2020 COLUMBIA GAS OTD PROJECTS

Gas Operations R&D Projects

Validating Non-Destructive Tools for Surface to Bulk Correlations of Yield Strength, Toughness, and Chemistry, Phase 2
Facilitate the use of non-destructive surface testing: micro-indentation, micro machining, in situ chemistry, and replicate microscopy analysis as accurate, efficient, and cost-effective tools for material property confirmation. This work will provide benefits to pipeline safety, energy continuity, and integrity assessment programs since these techniques do not require a line to be taken out of service and do not destructively cut out samples from the in-service pipeline.

In-Field Compliance Validation
Perform automated validation of field collected data during construction to ensure that all data required for regulatory compliance is captured. This validation will be performed in real-time to identify any gaps while in the field to allow issues to be addressed immediately before the asset is put into service and the project is closed-out. Further, the proposed solution will validate specific material properties and test results to ensure that results support the specified MAOP.

Self Healing Coatings
Develop self-healing coating formulas from commercialized anticorrosive coatings and self-healing additives for gas pipelines. Compare corrosion resistance, mechanical properties, and preparation requirements in the lab then determine relative cost differences.

GPS-based GIS Conflation System, Phase 3 - Pilot Project
Develop and demonstrate a real-time GPS-Based GIS Conflation System to increase the accuracy of a GIS using GPS data collected as part of routine operations. A process called conflation is used to shift the geometry stored in the GIS database to match the GPS coordinates of assets collected with high accuracy equipment. This Phase 3 project will focus on increasing awareness of GPS-based conflation as a process that is available to Gas Utility companies.

Cybersecurity Collaborative - Phase 2
Continue the successful efforts of the Collaborative between OTD and the Department of Homeland Security (DHS) which is a 50% co-funder. The collaborative addresses high priority cybersecurity issues using a multi-year coordinated process focused on the development of an outreach and education process and a technology evaluation and transfer initiative.

ORFEUS Obstacle Detection Technology for Horizontal Directional Drilling, Phase 2
Produce a field-proven, market-ready, obstacle location technology for use in horizontal directional drilling (HDD) applications. ORFEUS (Optimized Radar to Find Every Utility in the Street) is an effort aimed at developing a safe, cost effective “look-ahead” obstacle detection system for HDD equipment. The ORFEUS effort is conducted by a collaborative organization of multiple companies to develop a prototype that has been field tested, both in Europe and the US. This project seeks to further develop the technology to bring forward a commercially viable product for identifying obstacles in and around the path of a HDD drill rig, therefore, reducing third-party damage to underground utilities.
Material-Supplier Quality Assurance Program
Assist gas utilities in creating best practice guidelines to develop and manage a material-supplier quality assurance program, create a standardized approach to key processes affecting the quality of materials used by the gas utilities, and identify and select comprehensive regulatory and technical requirements specific to products utilized in natural gas transmission and distribution systems.

Spray-On Leak Seal for Meter Set Joints
Identify possible spray-on or brush-on solutions to seal thread leaks on meter set assemblies (MSAs) and conduct a thorough evaluation of the various identified systems. The evaluation effort is to establish ease of use and permanency of the identified sealants.

Advanced Cross-Bore Detection Using Visual and Sensing Technologies
Develop a new to the industry inspection system which combines visual and sensing technologies (e.g. mechanical spring, radar, ultrasound, etc.) to remove the human element and uncertainty from the cross-bore detection process. The proposed solution will be designed to tackle the worst-case scenario; drilling which requires fluid that makes visual inspection impossible. The finished product will be a solution comprised of both hardware and software that can be used to detect potential cross-bores regardless of the bore slot conditions.

Noncamera-Based Technology to Detect Cross Bores
Develop a tool to detect legacy cross bores. Focus on identifying viable non-camera technologies and evaluating prototypes which can lead to the development of reliable and cost effective cross bore detection tool for legacy transsections.

Virtual Reality (VR) Training: Emergency Response Situations and VR Library
Introduce virtual reality (VR) as a training tool and demonstrate the value that this type of training brings to the natural gas industry. VR training, or “learning-by-doing”, has one of the highest retention rates of all teaching styles and is an adult learning technique. As part of this project, a VR emergency response training module will be developed that can be used and if needed, customized by all project sponsors. The VR emergency response training scenarios may include: Communication between first responders, Eliminating sources of ignition, Performing leak investigation, Evacuating and ventilating premises, Responding to injuries, deaths, fires, explosions, and third-party hits on gas facilities, Making the scene safe, Working with tools and equipment, and Other scenarios identified by the project sponsors.

Single Path Meter Testing (Sensus and Itron)
Conduct the necessary evaluations of recently introduced Sensus and Itron (and potentially others) “Single Path” Ultrasonic residential meters for utility and State Commission acceptance. This effort will prove the measurement performance and accessory meter technology to allow the use of this style of meters by LDCs.

Evaluation and Demonstrations of the Utonomy Smart Regulator
Conduct a technical evaluation and North American field demonstrations of the Utonomy Smart Regulator for medium and low-pressure gas distribution systems.
**Vintage Polyethylene Pipe Squeeze-off – Best Practices**
Provide gas utilities with specific guidelines and best practices for performing squeeze-offs on vintage polyethylene pipes and also provide methods to maintain the life of the squeezed pipes.

**Over Pressure Protection Options for Low Pressure Gas Distribution**
This project will identify and evaluate overpressure protection options available within the industry for low-pressure gas distribution customers. Also, this project will engage gas pressure regulator manufacturers on possible R&D efforts to enhance current designs to meet industry needs. For example, increasing flow capacity, having the ability to regulate minor over-pressure fluctuations, and minimizing the pressure differential through the device. In addition, a reference guide will be created for LDCs to use when considering which type of over-pressure protection option to install on the end of low-pressure service lines to improve overall system integrity.

**Subsurface Multi-Utility Asset Location Detection**
The goal of this Phase of the Intrinsically Locatable PE Pipe project will be to build on the success of the past efforts and focus on necessary enhancements and industry implementation. The team will continue to enhance the electronic marker and locator. The team will work to optimize the attachment process for the efficient manufacturability of the locatable pipe. The team will define and validate the enhanced system through laboratory and field testing. The project team will work with utility owners/operators to implement the locatable pipe into the natural gas industry.

**Procedures for Selecting Locating and Excavation Equipment**
This project will identify recent advances in locating, GIS, and excavation technologies which address damage prevention, right-of-way monitoring, and detection of difficult-to-locate systems. Investigate relevant federal and state requirements and industry best practices. Select locating and encroachment notification systems to match excavators’ specific site properties and operation requirements. Perform predictive analysis to assist in identifying risk drivers and advancing the assessment of situational awareness.

**2020 Training Technologies Consortium**
The objective of this proposed project is to identify new cutting-edge training technology (e.g., VR, AR, XR, 360 video, simulators, gamification, etc.) that can be adopted by LDC’s for training their new workforce. In addition, this effort will include identification of training service providers and coordinating an annual workshop where project sponsors can evaluate the technology and meet with industry service providers of each technology.

**Pipe Thread Conformance to B1.20.1 Standard – Pipe Supplier Quality Assurance**
This project will investigate pipe thread conformance with the ANSI / ASME B1.20.1 Standard for the major pipe suppliers within the natural gas industry, work with project sponsors on creating an quality control check, and work with pipe suppliers on improving their conformance to the B1.20.1 standard.
**Single Path Ultrasonic Meter Long-Term Performance Testing and Monitoring**
The objective of this project is to install single-path ultrasonic residential meters on live gas distribution systems and conduct long-term performance and accuracy testing over an 18-month period. These installations can take place at GTI or on a project sponsor’s delivery system.

**HDD Weak Links**
This project is to review the industry’s best practices and evaluate various commercially available weak links for trenchless installation of plastic pipe and tubing. The intent is to create a Weak Link Break-away Best Practice guide that can be used by the project sponsors.

**Smart Shut off Technology for Commercial and Residential Buildings**
Currently, the natural gas industry infrastructure lacks enhanced smart safety features that can detect and terminate gas flow in response to a hazardous incident such as a gas leak inside a residential or commercial structure. There are commercially available stand-alone devices such as excess flow valves and natural gas leak detectors, however these devices do not possess the communication ability to automate a safety response among emergency personnel, natural gas customers, gas shutoff, and the local gas distribution company (LDC). A Natural Gas Smart Safety Shutoff System would provide an additional layer of protection for customer’s life and property by detecting hazardous conditions, providing appropriate alerts and having features that can automatically take preventative actions such as stopping the flow of gas into a structure.
This cofunded project with the California Energy Commission (CEC) will provide the natural gas industry with the necessary hardware and software components that comprise a full solution smart safety shut-off system for use in residential and commercial structures.

**Validation of Non-Destructive Testing (NDT)Technology for PE Pipe**
The objective of this project is to evaluate and validate the claims of commercially available non-destructive testing (NDT) technologies for PE pipe and fitting joints. This evaluation will include heat fusion (e.g., butt and sidewall) and electrofusion (e.g., couplings, branch fittings, service tees, etc.) pipe joining methods. It is imperative that the industry understands the capabilities and limitations of these different NDT technologies in order to make informed decisions on whether the technology should be relied upon to make decisions regarding joint integrity.

**PRCI Membership**
Provide labor and travel support in 2018 for the PRCI membership by OTD. This work is associated with keeping the OTD funders of the project informed about the projects they are funding. OTD will be represented at the PRCI Technical Committees and Board-level Executive Assembly meetings. There are many PRCI projects that complement OTD projects and this project will enable coordination and participation.

**Quality Audit Program**
Provide natural gas utility operators with a mechanism to collaboratively audit supplier’s quality management systems. Conduct an independent and unbiased assessment of industry suppliers in order to improve the overall quality and integrity of the natural gas system. The program was created to streamline and enhance the Gas Utilities’ audit processes and make it more efficient.
Center for Methane Research
The Center for Methane Research (CMR) was established to provide a centralized, industry-wide technical and policy support resource focused on the presence, measurement and potential impacts of methane in the atmosphere. The strategic approach to achieving this goal includes adopting a “good science / common sense” philosophy that addresses the end-to-end process of natural gas exploration, production, processing, transportation and ultimately end-use. Development of this “wellhead-to-burner-tip” industry resource provides a common platform of technical understanding that can be used in the decision-making process in support of balanced policy decisions that impact the environment, industry, and ultimately the consumer.

Remote Gas Sensing and Monitoring Phase 4
Perform field demonstrations of the prototype system that was developed during Phase 1. This will allow the sponsors to work with the prototype and to provide feedback. This feedback will be shared with a prospective manufacturer. The goal of these activities is to provide definition to the form the commercial system will take. The objective of the overall project is to develop systems to allow a leak investigator to remotely monitor methane levels at multiple points within a site under investigation. The investigator uses a tablet, phone, or other connected device to see the gas values in real time.

Evaluation of “Point and Shoot” Methane Detection Technologies
Test the effectiveness of laser-based “point and shoot” methane detection tools to identify leaks. Evaluate how well these instruments perform compared to standard handheld CGI type sensors for initial leak identification and how well they perform relative to each other.

Develop Remote Sensing and Leak Detection Platform with Multiple Sensors
The objective is to improve and deploy additional instances of a defensive pipeline right-of-way (ROW) Monitoring System based on stationary sensors mounted on and near the pipeline. Sensor data from multiple locations along the pipe is wirelessly forwarded to a central location for processing. Analytics at the central location correlates data from multiple sensors to rapidly alert operators to events occurring in the ROW. One prototype system is currently deployed; the project seeks to deploy two more instances with improved field hardware and Machine Learning (ML) analytics incorporated. This work is a collaborative effort that is co-funded by PHMSA and Operations Technology Development (OTD).

Validation of Remote Sensing Leak Detection Technologies under Realistic Conditions
The project will focus on advancing unmanned aerial (vehicle) systems (UAS, UAV, drone) mounted remote sensing technologies. These will be used to move integrity threat and leak detection methods (currently tested under highly controlled test facility conditions) toward more realistic validation under real-world, operational conditions found within natural gas transmission and distribution pipeline systems. The project will focus on key validation testing components that should occur after completing extensive leak facility testing to ensure equivalency of any new techniques with existing techniques.

Gas Dispersion Modeling for Venting Natural Gas from Structures
The objective of this project is to work with Fire & Risk Alliance LLC (FRA) to develop a best practice on how to properly vent accumulated natural gas from a building through both physical testing using a built
structure and computational fluid dynamic (CFD) modeling. The purpose of this research is to map the dispersion and ensuing ventilation of natural gas from within a residential structure for several different scenarios. Industry needs this information so that first responders or utility personnel can employ safe and proven techniques to carefully ventilate natural gas down to levels below the lower explosive limit.

**Laboratory Evaluation of Personal Flammable Gas Monitors**
The objective is to conduct a testing program of commercially available Personal Gas Monitors (PGMs) similar to work performed for OTD project 1.14.g Evaluation of Residential Methane Detectors. Testing will include performance evaluation of 5%, 10%, and 25% LEL of methane in air, possible interferences from commonly used household chemicals, and the impact of hydrogen blended into natural gas with testing at 5% hydrogen and 95% methane.

**Impact of RNG on End Use Applications**
Determine the effects of trace constituents in Renewable Natural Gas (RNG) on end use applications. Information from prior projects and the technical literature will be leveraged in this project to evaluate the impact potential trace constituents may pose.

**Trace Constituent Database**
Create an on-line searchable database that will compile natural gas and renewable gas major, minor, and trace constituent concentrations along with sampling and measurement techniques. A potential home for the database is the Gas Quality Resource Center (GQRC) website and this will be investigated during the project.

**RMD’s Sensor Drift and False Negatives**
Determine if a Residential Methane Detector (RMD) that experiences a long-term exposure to low concentrations of methane will exhibit sensor drift resulting in a false negative alarm.

**Remote QA/QC: Fusions, Phase 2**
The main objective of the Remote QA/QC Fusion project is to complete the development of an inspection workflow platform that enables the inspection of fusions from remote, offsite locations. The platform will provide a configurable web application that uses a process-based review of the field-collected data, incorporating best practice data collection templates and fusion-related artificial intelligence (AI) to assist remote inspectors in the inspection and approval process.

**Tracking and Traceability Marking Standard for Natural Gas Transmission Components - Phase 2**
Enable the capture of key information required for physically documenting and geospatially modeling new or repaired gas transmission systems to support the latest PHMSA regulatory requirements. In order to achieve this, three major developments must take place: 1) Develop a machine-readable marking standard for all steel natural gas transmission system components. The marking standard would hold key information and allow the linkage of information required to support the latest PHMSA transmission tracking and traceability requirements. 2) Construct an automated field data collection processes linking the required manufacturers’ inspection and test documentation, and support automated definition of each field-installed component in the GIS. 3) Gain the required industry acceptance for publication of the standard under one or more standards organizations.
**GNSS Smart Automations for Field Data Collection**
Increase the quality and consistency of location data collected using Global Navigation Satellite System (GNSS) receivers by automating certain steps of the collection process and reducing the burden on field data collection personnel. Produce a middleware software and hardware technology that operates between the user’s existing GNSS receiver and existing field data collection smart device. The new technology will help ensure consistency and verify that quality thresholds are satisfied. Additionally, the technology will reorganize the collection process so that the field data collector is required to operate and handle fewer components during any given step.

**Component Marking and Laser Etching Development – Phase 2**
Improve the durability and readability of data carriers (intelligent marks) suitable for use on construction materials. While many data carriers (such as barcodes) are suitable for processing materials at point of sale terminals, the use of data carriers in the construction industry for field data collection is just starting. This project will research improvements in data carriers, including barcodes, RFID, intelligent coating systems, and embedded intelligent particles in the bodies of a construction component. The research will focus on data carriers that may be read by a machine during transportation, storage, and eventual incorporation into a network service delivery system or structure. Laser etching is one data carrier that will be tested in this project.

**Structured Approach Incorporating Pipeline Safety Management Concepts into Existing Programs**
Improve overall organizational safety by broadly implementing Pipeline Safety Management (PSM) concepts across existing programs and technology platforms used to support the activities of those programs. Such an undertaking represents a significant change for any organization and could pose several challenges. Demonstrate how tools and techniques from the Business Analysis discipline can be applied to manage the transformation of existing programs for the improvement of pipeline safety management.

**Smart Phone Tools**
Evaluate and rigorously test freely or inexpensively available smart phone apps which may serve as tools for increased safety or productivity for gas utility personnel. The focus will be on apps which the user can download and deploy themselves, rather than on expensive enterprise applications which require expert deployments and on-going maintenance. These include the types of apps employees may already be using without official recognition or accessibility from the company.

**Augmented Reality (AR) O&M Procedures and Checklists**
To identify and evaluate augmented reality (AR) software applications and hardware equipment (i.e., wearables and handheld) that can be used by field personnel within the natural gas industry to assist with performing operations and maintenance (O&M) tasks. The goal of this project is to demonstrate the value of this technology and identify intuitive software applications and hardware equipment preferred by the natural gas industry.

**High-Accuracy Mapping of Leak Surveys**
GTI will develop a framework to couple high sensitivity methane/ethane sensors with high accuracy GNSS systems for on-foot leak investigations and walking surveys. GTI will
focus on real-time data visualization and compatibility with multiple methane/ethane detectors and GNSS devices.

**Above Ground Service Tee Identification and 3D Mapping**
White River Technologies has above-ground three-dimensional electromagnetic (3DEM) technology that has been proven in defense applications of locating subsurface, metallic infrastructure. In this project, the 3DEM technology would be used to define distinct fingerprints of service tees to distinguish between other subsurface features. Tees would be located by identifying the locations of the metallic cutter tool within the tees.

**Enhanced Locating Technologies for Underground Pipelines with Better Accuracy**
Gas Technology Institute (GTI), along with White River Technologies (WRT), proposes to improve the safety and integrity of underground natural gas pipelines by increasing the accuracy and availability of horizontal and vertical pipeline location information. The solution is based on enhancing and adapting above-ground large standoff 3D electromagnetic (3DEM) detection technology (developed by WRT) and supplementing the technology with an in-pipe mechanism (developed by Reduct) to focus on congested areas and plastic materials. The combined solution will address most of the infield conditions, including varying pipeline material, depth, and surface cover. The improved tools will provide access to the three-dimensional data in near-real-time.

**Data Collection, Normalization and Integration Methods to Enhance Risk Assessment Tools for Decision Making**
Explore the application of various kinds of statistical and machine learning techniques to identify the quality, reliability, and traceability of sensor data in assessing integrity risks. Develop improved methods for estimating risk levels within a pipeline risk management system. Develop methods to estimate the value of information provided by sensors of various types in different applications. Develop decision tools to support pipeline integrity managers in selecting the most cost-effective additions to sensor networks in terms of reduction in expected risk within a given budget for risk management.