trackers. They like to examine all costs at one time, but a lot of these come out of settlements where the pipeline -- the customers agree to a mechanism to address certain things. The Tennessee system had a settlement where they agreed to a pipeline safety greenhouse gas tracker for a certain amount of cost there, and the Commission approved it because it reduced the port's settlement and things that come out of settlements are a net deposit to the system. So these are separate costs that are incurred, recovered apart from the base rates.

Next, a little bit about how the pipeline establishes its rates. In terms of the modernization policy statement, in 2015, the Commission issued a policy statement which was -- and it's -- I guess I should point out first it was a policy statement, not an order, and there's a distinction there. When the Commission issues an order out of a rulemaking proceeding, the pipelines are required to do something. An example would be when the Congress passed the corporate tax reduction in 2017, Commission issued Order 849 which required the pipelines to file a form, to reduce their rates, or provide a different option, and the pipelines had to do that.

The policy statement is a regulatory vehicle that basically says if you're going to do something, here's how we'd like you to do it. It doesn't require you to do it. It's kind of a roadmap for how you need to do it.

So in 2015, the Commission issued a policy statement on cost recovery mechanisms for the modernization of natural gas facilities. And this was basically issued in response to a couple different things that were going on. Congress passed the Pipeline Safety Act in 2011. That was one of the things. And then the PHMSA had started up their pipeline safety reform initiative to address pipeline infrastructure, safety, reliability.

So the Commission kind of saw what was happening. We knew that as a result of these initiatives, pipelines would probably face new safety standards that would require significant capital costs to enhance the safety and reliability of their systems. We also -- the Commission also inserted the pipelines may, in the future, face some increased environmental monitoring cost and environmental compliance cost as well as potentially having to replace or repair existing compressors or other facilities. So the modernization was -- the modernization policy statement was put in place to -- and I'm going to read the quote here -- to address these potential costs and to ensure that existing Commission rate-making policies do not unnecessarily inhibit interstate natural gas pipelines' abilities to expedite needed or required upgrades and improvements.

So the modernization policy statement does allow for trackers to be established to recover certain costs associated with replacing old and inefficient compressors, replacing leak-prone pipes, things like that, and performing other infrastructure improvements and upgrades to enhance the efficient and safe operation of the pipeline systems. And it also sets in place the standards that are required for the pipelines to do this.

You had five basic principles that are in the modernization policy statement that the pipelines would have to comply with. Number one would be a review, that it would have to be done in accordance with the review of existing base rates. So you couldn't just file for a modernization tracker. You have to file to also at the same time change your base rates.

Number two, you had to define your eligible costs. So it has to be -- it can't just be a vague kind of, you know, we're going to do this, we're going to do that. If you look at the

Columbia settlement, which was the first one through, it clearly listed all of the different facilities that they were going to do under the modernization settlement. So it's, you know, this pipe, this pipe, this storage facility. It has to be defined.

Number three was an avoidance of cost shifting. So existing customers in the system would be protected in case the pipeline loses load, discounts, things like that.

Number four was a periodic review, so it had to be a defined time period, couldn't go on ad infinitum.

And number five, it had to have shipper support, which is a big criteria. The pipeline needs to work with its shippers to come in and agree, they have them agree with what facilities are going to be replaced and how that process will occur. So that was the fifth criteria.

To date we've had two pipelines, that at least I'm aware of, that have settlements that came out of this, the Columbia, the second Columbia modernization settlement was here, and National Fuel, I believe, is the other one that's put in place a settlement under the policy statement.

Several pipelines have proposed cost recovery mechanisms under this vehicle. However, as a result of the settlement negotiations with their customers, they elected not to move forward. So it doesn't always -- it does not always come to fruition.

I think the Commission is hopeful that this mechanism will contribute in the future, going forward, but we do recognize that there -- that in these rate cases, there are a lot of issues at play and customers don't always support them. So it is a variable that is out there.

And the third thing I wanted to talk about was kind of how pipelines recover fuel. Most of the pipelines recover fuel through a tracker mechanism. And by fuel, I mean a couple things. It's obviously a fuel that's required to run the compressors. And there's also a lost and unaccounted for component usually in that fuel, and that can kind of be a wide variety of things. It can be leaks. It can be blowdowns. It can be meter error, accounting error. It's kind of a mishmash of categories, but that's also part of the general fuel percentage.

So the pipelines go through a -- they have a fuel cycle. They make an estimate of what their future throughput is and how much they think they'll need to run the compressors, that type of thing. And they will actually create a fuel rate for the system. So say it's 1 percent is what we think we need to operate our system. And then the shippers, the customers that use the pipeline, will give them that fuel when they transport their gas. So if you're trying to move 100 dekatherms and the fuel rate is 1 percent, you will actually give the pipeline 101 dekatherms. You give it the fuel that's required to operate the systems.

I guess this -- now this is kind of

Brian White talking, maybe not the Commission talking. The fuel trackers, they have positives, and they have negatives. They tend to be fairly non-controversial. The pipelines' tariffs lay out the tracker mechanisms. There's a true up mechanism. Obviously, nobody's estimates are going to be correct, so if one year the pipeline recovers more fuel than needed, you know, it rolls over the balance, and the rate's reduced next year. Vice versa, if it doesn't collect enough, the rates go up next year. So it tends to be -- they tend to be non-controversial, and that's at least a positive, I guess, from moving forward.

On the negative, you know, one could say maybe they're not the best vehicle for encouraging, you know, full efficiency, since it's just a passthrough. There are some pipelines, not that many left, that have a fixed fuel rate. So in a rate case, you may agree that the rate is 1 percent and then, you know, if the pipeline can operate its system at .8 percent fuel, then they get to keep the differential. Similarly, if they can't, if they operate the system at 1.3 percent, that comes out of their own pocket. So one could, not necessarily me, but one could make the case that that would be a better incentive for encouraging efficient operations.

The Commission's regulations give the pipelines the options. You can have a fixed fuel rate. You can have a tracker. Either one. We don't mandate one or the other. So that's basically it for me. Thank you.

MR. TAHAMTANI: Thank you, Bran. Thank you very much. Our last speaker is Erin Murphy. Erin spoke to us yesterday on another panel, and thank you, Erin, for agreeing to serve on this panel. I'll take about 30 seconds and introduce Erin again. She is a senior attorney with the Environmental Defense Fund Energy Markets and Utility Regulation Team. She presents EDF before federal and state agencies advocating to reduce methane emissions from gas distribution transmission networks, maintain pro gas utility planning frameworks make sure alignment with policy -- climate policy. Previously, Erin worked on Clean Air Act litigation, clerked with the Maine Supreme Court, and graduated from Georgetown Law and the University of Florida. And the floor is yours, Erin. Thank you.

MS. MURPHY: Thanks, Massoud. Can you hear me?

MR. TAHAMTANI: Yes.

MS. MURPHY: Great. Hi, everybody. Good afternoon, again. I am thankful to PHMSA for the opportunity to participate in this panel and conversation today. I am going to just share a couple of examples of positive and negative incentives that EDF has observed in different state commissions and agencies. And these incentives are specific to distribution companies. And so let me get started.

So taking a look at some helpful leak incentives that we've seen -- and the quoted example in this slide is from New York -- so there are some incentives in place for gas utilities to receive a positive revenue adjustment for repairing additional Type 3 or Grade 3 high emitting leaks beyond their annual reduction target. And the example I'm pulling here is from National Grid's last rate case settlement, which allows the company to earn a positive revenue adjustment of one basis point for the repair of every 50 additional high emitting Type 3 leaks beyond their annual backlog target with a maximum of five basis points available.

And obviously, the objective of this incentive is to provide the utility with a reason and sort of a financial reason to specifically pursue these Type 3 leaks that are known to be higher emitters. And for additional context -- and I think I mentioned this in my presentation yesterday -- National Grid recently proposed the next rate cases and enhanced high emitter methane detection programs, which would deploy advanced leak detection with the objective of identifying and remediating these super emitting leaks.

So this positive revenue adjustment kind of connects to that high emitter program and the deployment of ALD by the utility. And EDF would recognize an additional element of these types of incentives, which would be to require reporting to quantify the abated methane emissions that resulted from the Type 3 leak repairs and just because that additional reporting element would, of course, provide transparency for the regulator and the public to understand the progress that's being made as a result of the program.

I also wanted to note it's not included on the slide, but another helpful example of this type of incentive is a regulatory program in Massachusetts that requires gas utilities to identify and repair grade 3 non-hazardous leaks that are determined to have a significant environmental impact. And there is a more detailed explanation in the Massachusetts regulation of how that program is implemented. But it similarly requires gas utilities to make sure that they're identifying and working to remediate those high emitting Type 3 leaks.

So if we take a look at some unhelpful incentives that we've seen in place -- and I want to note that the -- these specific utilities that I'm pointing out here as examples are partially a product of where my own work focuses and looks. They're certainly not looking to identify these as bad actors or anything like that. Rather just looking at some of the incentives that we've seen in place in different jurisdictions around the country.

So this -- and I think this certainly happens in other jurisdictions as well, but we've observed it in New York and D.C. where the gas utility has leak backlog performance metrics that carries a financial penalty if the utility's leak backlog increases year over year. And obviously, that's an incentive that's put in place with the admirable objective or decreasing the number of leaks on the system, which is absolutely something we want to see.

But there's a problem that results from the way these incentives are structured, which is that it incents utilities not to use advanced leak detection or any other innovation that they might identify that could significantly increase the size of their backlog, because if there's a big jump in the utility's backlog because of a new leak detection program, then in turn, if the utility doesn't have the staff or the resources rapidly on hand to repair all of those newly found leaks quickly, then they're going to be reporting or they could be facing reporting a big increase in their backlog at the end of the year, and thus experiencing this negative revenue adjustment or penalty, however it may be structured.

And so a solution that EDF has recommended is that regulators should instead incentivize reductions in the volume of leaked methane on the system rather than focusing on a reduction and the number of leaks in the backlog. And so on the one hand, this is with the objective of incentivizing and encouraging utilities to find all of the leaks that are on their system and report on those leaks and then furthermore, to focus the remediation effort in addition, of course, to all safety-focused programs, but from an environmental perspective, to focus remediation efforts on those high volume leaks.

And obviously, an incentive like that would pair very well with implementation of advanced leak detection by a gas utility, because ALD surveys would provide those leak volume flow rates for individual leaks that would allow the utility to engage in this prioritization to address higher emitting leaks first.

I'm going to talk briefly about lost and unaccounted-for gas. EDF, these are a couple of recommendations that are pulled from a white paper that EDF released earlier this year that provides a number of recommendations for state regulators to improve oversight of gas utilities to ensure that oversight is being aligned with climate change goals.

So one of our recommendations is the Commission should review standards for lost and unaccounted-for gas that are attributable to leaked gas and consider whether they are consistent with climate commitment.

And another element of that would be requiring gas utilities to incorporate the societal cost of methane into their long-term planning. And I want to point to a specific example here. So a recent order from the California Public Utilities Commission did require that utilities include in the cost benefit analysis for their leak abatement compliance plans a quantification of the avoided social cost of methane.

And so by really putting pen to paper in terms of -- in trying to put a dollar amount on the value to society of reducing these methane emissions, we think it's helpful in creating that incentive and also that transparency to see, you know, why this is important and worth pursuing. And I'll note that that requirement from the California Commission for Utility Leak Abatement Compliance Plan is, you know, a result of the larger program that's come out of FD 1371 in California.

And I also just wanted to make the point because I know this is often a topic of discussion, just the level of challenge in identifying what portion of loss is attributable to actual leakage and, therefore, to methane emission on the system. In its recent order, the California Commission found that it was able to quantify that portion of loss, and that's in part because of the more detailed reporting requirements that the Commission has to break down leakage on the system. And in that instance, the California Commission estimated that methane emissions represented about 30 percent of total loss for the four large gas utilities in the state. And there's a more detailed explanation in that Commission order of how they did that math, essentially.

And finally, just to talk a little bit about reporting, I wanted to share a specific example from Washington State, which passed legislation, I think it was in 2019 -- it might have been last year in 2020 actually -- that requires all gas utilities in the state to file annual leak reports. And so each gas utility is required to file an annual leak report and then in turn, the utilities commission is then required to take that information and sort of sort through it and produce its own reports to summarize some of that information.

So the commission is permitted to require the gas utilities to report the volume of each leak measured in carbon dioxide equivalent as well as in thousands of cubic feet. And then the commission has to estimate the volume of leaked gas and the associated greenhouse gas emissions from operational practices in the state using that data that was reported. And starting in 2021, the commission is required to publish annual aggregate data regarding those greenhouse emission volumes and the causes of the leaks.

So I think this is just a helpful example to show, and I think this, you know, carries forward some of the controls I was talking about yesterday in terms of the value of reporting both so that utilities can demonstrate improvements over time in reducing emissions on their system which, you know, can provide a lot of value, including value to stakeholders and investors, but then also, of course, there's an oversight value here as well and transparency to the public.

So there's, you know, a lot of sort of push and pull mechanisms that are available, and there's, of course, huge variety across the country, but those are at least some high level observations about incentives that can either push for or detract from utility efforts to identify and manage the leaks on their systems with an eye toward reducing methane emissions.

Thank you.

MR. TAHAMTANI: Thank you, Erin. Now we have plenty of time for questions and answers. Sam, do we have any questions?

MS. BURMAN: This is Diane Burman. Before we get to the questions I just wanted to know if I could kind of respond to a couple of things.

MR. TAHAMTANI: I'm going to ask you, Diane, perfect opportunity to go ahead and respond to, I'm assuming some of the points that Erin shared.

MS. BURMAN: Yes. Well, first of all, I think it was great. And I appreciated some of the analysis in looking at that.

I think the bottom line, first in terms of, and Brian talked a little bit when he was talking about FERC, about the rate proceedings and how they typically result in the fuel tracker with the true-up mechanism. And I do think that Brian raised a good point about what's positive and negative of that.

And while trackers do provide incentives to improve fuel efficiency and reduce loss not accounted for gas and modernized compressors, pipelines, understandably, have concerns due to the risk of unrecoverable costs. So that's something that kind of gets looked at with settlement negotiations and trying to figure out how to do that.

So, it may be something, from my perspective, when we look to FERC, that FERC can be helpful in methane, in advancing methane reduction from jurisdictional pipelines in approving and incentivizing replacement of facilities that are known methane emitters. And also helping to streamline the approval process.

But also, across the board, I think the federal regulators and the state regulators can really be helpful in looking at ways that our policies may actually be not incentivizing enough to make it workable and figure out some solutions that will help with that.

And, Erin, I think you raised some

good points. Obviously it was a lot that it is in potential filings or current filings at the commission, that I can't speak directly to.

I do want to point out that however I may decide on a matter that comes before the commission it's based on what's in the record itself and not from discussions that might happen in this setting.

But I did think that what was important is to kind of look at a little bit, especially as the loss and unaccounted for gas issue, is something that really needs to be thoughtfully looked at. And again, a reminder about not inappropriately prioritizing emission concerns over safety concerns when it comes to leaks.

But just in terms of the loss and unaccounted for gas, I think it can be difficult to compare one state and how they categorize it in another state. So the reference to California is helpful, but loss unaccounted for gas is primarily an accounting concept for gas distribution. And state and federal agencies have varying definitions for it.

And in general, as kind of how I see it, is that it may not always be something that is the best way for us to rely on to accurately measures reductions in methane emitted into the atmosphere. So at times it can be an imperfect metric for the effectiveness of infrastructure replacement programs.

And so, I do think it does, it is, it does require us spending a little time on what's appropriate and what is the best incentives to help fix all leaks, but also whether you're fixing a leak because it's from the safety perspective, you're fixing the leak to address the methane, emission perspective is really important for us to look at.

But I really, really appreciate that Erin laid out the different issues. And also possible solutions. So I wanted to give her credit for that. So thank you very much.

MR. TAHAMTANI: Thank you,

Commissioner Burman. Sam, I understand we have questions. Please go ahead.

MR. HALL: We do have some questions in the Q&A chat box. Before I get to those, I just want to remind anyone who's on the telephone called dialed into the toll free telephone line, if you wish to make a comment, Dial 1 and then 0 on your phone, then you'll be entered in the queue.

While you do that, we have a question from Aalap Shah, A-A-L-A-P, S-H-A-H. And I believe this is directed to Erin.

Does this incentive apply to temporary leak repairs?

And I don't have any more specificity so perhaps you can understand what is meant there. If not we can move on.

MS. MURPHY: Sure, I can take a stab at that. I imagine that's a reference to some of the leak incentives that I was talking about in the first couple of slides.

And I want to start by sort of

characterizing this as something that I came to while working on a case and really trying to think through what is the best way to structure some of these incentives.

And I ended up envisioning sometimes utility leak backlogs as a jar of marbles, right? And the jar of marbles are constantly marbles being put into the jar and constantly marbles being taken out of the jar because any utility is constantly identifying new leaks on the system and then always in the process of going out and repairing those leaks. So there's kind of this balance in place, right?

And I imagine the question might be referring to a way that leaks that are categorized by a utility if some of them as categorized as temporary. And I can't speak to the specifics of how that categorization might work or might come into play, but I think the principle that we're trying to recommend is that because we want utilities to be incentivized to put, adopt into their operation technologies that find as many of the leaks on their system as possible, including leaks that might not have been identified previously using traditional survey methods, we don't want to see utilities be penalized for going out and finding those leaks, right.

And in turn, we want to make sure that utilities are able to have the resources they need on hand to remediate leaks in a timely fashion. So I think there is a balancing there and different ways of thinking about how we can really maximize utilities attention to this issue.

MS. BURMAN: And just, this is Diane Burman, just to clarify also. For in New York it's only for permanent repairs, and repairs must be verified after, I think, 14 to 30 days to qualify.

MS. MURPHY: Thanks, Diane. Probably a more succinct response than what I provided.

MS. BURMAN: And the other thing I just, I think is important also, for us, I do believe we're all on the same page, that we need to figure out ways to incentivize the elimination of leaks, especially if there is not necessarily a regulatory requirement to repair them so how do we do that.

And I do point out though, I don't necessarily know that I have a cause and effect data to prove it, but all of our LDCs with the lowest leak backlogs also have very low loss and unaccounted for gas. So, for me, that's important information.

MR. HALL: Very good. We have a question directed to Commissioner Burman from Rebecca Craven.

Rebecca says, I thought I heard you refer a couple of times to declining levels of Co2. I'm not sure of the context for that but I'd appreciate it if you could clarify that portion of your remarks.

MS. BURMAN: So I guess for me it was making an observation that yesterday I heard a number of times that methane emissions had increased suddenly and notably, noticeably since the 1990s. And I do believe that it's important for us to look because I do believe that it's true that the Co2 levels have dropped substantially during that same time period.

And so, we should be looking at that and making sure that we're carefully evaluating what we're doing, but also in the context of not just state-by-state and U.S. emissions of Co2 and methane, but we should be comparing it to other industrial countries. Such as China and India.

And I do think that for me, even looking at what we've done going from coal to gas conversions, as well as fuel oil to gas and how that has been helpful, I think is really important. Understanding also that looking at the whole energy production has to include also the focus on the role that gas has played increasingly in the energy sector.

MR. HALL: Very good, thank you. Rick Weber asks a question directed to Erin.

Which examples from states

incentivizing leak detection should be included in the PHMSA rule?

MS. MURPHY: So, I'm not sure if have a direct answer to that at this time. I think my presentation is teaching to catalogue some of the positive and negative incentives that we have seen with the hopes that that can help inform the way the PHMSA rule is structured.

MR. HALL: Thank you. Ryan Miller says, where we can find more information on the methodology for the leak gas calculation in the Washington State law?

MS. MURPHY: Sure. So, I imagine that there is going to be methodology developed by the Commission, by the utilities commission, as it implements that state law. And I am not aware if that has been published yet, but I'm certainly happy to try to track that down.

So, I'm sorry, I don't know who you are, but if you saw my email in the presentation, or when that presentation is posted, please feel free to reach out.

MR. HALL: And then due to the way this question and answer system is working, we have a follow up question for Commissioner Burman from Rebecca Craven regarding her initial question.

Rebecca says, so you mean Co2 emissions, not levels? Commissioner Burman, you might be muted.

MS. BURMAN: Yes. No, okay, I think Co2 emission levels have dropped substantially so for me, I think I answered the question.

MR. HALL: Okay, thank you. Operator, do we have anyone in queue?

THE OPERATOR: We have no questions on the phone at this time.

MR. HALL: And, Massoud, there are no additional questions in the Q&A box.

MR. TAHAMTANI: I have a couple of questions. We talked about loss and unaccounted for gas. And this goes to Commissioner Burman and Brian.

Are caps on loss and unaccounted gas appropriate means to incentivized methane emission control?

MR. WHITE: This is Brian. From a FERC perspective, I mean, we don't have any type of cap. And it's in our regs that we issue it.

I think what we do is, really we look at things on a case-by-case basis. The commission, loss and unaccounted for does tend to be a fairly small piece of the fuel pie, but we do look at it in each fuel cycle.

And there have been times with, I know the Columbia system, a couple of the midcontinent systems, that we've seen the numbers go way up and we have instituted proceedings to address those. But there is not like a standard we have that we look each time, we kind of just look at what goes on, how things have changed year-to-year and kind of react that way.

MS. BURMAN: So, thank you. So this is Diane Burman. So for me, loss and unaccounted for gas, it's really an method of screening which takes the highest priority for replacement.

As I understand it nationally, this

data is reported to both PHMSA and Energy Information Administration. And that is used to, overall, evaluate the overall efficiency and infrastructure investment needs of the gas distribution system.

And obviously there is several components that comprise the loss and unaccounted for gas metrics, including, but not limited to, things like the billing cycle adjustment, meter error, meter tampering, theft. And then to a lesser extent, the methane releases associated with construction and pipe replacement, venting and purging.

That's way for me it's a useful metric, but at the same time we also need to recognize that it's not necessarily can be always relied upon to accurately measure the reduction in methane admitted into the atmosphere. And so it can be an imperfect metric when we get to the effectiveness and infrastructure replacement program.

In New York, LDCs do report loss and

unaccounted for gas to us on an annual basis. They each have a default amount based upon historical information.

And the fault amount allows them to, in which they're able to collect for repairs. If they go over that amount, they cannot collect the amount for repairs.

To the extent that that cap is a challenge and is problematic from incentivizing the overall goal that we want, it's something that I think folks have weighed in one. Obviously we heard from Erin, some of her thoughts on what we can do in this area. So I hope that's helpful.

MR. TAHAMTANI: Thank you very much. Sam, I'm checking back again to see if there are any questions from the public.

MS. MURPHY: Massoud?

MR. HALL: We do have any additional question. Go ahead.

MS. MURPHY: This is Erin. I just wanted to add on very briefly to that discussion of loss. To make one clarifying point.

Which is that, we're not suggesting that loss should be a metric that's used to try to estimate methane emissions on the gas system, in fact, that's part of why EDF advocates for the use of advance leak detection as a better way to really track and understand leakage from the system. So I almost view it the opposite.

It's not that we view loss as a tool to really drive or change the way utilities are handling leaks in this state, but almost the opposite. Like, let's just make sure that the way loss is considered and recovered, and cost right now isn't a barrier or a disincentive to taking the actions that's needed to reduce methane emissions on the system. Thanks.

MR. TAHAMTANI: Thank you.

MS. BURMAN: That is a good point. I think what's important is also looking at, is what we're doing from a policy perspective actually helping to properly incentivize and are we having an effect that we can, from an accountability perspective, really look at and quantify.

MR. TAHAMTANI: Thank you. Back to you, Sam.

MR. HALL: Dustin Trent asks, Erin, you mentioned the incentives are generally for distribution systems, will there be a separate incentive rollout for transmission systems or will the same incentives apply?

MS. MURPHY: Yes, so, I guess I'll just say briefly, the incentive I was describing are programs that exist in various states across the country. And I think there is going to need to be more careful thinking and consideration about whether any of these types of incentives could translate to something that would be helpful on the federal level from PHMSA, and if so, what would they look like, right?

So that's not a question I have an answer to right now. And I think you have raised another important question which is, how should incentives differ and what's sort of the best structure for the different elements of the system here, including transmission and gathering.

And I don't think I have an answer for that at this time, but agree that it's something that's going to be really important to consider moving forward.

MR. HALL: Very good. We have an additional question from Kindal Keen.

Have there been any studies that have looked at loss compared to the number of leaks found from one year to the next?

MS. MURPHY: This is Erin. I am not sure actually if that has been done or not. We can look into it.

MR. HALL: Okay.

MS. BURMAN: And can they repeat the question?

MR. HALL: Yes, certainly. Have there been any studies that have looked at loss compared to the number of leaks found from one year to the next?

MR. TAHAMTANI: Any other questions?

MR. HALL: There are no additional questions in the Q&A box. Operator, are there any commenters in the queue?

THE OPERATOR: No questions from the phone.

MR. TAHAMTANI: I'll go ahead and ask another question. Thank you, Sam.

For the Panel, how can PHMSA take commissions, or FERC, encourage operators to adopt advance leak protection technologies?

MS. BURMAN: So, this is Diane Burman. So I would just say it's really important that you be supportive and have an open mind, that we all kind of work together to evaluate and help to adopt newer technologies in a prudent way.

Again, I did say that I think it's imperative for our safety staff to be involved, but I think it's still comparative for us to really be focused on moving the value in this space because if we do, we are actually helping reduce greenhouse gas emissions, we're helping to make things safer. And I think it's important for us to make sure that our policies are aligned in the way that it's helpful to do that.

I have the question repeated before on the study. I'm not aware of any studies specifically, but I am aware that our companies at least, with low leaks, have low loss and unaccounted for gas.

And so for me, it's something that I think how we are looking at all these things is very helpful and important.

As to PHMSA directly on loss and unaccounted for gas, I think one thing would be defining exactly what it is. As I look at the definition in the annual report, it's not necessarily so clear. And as I said, each different state and federal folks look at it differently.

MR. TAHAMTANI: Any comments from Brian or Erin?

MR. WHITE: Yes. That's, see, that's a tough one. I mean, we tend, from a FERC perspective, we tend to be more of an economic regulatory agency.

I am struggling with, like what the regulatory vehicle we would have to do that. I guess I, certainly that's something that the pipeline customers could agree to in their discussions if they were going down the modernization topic statement route.

Other than that I'm not, I'm just not sure how it would come up in a FERC proceeding to be perfectly honest with you.

MR. TAHAMTANI: Thank you, Brian. Erin, anything?

MS. MURPHY: Sure. So, I think so maybe just a highest level observation I would have that almost goes without saying, in terms of how PHMSA, as an agency, can encourage an option of these technologies is that, of course, we're so excited by the great mandate out of the PIPES Act of 2020 and pleased that PHMSA is moving forward with a rulemaking accordingly to set these advance leak detection standards.

And so, we're happy to be part of this conversation and make sure that the agency has all the information it needs to set those standards appropriately.

I think I probably shared our best examples of positive incentives that we've seen out of state commissions. I wanted to mention one other thing because I imagine anyone listening to this meeting from a utility is thinking about the fact that all of this costs money, and we recognize that as well.

And when EDF is engaged in utility proceedings on the state level and is recommended an option of these technologies and implementation of new programs, we recognize that that is something that the utility needs dollars in order to undertake. And so we always try to ensure that there are resources accompanying any mandate to pursue a program. And so, we'll continue to recognize that.

MS. BURMAN: This is Diane Burman. I also think it's really important that PHMSA, state commissions and FERC also support the need for resources as well. Especially in the area when we're talking about the impact on the opportunities for jobs in the clean energy space.

This area is one that really needs a lot of qualified technical staff, not just at the commission and the agencies, but also an ability for in industry as well. And so, being supportive of that is really important.

MR. TAHAMTANI: Thank you. Sam, any questions from our public audience?

MR. HALL: Operator, are there any questions in queue?

THE OPERATOR: No questions in queue at this time.

MR. HALL: No further questions, Massoud.

MR. TAHAMTANI: Thank you. I got a couple more questions.

Obviously a lot has been done to reduce legacy pipelines, like cast iron, bare steel and legacy plastics. But we still have about, I think, 20,000 miles of cast iron in the country. I'm not sure how many miles of steel we have. And then don't have the number for the legacy plastics.

What else can we do, the commission, PHMSA, others, do to continue to reduce the legacy pipelines that often are responsible for most of these leaks, I think? Commissioner Burman.

MS. BURMAN: I think we need to continue to encourage what we are doing in New York. Again, like I said, in 2014, 2015, the commission did open up and focus on aggressive leak prone pipe replacement program. And we expected companies to replace all the prone pipe within 20 years.

The issue really is, is that there is a lot of pressure not to continue that aggressiveness. And it's something that we really need to be focused on.

And for me, we have performance metrics for the leak prone pipe replacement, we have emergency response time, damage prevention. We go through all these different things. And we're trying to create incentives for other gas pipeline safety measures, such as improvements to damage prevention or installation of residential gas detectors.

I'm really hopeful that we can all focus on the need to continue in a reasonable way, pushing important safety mechanisms in this area.

MR. TAHAMTANI: Thank you so much. You touched on my second question, on damage prevention and residential gas protection. Erin, any comments on any of that?

MS. MURPHY: Yes. I'll just build on what Commissioner Burman was describing and say that we certainly agree that leak prone pipe replacement is a big part of this conversation and an important tool in the tool box to continue to address these really elderly, leaky segments of pipe.

I think our approach in terms of

thinking about what is the best fit for any given pipe segment is to think about the options on the table, which are leak repair, leak prone pipe replacement, as well as retirement.

And I want to just briefly touch on that retirement option because it's something we're seeing, particularly in states that have more ambitious climate goals and climate legislation that's starting to be implemented.

And I'll give an example from New York because I've been doing a lot of work there recently and watching things unfold. So there are two gas utilities in New York that recently issued, not issued, but recently made small pilot type proposals to try to identify leak prone type segments that are nonessential sections of the distribution system that could be primed for retirement. And so, that's another sort of element to be considered here.

Obviously that's something that needs to be approached really carefully and strategically to ensure that there is another energy solution online for those customers.

MR. TAHAMTANI: Thank you, Erin. And, Brian, you're welcome to comment.

MR. WHITE: Yes. I guess that's really what our modernization policy statement was designed to do, to let the pipelines come in, work with their customers and come up with a plan to replace their systems.

I think the two that are, that have been in place, Columbia National Fuel, our old systems. So that it seemed to have worked well there.

But I think we realized that at the same time we have seen other proposals fail just because in a rate case there is a lot of competing, competing issues. So, we continue to hope that that vehicle is available and that the pipelines and their customers will take advantage of it.

MR. TAHAMTANI: Thank you, Brian. Sam, one last chance for any questions?

MR. HALL: Yeah. We do in fact have

three additional questions. From Corinne Byrnes, this may be more of a comment.

Can you look again at approving cast iron lining as a reconstruction process that would be capitalized?

This would greatly help operators with power cast iron that is in good shape but needs sealing.

From Wallace B. McGaughey. I apologize sir, if I'm mispronouncing your name. Are residential methane detectors being considered as a requirement and regulation?

MR. WHITE: I'll look into that. I guess, I'll come to that saying, we're looking at everything.

MR. HALL: Yeah. Good.

MS. BURMAN: And I just want to flag --I just want to flag again, on the residential methane detectors, especially AMI enabled ones, the safety gained by installing a very affordable device is immense.

I get that states have a long way to

go with this. But, in New York we are seeing quantifiable successes where the company was notified of gas leaks prior to the customer detecting any gas odor.

This is for also inside and outside leaks, you know, that were determined to be the source. It was not just inside leaks that this applied to.

But also, this really came about from engagement in these issues. And after an event in New York, and actually NTSB made some more recommendations about the importance of residential methane detectors.

Just as a point of reference, we have instituted programs in both rates and enforcement settlements that require residential methane detectors to be provided in most of our largest LDCs.

And for Con Ed, we have improved installation of AMI enabled detectors on 100 percent of their services. And they're to be completed in the next three years.

At least seven of our other largest LDCs have residential methane detector programs that require RMDs to be distributed to customers. Most of those customers, we're focusing on low income customers and heat customers.

For what it's worth, that's the information that we have.

MR. HALL: Very good. We have a follow up question from the same commenter. What data is there to indicate the amount of methane emission that can be attributed to residential leaks?

MS. BURMAN: Can you repeat the question?

MR. HALL: Sure. The question is, what data is there available to indicate the amount of methane emission that can be attributed to residential leaks?

MS. MURPHY: So --

MS. BURMAN: So, I'm not sure I know -- I'm sorry, Erin.

MS. MURPHY: Yeah. I'm not sure either.

And it sounds like the question's referring not to the distribution system, but to the sort of end use residential site and leaks from there.

And I don't have an answer to that. I think a lot of the research that I shared in the presentation yesterday does attribute and try to, you know, quantify the methane emissions from the distribution system, but not the residential end site.

MR. HALL: Very good. Lindsey Fitzgerald asks, are residential methane detectors considered advanced leak detection under the PHMSA PIPES rule?

I assume that might mean Act. Massoud?

MR. TAHAMTANI: Can you repeat the question, please?

MR. HALL: Sure. Are residential methane detectors considered advanced leak detection under the PHMSA PIPES rule?

MR. TAHAMTANI: I think we need to look at that. I'm not sure.

MR. HALL: Okay. Very good. Operator, are there any additional questions in queue?

OPERATOR: Yes, we do. Go to the line of Randy Knepper. For the record, sir, please spell your first and last name.

Your line is open now.

MR. KNEPPER: Yeah. My name is Randy Knepper. It's R-A-N-D-Y K-N-E-P-P-E-R. And I'm a State Regulator from New Hampshire. So, interesting discussion and I appreciate the panelists.

A couple of comments I want to make. When we talk about type three or class three leaks, the GPTC guidance talks about monitoring.

And so, I want to approach my feed to at least found successful in New Hampshire has been to define what monitoring is. And how often you have to go back and look at a leak.

Because if you have a leak, it's only going to do two things. It's only going to get worse, or it's going to stay the same, but it's not going to heal itself.

So, one way to incentivize or maybe it's deincentivize, whatever you want to call it, is to help the utilities or LDCs make that economic decision a little bit.

And so, one of the things we've done, is we've said you know, how many days you got to go back to monitor that leak. And it's not just the next inspection period.

So, we came up with different things to do that. And it's been very successful in reducing backlogs.

Second comment is, when you talk about backlogs, be careful with your starting point. Because I find that the data that the LDCs sometimes have on their leaks, isn't -- they've double counting, they -- they're not sure.

This one's three, this one's two. I've been there a couple of times. This one doesn't exist.

So, you have to kind of establish, you know, what is a true count on number of leaks. So, don't even just assume that the leak list is correct to start with.

I'm a big believer in find it and fix it. And I'm a big believer in what Commissioner Burman said, is that pipeline safety specialists have to be in front of their commissioners.

Especially in terms of rate cases. To comment on things like this and the new technologies and the approaches that the utilities are taking.

That's it.

MS. BURMAN: This is Commissioner Burman. I just want to thank Randy for speaking openly.

Finding as many active methane leaks as possible and repairing them in a timely manner, not only improves safety, but it reduces methane leaking into the atmosphere.

I really think for me, it's also about a collaborative approach in a way that's working with the federal regulators, the state regulators, interested stakeholders, and industry.

I really like the leaning into how we can improve our policies on new technologies that are appropriate and will work. So, I'm really looking forward to engaging on those issues.

MR. TAHAMTANI: Thank you all. And thank you --

(Simultaneous speaking.)

MR. HALL: Operator --

MR. TAHAMTANI: Sorry, go ahead, Sam.

MR. HALL: Well, I was going to ask for an additional question from the Operator if there's anyone else in queue.

OPERATOR: No additional questions in queue.

MR. HALL: Thank you. And no additional questions on the Q&A box. Go ahead Massoud, excuse me.

MR. TAHAMTANI: Well, thank you very much to our panelists here. Again, a great discussion to all those in our two-day public meeting.

With that Sam, if there are no

questions, and we've had our public comments. Or would you like to see if there are public commenters?

MR. HALL: We do have a public comment portion of the agenda here. And we can transition to that now.

MR. TAHAMTANI: Please, go ahead.

MR. HALL: Our public comment period begins now. I want to thank our previous panelists and those of you who provided comments and questions.

This is -- this public comment period will be moderated by me. I am Sam Hall. I am a Program Manager in the Office of Pipeline Safety.

This is a bit different from a Q&A session. We don't have the ability to answer questions due to limitations on technology.

We can't have all of our speakers up and available at the same time. So, this is your opportunity to simply provide comment that you wish to be considered as part of the record.

If you want to make a comment with

your voice, you must be dialed into the conference line, which you can see in the top left of your screen, and also on the slide.

If you're not dialed into the conference phone number, you can type your comment in the Q&A box on your screen. And we'll attempt to read those comments.

Please keep your comments on the telephone to two minutes or less. We want to provide opportunity for all to comment within the time allotted in the agenda.

And I'll be encouraging commenters to wrap up their comments within two minutes. Please keep your comments professional and within the scope of this public meeting.

We do reserve the right to cut off and mute commenters who refuse to yield the floor or who cause a deliberate disruption to the proceedings. Although we do not anticipate having to do that.

If you do have a comment and you are dialed into the telephone number, please dial one and then zero to be entered into the queue.

The comment period is now open. Operator, please go ahead if you have any comments in queue.

OPERATOR: Yes. We go to the line of Dirk Smith. You line is open now.

MR. HALL: And Mr. Smith, if you would please spell your name for the record?

MR. SMITH: Spelled D-I-R-K. The last name is Smith.

MR. HALL: Thank you, sir.

MR. SMITH: Thank you for the opportunity to comment. First, I would suggest that PHMSA might review the current grade classification system to account for the amount of methane emitted over the life of the classified leak.

Brooke Sinclair told of KUB's policy to repair class one leaks within two hours. Such a leak does emit a great deal of methane, but only for a very short period of time.

We have experience with operators who

have pinhole leaks in plastic service lines. And while GPTC recommends class three leak repair within 15 months, I have read of some operators who have a two-year repair window.

The class three leak unrepaired for 15 to 24 months over the life of the leak, might leak as much as the two-hour class one leak.

So, with one and a half million miles of PE fuel gas pipe and distribution service, this could be a considerable source of emissions, if the current repair time frames remain in place.

Second, I'd like to note that while much intention in this hearing has been given to leak detection and repair, apart from damage prevention, I hope PHMSA will dedicate an equal amount of effort to leak prevention in its rulemaking. Which it has done in the past.

In 2015, in order to reduce future pinhole leaks in PE fuel gas pipe, PHMSA ruled that no regrind resin be used in manufacturing PE fuel gas pipe.

And it cited research reports of static breakdowns of pipe. And believed that improving resin quality would prevent pinhole leaks.

Indeed, Gas Research Institute as well as four forensic lab studies, have shown interior pipe static as the cause of pinhole leaks in PE fuel gas pipe.

Knowing that, operators which were experiencing such pinhole leaks, installed interior static suppression in their system. And achieved a 90 percent reduction in pinhole leaks in subsequent leak surveys.

Brooke Sinclair noted that KUB found couplings were a common source of leaks in their steel system.

I think by working to identify such potential leaks prior to installation, leaks are prevented. You're going to have repair costs saved, and methane emissions reduced.

And this could be accomplished by establishment of leak safety reporting system modeled after NASA's Aviation Safety Reporting System.

The ASRS system allows those involved in the aviation system to anonymously report safety incidents with immunity from prosecution in those incidents.

The information received through this program has widely been credited for improvements that resulted in the fact that there have been no fatal crashes in the United States of U.S. flagged air transport carriers in the last ten years.

So, I hope PHMSA will take those two suggestions in account. Thank you.

MR. HALL: Thank you for your comments, Mr. Smith. Any additional callers on the line, Operator?

OPERATOR: Yes. One moment, please. We'll go to the next line, is Mark Uncapher. Your line is open now.

MR. UNCAPHER: U-N-C-A-P-H-E-R. And I'm the Executive Director of the Fiber Optics

Sensing Association.

And I wanted to make the observation that much of the discussion in the last two days demonstrates how new and emerging technologies can enhance pipeline safety, and also meet environmental expectations.

I wanted to note that the Pipe Fact, Section 105, directs PHMSA to conduct a study and report back to Congress on the potential for having its own pipeline research and test facility.

Pipelines are, of course, the only transportation mode without their own facility. So, having a recognized federal pipeline research safety and test facility, will help speed the validation of promising technologies, and lead too much more rapid adoption.

MR. HALL: Thank you for your comment, sir. Any additional callers in queue?

OPERATOR: Yes. We'll go to the next line. One moment, please.

And that next line is Damon Evans.

Your line is open now. Please go ahead.

MR. EVANS: Thank you. Good afternoon. Thank you again, for the opportunity to speak and provide some additional perspectives on leak detection, and particularly leak detection technology.

My name is Damon Evans with the American Petroleum Institute. And I work with our member companies on safety and cybernetics, including leak detection.

After a day of robust discussion around the use of this technology, there are a couple of things that I wanted to highlight that are critically important to pipeline operators in managing leak detection.

The first is the importance of continuing to allow operators the flexibility to select and implement specific commercially available leak detection and repair technology and best practices -- and best practices that are appropriate to the assets involved.

Pipeline operators take a programmatic

approach to leak detection, which at times can include various types of tools to address leak detection concerns.

And often, operators have found that there is not one specific technology or approach that is right for every pipeline system.

Specifically, many operators employ computational pipeline monitoring system, CPM and other similar technologies. But, that is only one aspect in considering a layered programmatic approach to leak detection management.

Other tools operators are utilizing in concert, are such things as drones, satellite imagery and visual inspection surveys.

For liquid pipelines, American Petroleum Institute recommends recommended practice 1175. It proves operators a framework to develop and implement a comprehensive leak detection management program that is similar to the techniques used in gas pipeline leak detection protocols.

Also, American Petroleum Institute

recommended practice 1130, on the computational pipeline monitoring supports, are the current regulatory requirements through incorporation by reference, providing operators the latest in TPM as they continue to look for ways to enhance their current programs.

Additionally, it cannot be overstated that the importance of research and the development and testing of leak detection, technology must continue in order to properly address current and future concerns of methane emission from pipeline systems.

And you have heard earlier today, leak protection continues to be a strategic research priority within the industry.

And a great deal of research is ongoing to improve performance in the detection of small leaks, highlighting the importance to align research priorities between the industry and the government.

Lastly, during the most recent pipeline safety reauthorization, Congress included a mandate authorization for PHMSA to establish a technology pilot program to include testing and evaluation of technologies, including leak detection for gas and liquid pipeline.

Prior to inventory updates, PHMSA requires data to demonstrate technology capabilities or the technical validity of newly developed risk models and safety management practices.

The pilot program identified in the 2020 PIPES Act, can help in building that data needed to modernize and seal gas in its regulations.

As such, we would encourage PHMSA to move quickly in establishing the technology pilot program, to ensure operators have ample time to participate and test new technologies.

Thank you for your time.

MR. HALL: Thank you for your comment.

OPERATOR: And Mr. Evans, if we can get you to spell your first and last name for the record?

MR. EVANS: Yes, sir. Damon Evans, D-A-M-O-N, Evans, E-V-A-N-S.

OPERATOR: Thank you.

MR. HALL: Thank you. We have no comments in the Q&A box. Go ahead Operator.

OPERATOR: Well go to the next line. One moment, please. And please spell your first and last name for the record.

And Erik Rodriguez, please go ahead.

MR. RODRIGUEZ: E-R-I-K R-O-D-R-I-G-U-E-Z. Hello everyone. I'm with the Gas Emissions R&D Group at SoCalGas.

I just wanted to mention a few key points from our research lessons learned that I think would be valuable for this audience.

For emission factor studies, we've seen that national studies only provide a national average. These are therefore, not useful in emission reduction strategy.

Company specific emission factors have the advantage of being able to track reduction efforts.

Leak measurement is not easy. And it requires standardized procedures and equipment. Which are actively being developed, as we covered during this meeting.

Sample size and sampling technique are critical to obtain necessary procession and confidence in leak rates.

Because leak measurement is so costly and difficult at the moment, being able to perform sample measurements and use statistics to determine company leak rates and develop company emission factors, is advantageous.

Second, emissions can be reduced without knowing the true volume of the emissions through largely prioritization strategies, leak inventory reductions, and risk-based leak survey strategies.

And lastly, cost effectiveness is key to evaluating new technologies. We must always keep in mind the incremental costs of adding screening technologies, compared with just doing additional leak survey, or the incremental cost of installing and maintaining additional sensors compared to inspecting facilities more frequently.

That is all. Thank you.

MR. HALL: Thank you for your comments. Go ahead Operator.

OPERATOR: And we have no further comments in queue at this time.

MR. HALL: We also have no comments in the Q&A box. I'll give folks a minute to make their comments if you wish.

And again, we're standing by for any additional comments from the public. If you have a comment on the telephone line, you can dial one and then zero to get into queue.

Or you can enter your comment in the Q&A box. We'll give you 30 seconds to participate if you wish.

Okay. One last check. Operator, no additional comments?

OPERATOR: No additional comments at this time.

MR. HALL: Thank you. Thank you all. This concludes the public comment period. Thank you very much for your comments.

We'll now transition to the close out and wrap up for the day. Again, please welcome Massoud Tahamtani, Deputy Associate Administrator for Policy and Programs.

The floor is yours, Massoud.

Massoud, you may be muted.

MR. TAHAMTANI: Thank you, Sam. On behalf of our Acting Administrator, and Associate Administrator, and our entire staff involved with organizing this public meeting, thank you all for your attendance and participation in this public meeting.

And a special thanks to all of the panelists. And the last time I checked, we had over 270 individuals still on the line. That's a great indication of the interest in this matter.

As had been mentioned a couple of times, public meetings like this are very important to PHMSA, in order to have an open exchange of ideas with all of our stakeholders, and to establish a public record to assist us in carrying out rulemaking and other mandates.

Over the last two days, we've covered a lot of areas relative to leak detection, leak repair, and methane emission reduction.

It was a lot of productive dialog in each of the panel discussions. We had a lot of great questions and great responses.

We heard a variety of perspectives from public, federal and state government, pipeline operators, and the technology sectors. We truly appreciate all your comments and feedback.

I do wish to reiterate our overall goal of reducing methane emissions and improving pipeline safety using a variety of approaches.

Our staff under John Gale's leadership, who has done a lot of work already to help PHMSA meet this mandate, will begin drafting this proposed rule considering the comments and feedback we have received during this public meeting, and I'm sure will receive in this docket.

So, with that, I will now turn the meeting over to Sam to conclude what I believe a very productive two-day public meeting.

Thank you, Sam. Back to you.

MR. HALL: Thank you, Massoud. This does conclude our meeting for today. Thank you again to all who participated, especially our panelists and our commenters.

As a reminder, a recording and a transcript of the meeting will be available on the meeting website where you registered in approximately ten business days.

This concludes the meeting. Thank you again. Have a good and safe evening.

OPERATOR: Thank you. Ladies and gentlemen, that does conclude your conference. We do thank you for joining. You may now disconnect. Have a good day.

(Whereupon, the above-entitled matter went off the record at 3:51 p.m.)

A

D

I

C E R T I F I C A T E

This is to certify that the foregoing transcript

In the matter of: Pipeline Leak Detection, Leak Repair and Methane Emission Reduction

Before: USDOT/PHMSA

Date: 05-06-21

Place: teleconference

was duly recorded and accurately transcribed under my direction; further, that said transcript is a true and accurate record of the proceedings.

Court Reporter