

# METEC Facility: Building a Pseudo-Realistic Underground Pipeline Testbed to Enhance Leak Detection Testing Capabilities

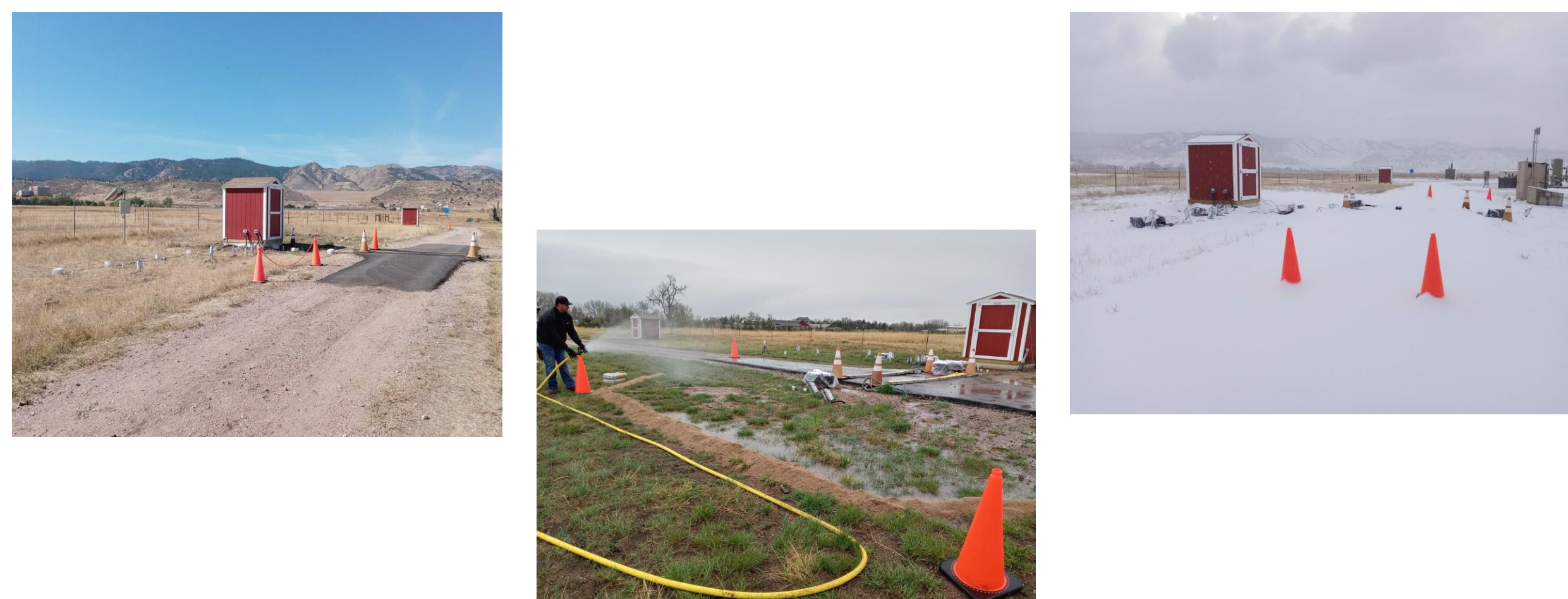
## Intro and Motivation

- Leak detection and repair (LDAR) effectiveness is influenced by soil, moisture, wind, and other environmental conditions.
- Shifting environmental factors cause complex underground gas migration.
- Leak detection protocols must be able to adapt to diverse subsurface and surface conditions.
- Pseudo-realistic pipeline testbeds support LDAR development, testing, and validation.
- Verifying LDAR methods on underground leaks ensures robust, field-ready solutions.

## Past Pipeline Builds at METEC

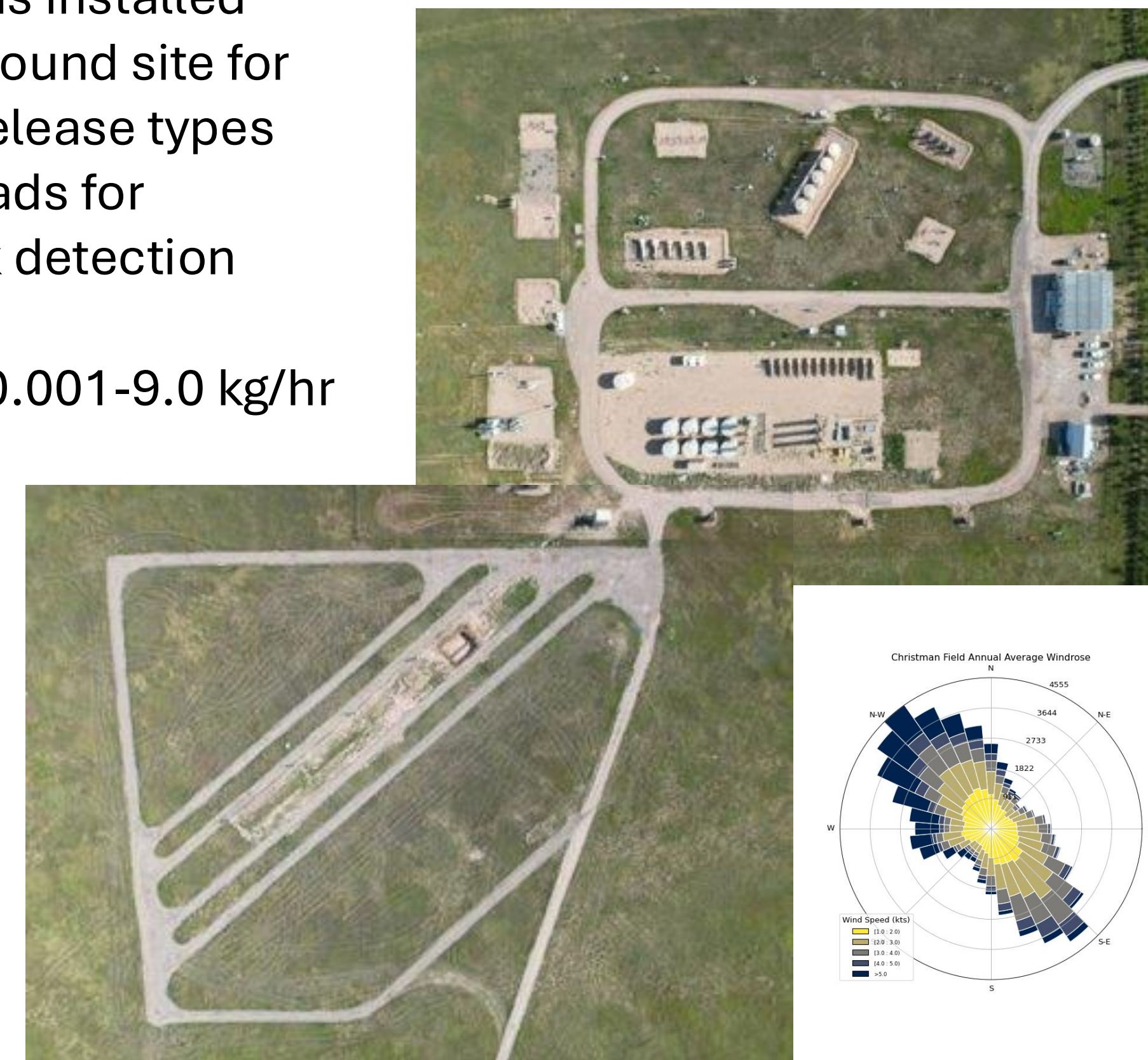
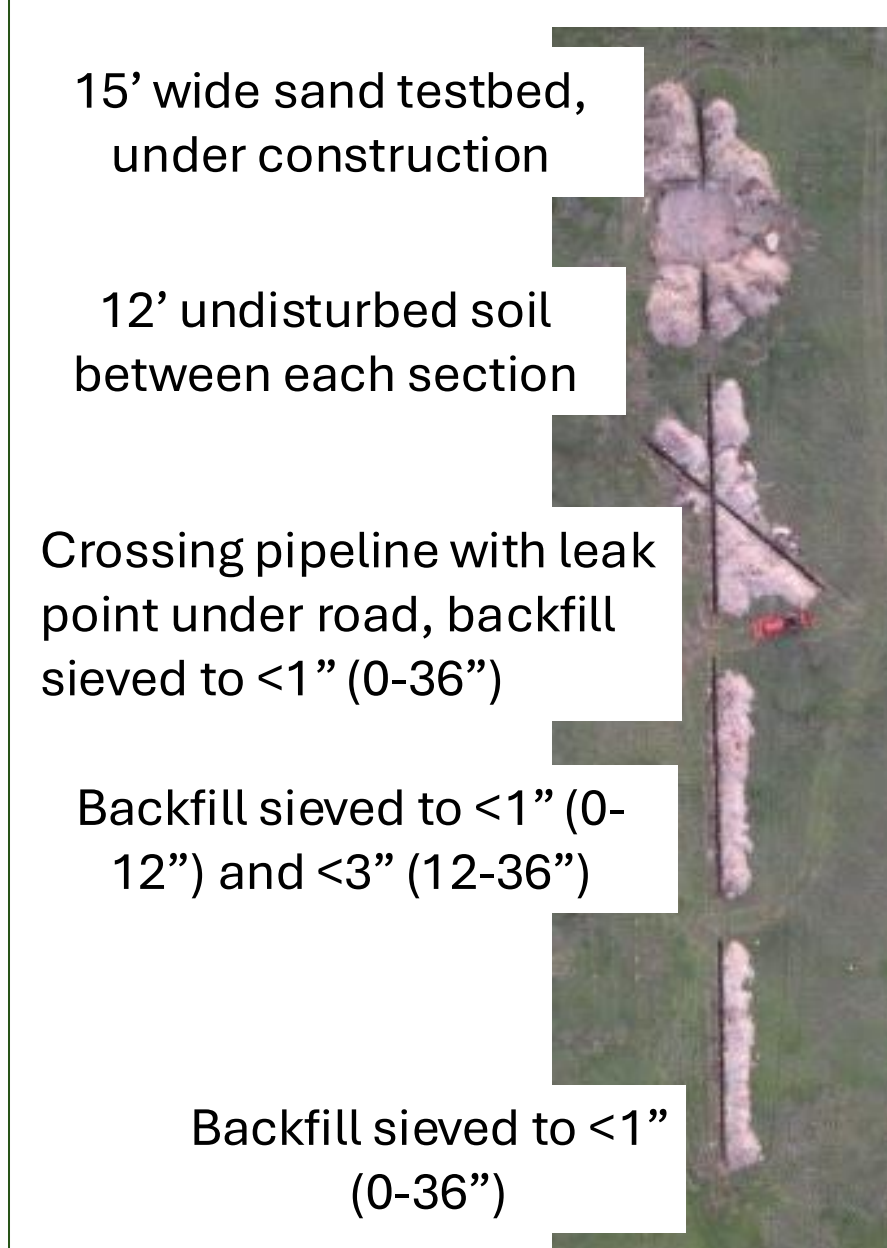


- Aboveground testbeds with the ability to release upwards of 200 kg of CNG a day.
- Rural testbed; simulated leak
- Sand testbed; simulated pipe and leaks in sand and natural backfill
- Urban testbed; simulated pipes and leaks with structures and asphalt pavement (photos below)

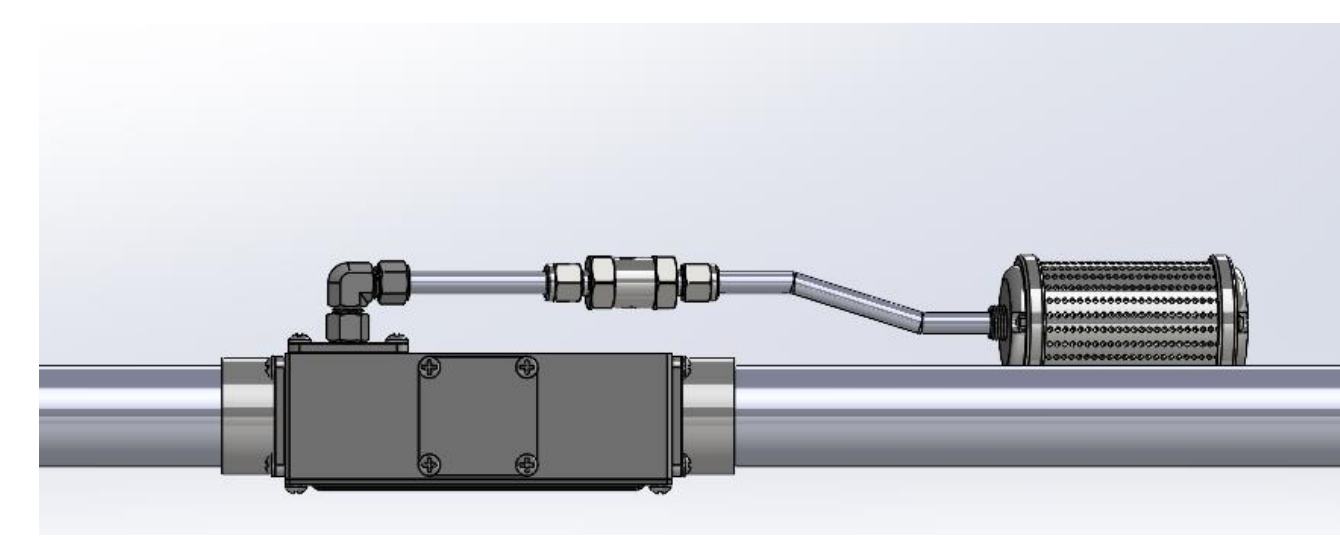
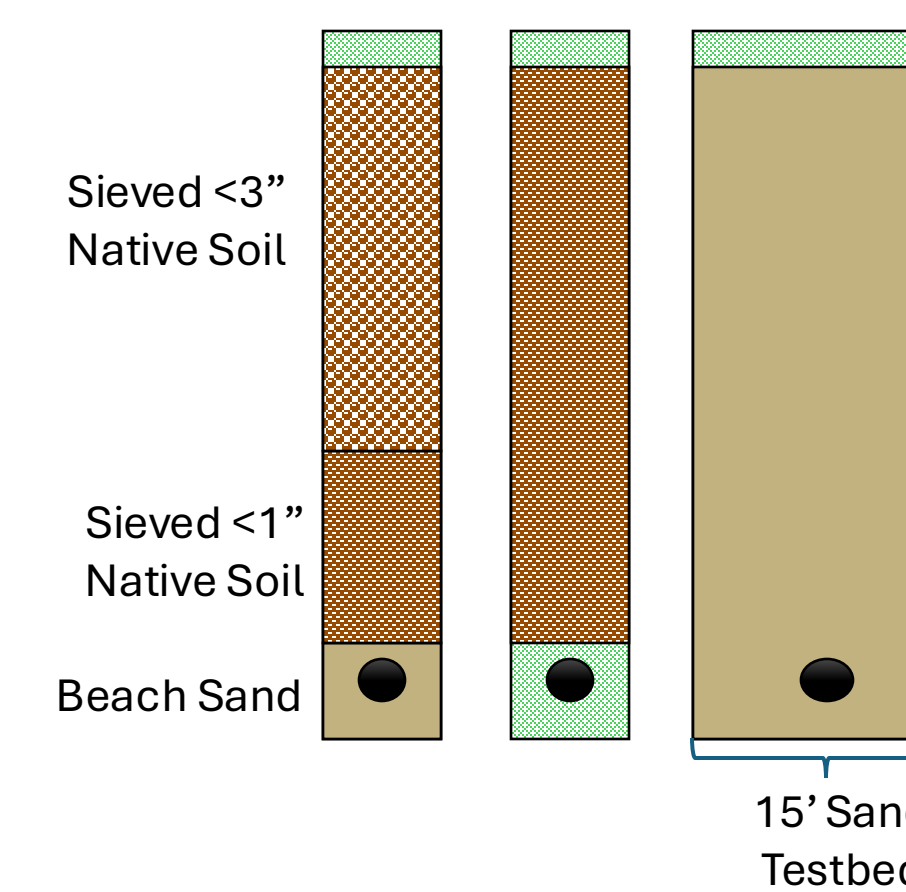


## New Pipeline Testbed Build

- Four 20-meter sections installed southwest of above ground site for separation between release types
- Surrounding gravel roads for advanced mobile leak detection surveys
- Capability to release 0.001-9.0 kg/hr



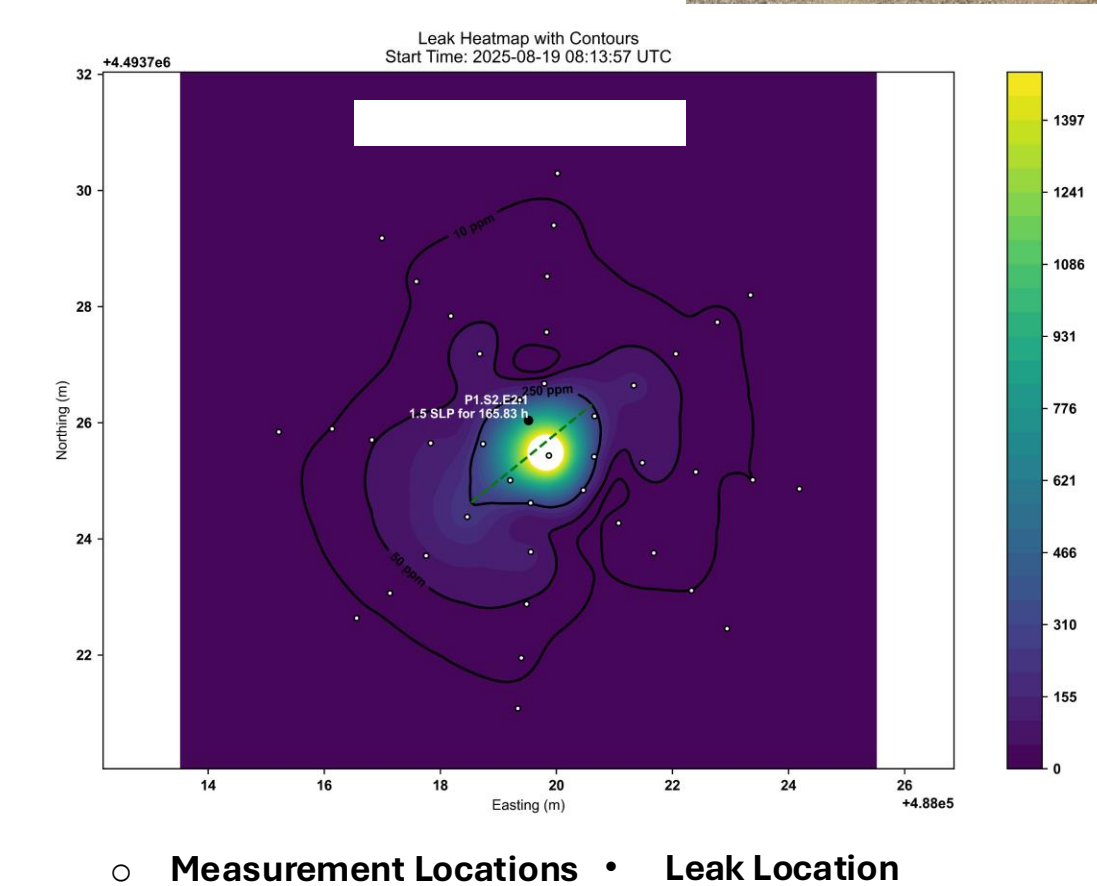
- Three backfill configurations
  - All sections are bedded in 4" of sand
  - Native soil was removed during construction, sieved to two different sizes and used as the backfill for 3 of the 4 sections.
  - Sand testbed will be backfilled with sand and active soon



- 2" PVC tubes simulate the pipeline.
- Emission points are located every 10' along the pipeline.
- Emission points were designed with minimal extension from.

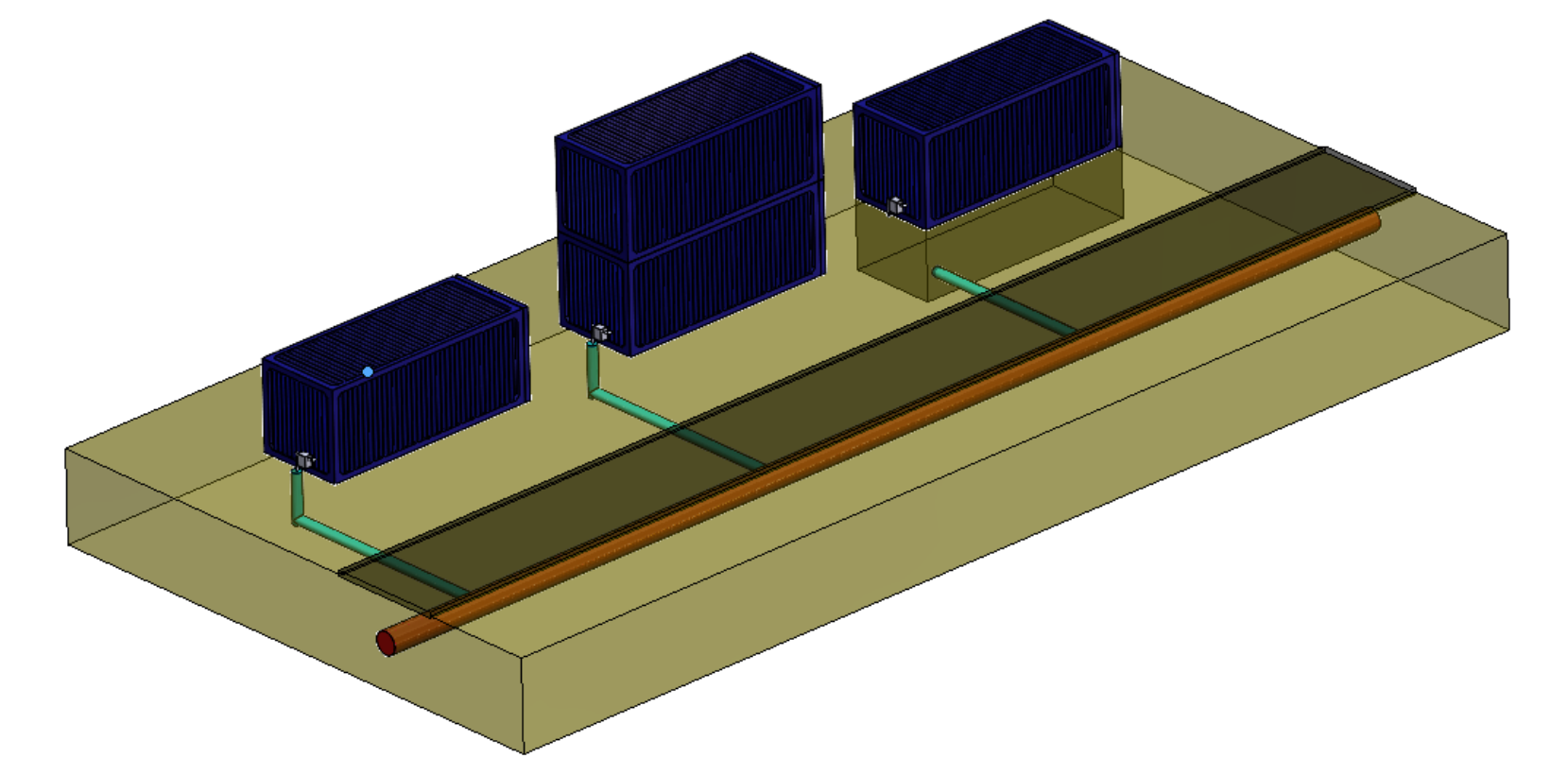
## Data Collection Efforts

- Driving, walking, and simulated UAV surveys are being conducted over long term releases.
- One of the goals is to conduct a variety of surveys over a variety of leak sizes and environmental conditions
- Surface expression data is collected in a 5-meter radius around leak location



## Next Steps

- Current site provides significant area to expand through the construction of additional sections
- High level of variability in backfill, depth, and pipeline material possible
- Multi-mode capability for different sensing technologies
  - Ground penetrating radar
  - Magnetometry
  - Acoustics
  - Oxygen depletion
- Ability to add real world obstructions such as structures, cars, and vegetation
- Complete sand testbed
- Install underground gas monitoring system
- Install underground soil moisture and temperature system
- Implement automated data collection to replace surveys



## Contact

Pipeline testbed development efforts are supported by the Department of Energy under Award Number DE-FE0032276 as well as by METEC's diverse industry partners' support including provision of cost share funding.

The METEC facility depends on active stakeholder engagement to remain relevant. Please reach out if you have ideas for site improvement, expanded testing capabilities or would like to utilize the site for your testing needs.

Kate Patterson  
Research Associate  
Kate.Patterson@colostate.edu

Dan Zimmerle  
Director, METEC  
Dan.Zimmerle@colostate.edu

## Acknowledgments

We would like to acknowledge the Dr. Kathleen Smits Research Group at SMU for their contributions to the design and development of the pipeline testbeds at METEC. <https://people.smu.edu/ksmits/>

