Chesapeake Energy – Eastern Division Aerial Leak Detection in Natural Gas Gathering Pipelines

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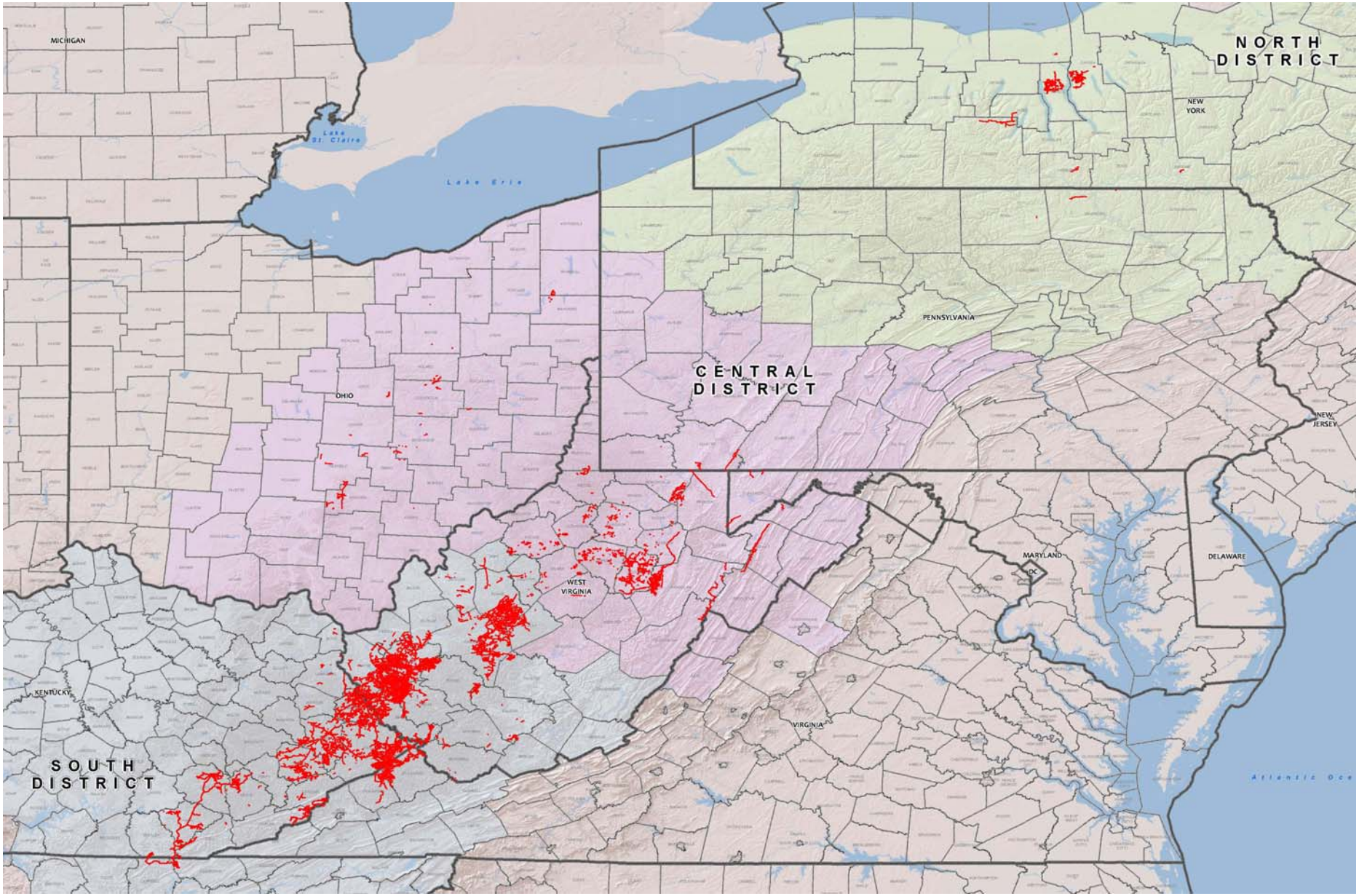
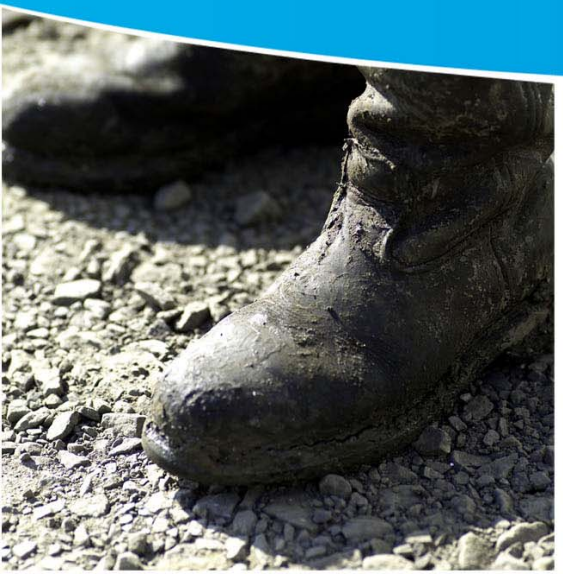
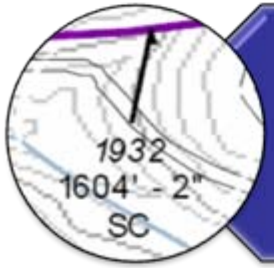

MICHIGAN
Lake St. Clair
Lake Erie
NORTH DISTRICT
NEW YORK
PENNSYLVANIA
CENTRAL DISTRICT
OHIO
NEW JERSEY
MARYLAND
DC
DELAWARE
WEST VIRGINIA
KENTUCKY
VIRGINIA
SOUTH DISTRICT
Atlantic Oce

Reasoning for Helicopter Based "Sniffer" LDS:



Approx. 6500 Miles of Active Pipeline



Vintage range from 1890's to Present

Terrain, Canopy (lack of visibility in leaf-cover), Accessibility Issues

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Apogee Leak Detection System

An innovative infrared-based method for detecting leaks from hydrocarbon liquids and gas pipelines, production and storage facilities, landfills, and coal-seam seeps.

LDS – 3rd Generation

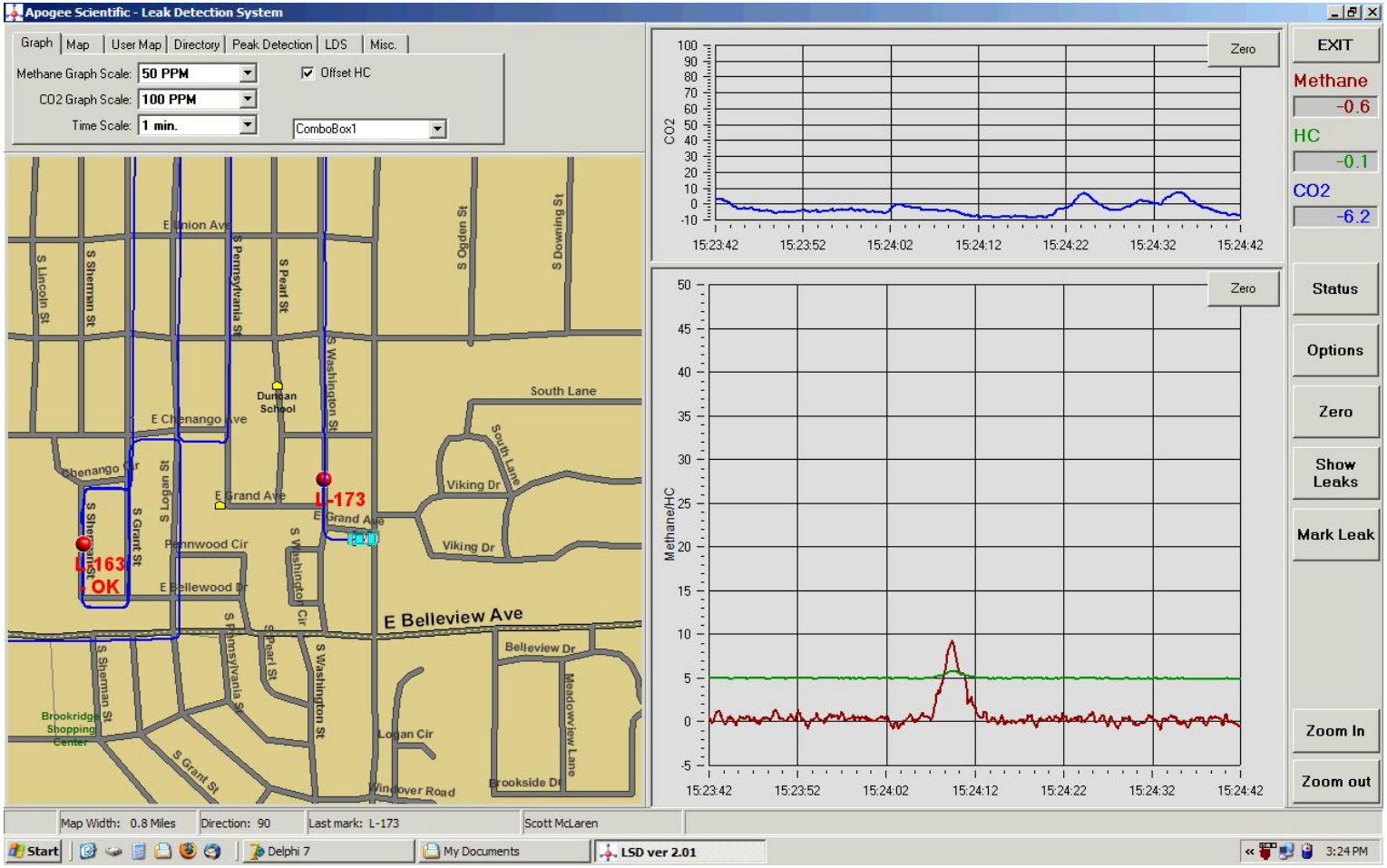
- High Speed – High Sensitivity Three Gas Detector for Mobile applications
  - Methane
  - Total Hydrocarbons
  - Carbon Dioxide
- GPS with real time mapping system
- Integrated Geographic Information System (GIS)

Truck Mounted LDS

ATV Mounted LDS

Helicopter Mounted LDS

LDS Operating Software



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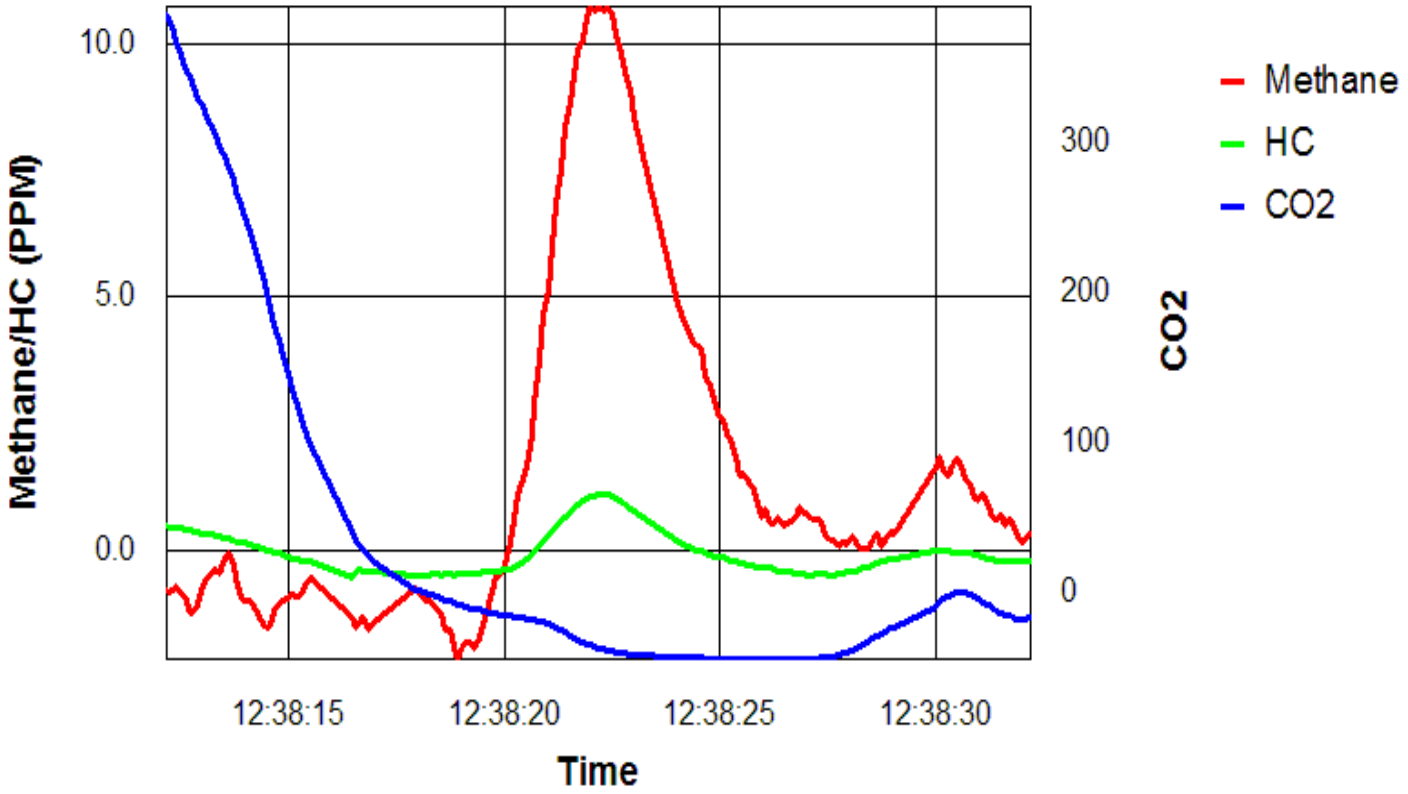
Dry Gas

- Mostly methane, small amount of HC, No CO2

→ Dry Gas leak



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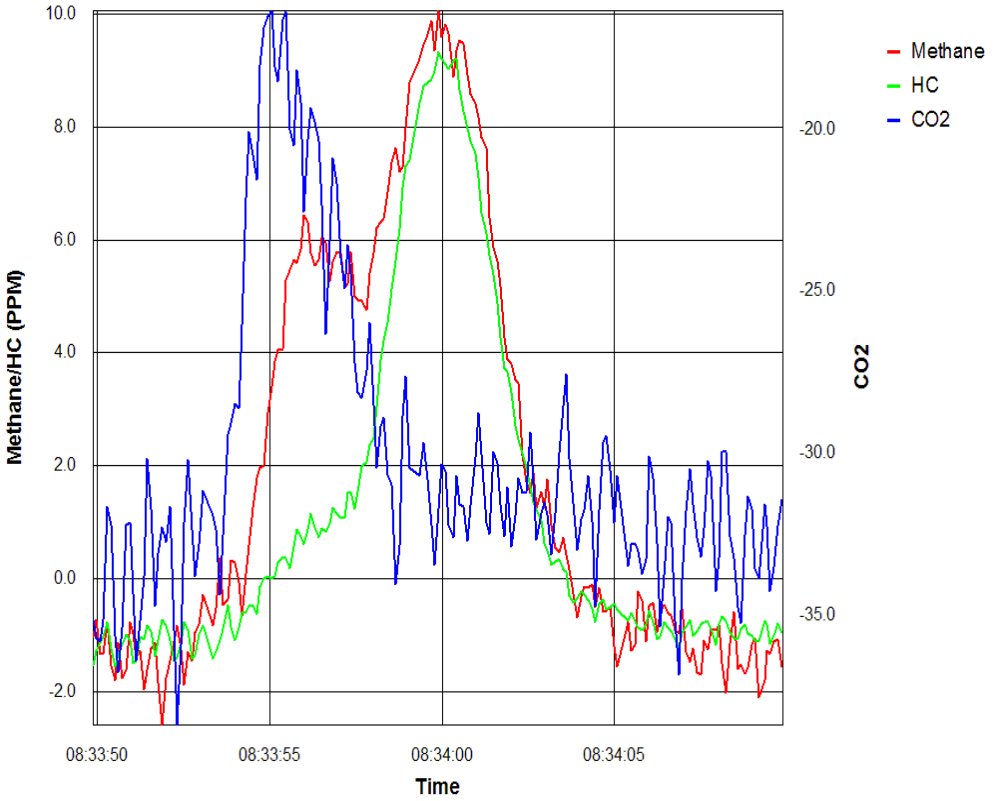
Rich Gas

- Methane and HC, No CO2

→ Rich Gas leak



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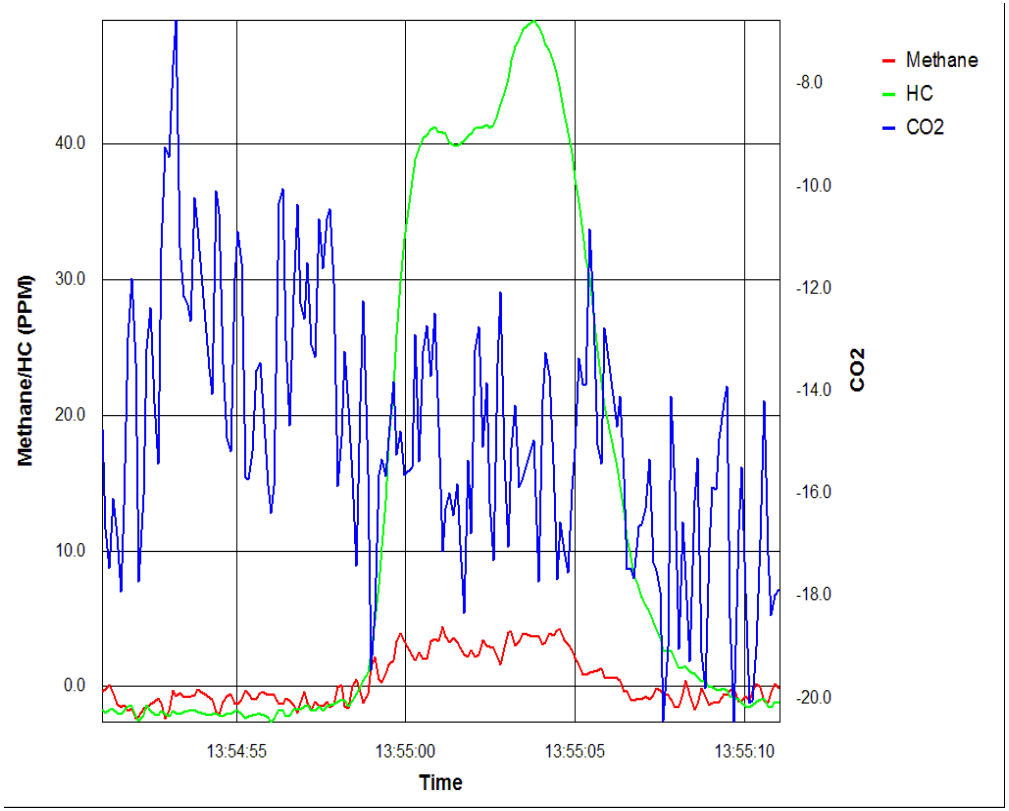
Non-Methane Hydrocarbon Gas

- HC, no methane or CO2

→ Propane or other HC leak



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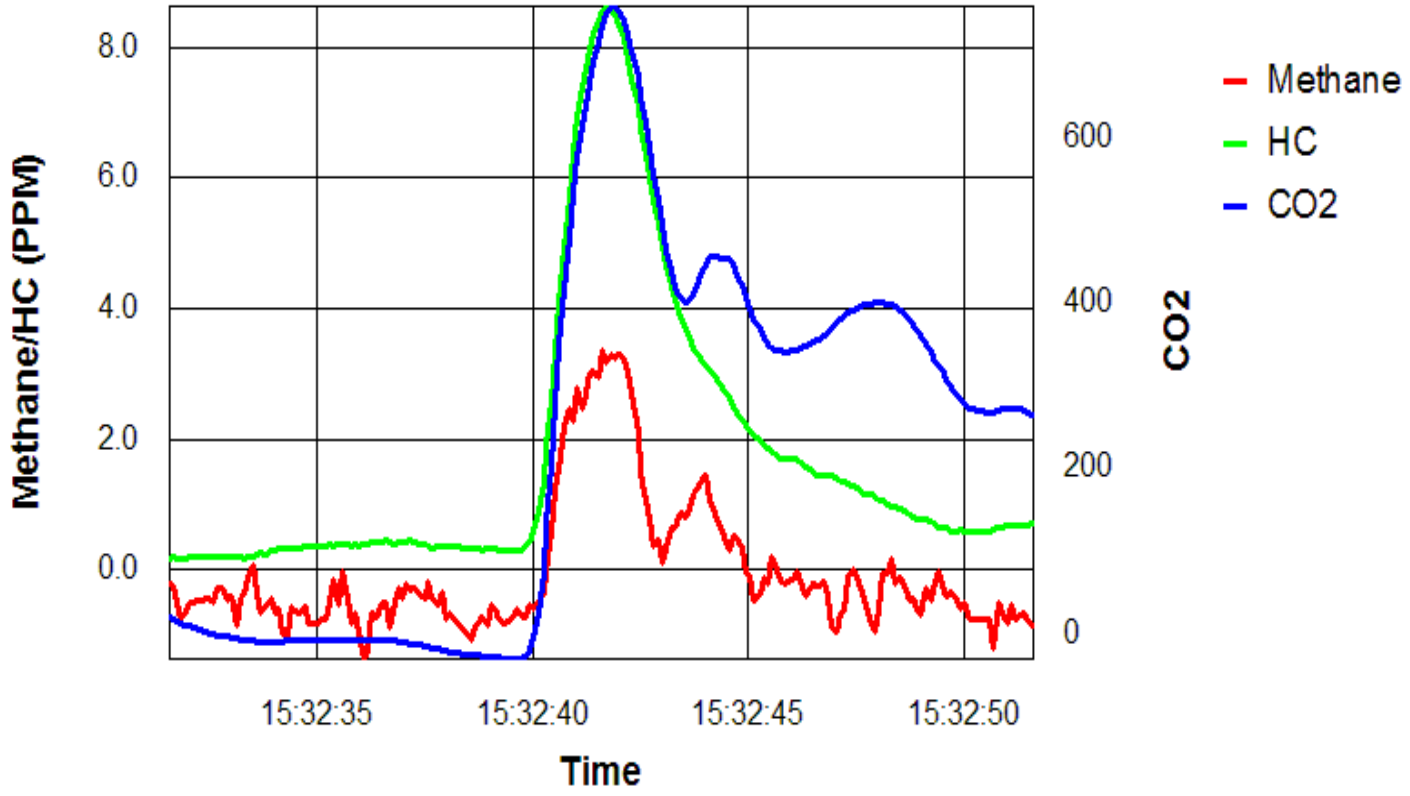
Vehicle Exhaust

- Methane, HC, and CO2

→ Exhaust Gas – Not a leak



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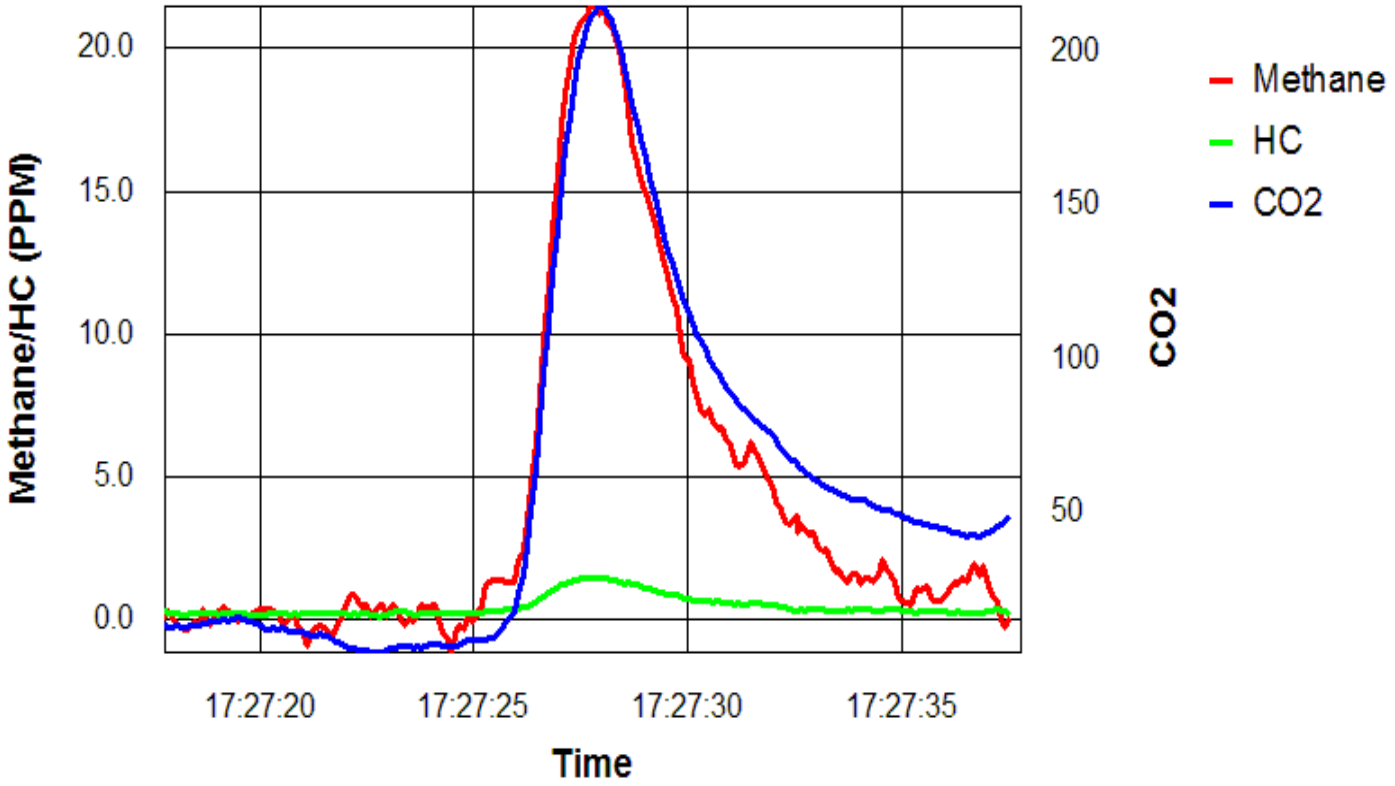
Landfill Gas

- Methane and CO2, No HC

→ Landfill or Sewer Gas



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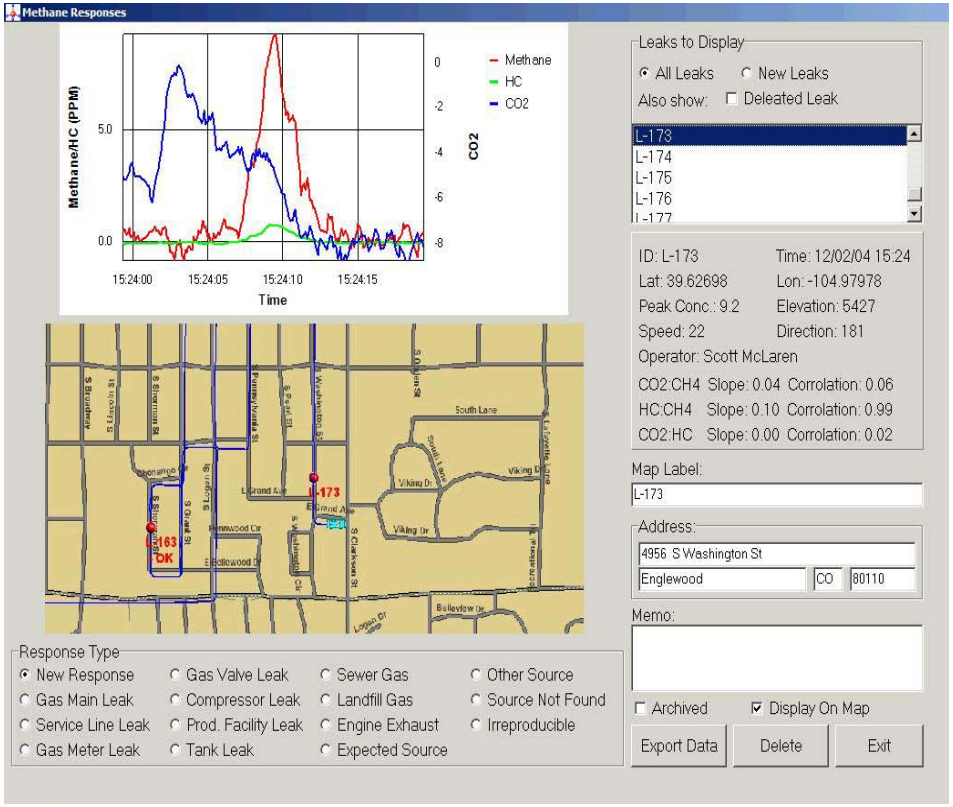
LDS Database

- All LDS data is stored in a database file
- Data can be exported into Excel or other format



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Video Sample

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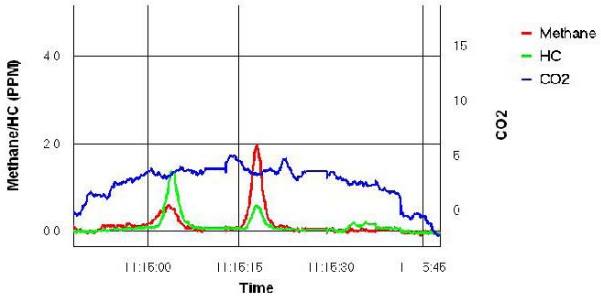
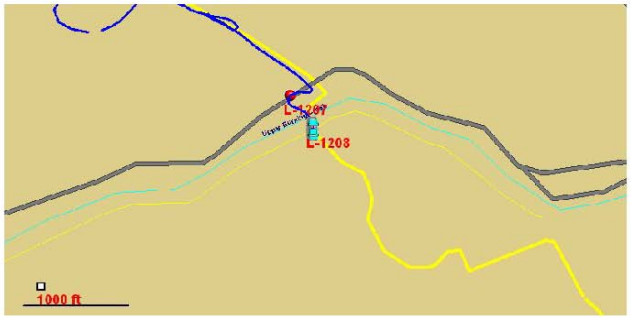
L-1208 (South District)

LDS Leak Report

Leak ID: L-1208
Project Name: SW
Date/Time Found: 06/25/2008 11:15
Max Methane Conc: 1.98 PPM
HC:CH4 Ratio: 0.28 R2 = 0.99
Address: Not Found

Lat: 37.827816
Lon: -82.382766
Altitude: 816 ft.
Vehicle Speed: 23 mph
Operator: Marpat
Comments:





Report generated on 7/16/2008

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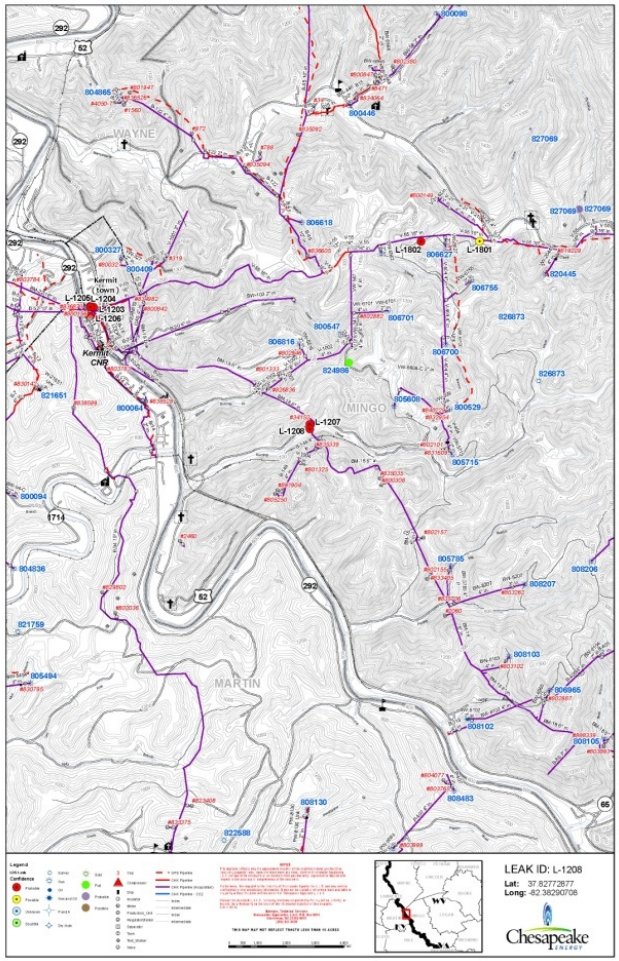

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Summary of Detections To-Date

- 1st Demo Flight in December 2007
- 812 Detections (Probable, Possible, Doubtful, & Unknown)
- 324 Verified Leaks So Far (Both CHK & Foreign Sources)(Note: Still awaiting feedback from North District)
- 2,229 Miles Flown on 5 Flight Groups

Example of Cost Savings

- Sept. 2008 Flight in SE District was approx. 616 Miles
- To cover the same area with ground patrol:
  - 2 Crews (4 Total men)
  - 6 Hours / Day
  - Average 6 Miles / Day Total
  - Equals 100 days, 3200 man hours, not including 2 vehicles and fuel for these 5 months
- 299 Tags (CHK, Foreign, Natural (Mine Cracks))
- Flight time was 64 hours
- Savings not only in time, but in recovered gas carried over the time frame saved by not using ground patrols.

Additional Benefits of Aerial Patrols

- **Manpower Savings**
- **Time Savings**
- **Point of Interest Collection (Customizable List)**
  - Blasting Near RoW
  - Buried Line Exposed
  - Construction Near RoW
  - Debris
  - Liquid Spill
  - Missing Line Marker
  - Power Line
  - Recent Excavation
  - RoW Needs Cleared
  - Slip
  - Stream Crossing Exposed
  - Structure on RoW (Encroachment)

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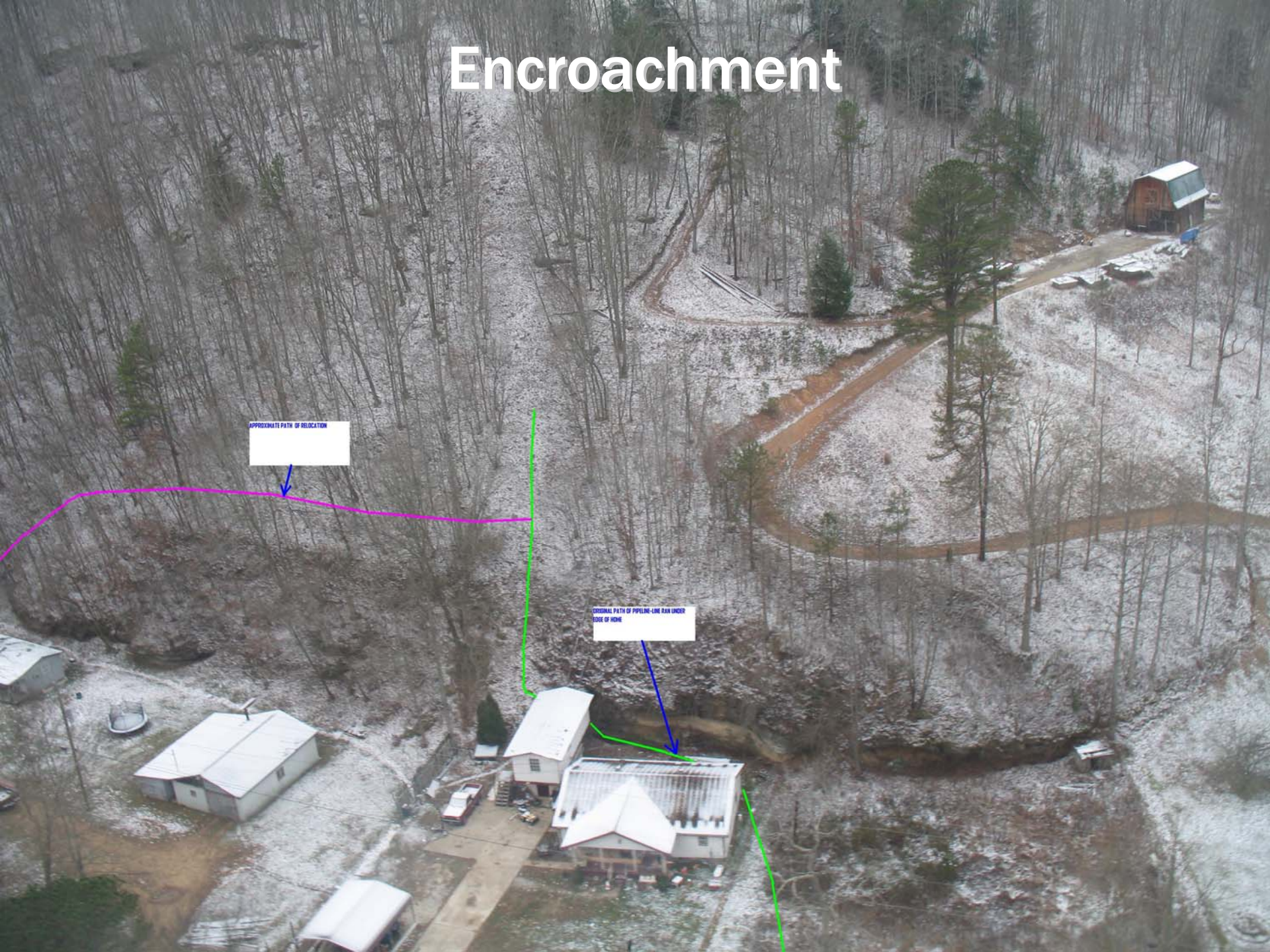
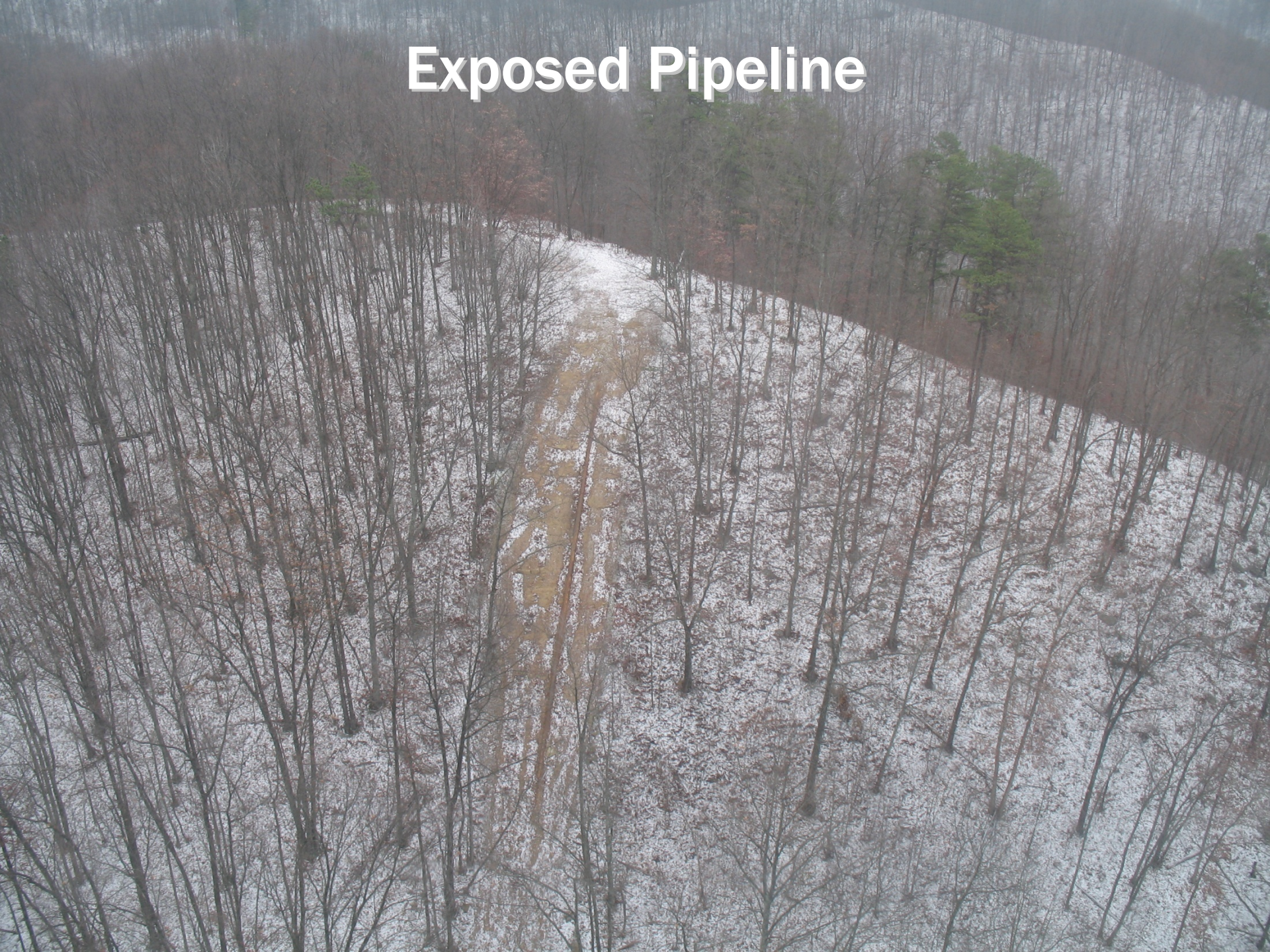
Encroachment



Exposed Pipeline



Exposed Pipeline
In Road Crossing

Possible Future Project Expansion

- Using gyro mounted high-def camera and external drive storage for digital record of patrols (with gps time frame stamp)
- FLIR use in conjunction around compressors and dense facility groups like meter manifolds, multiple valve settings, etc.
- Explore possibility of using this as a method of meeting DOT line patrol requirements

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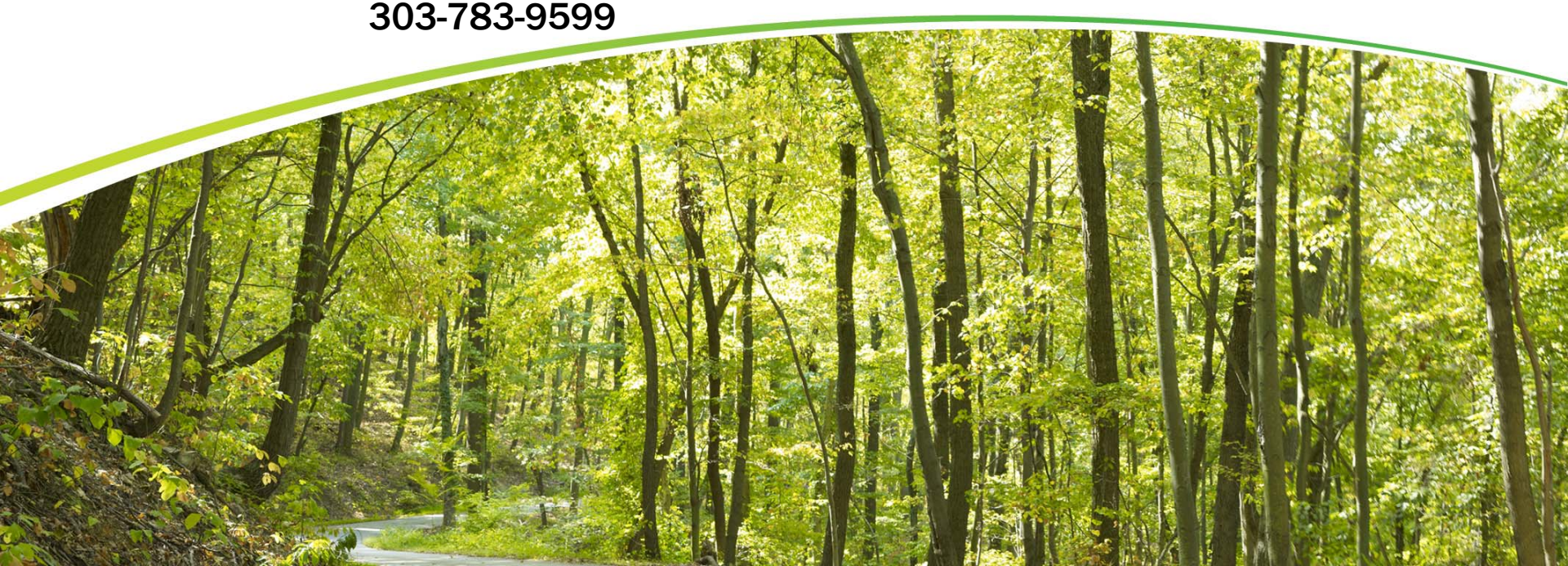

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Q & A

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