



Chesapeake Energy – Eastern Division Natural Gas Gathering Pipeline Surveys & Fugitive Leak Reductions



May 14, 2009

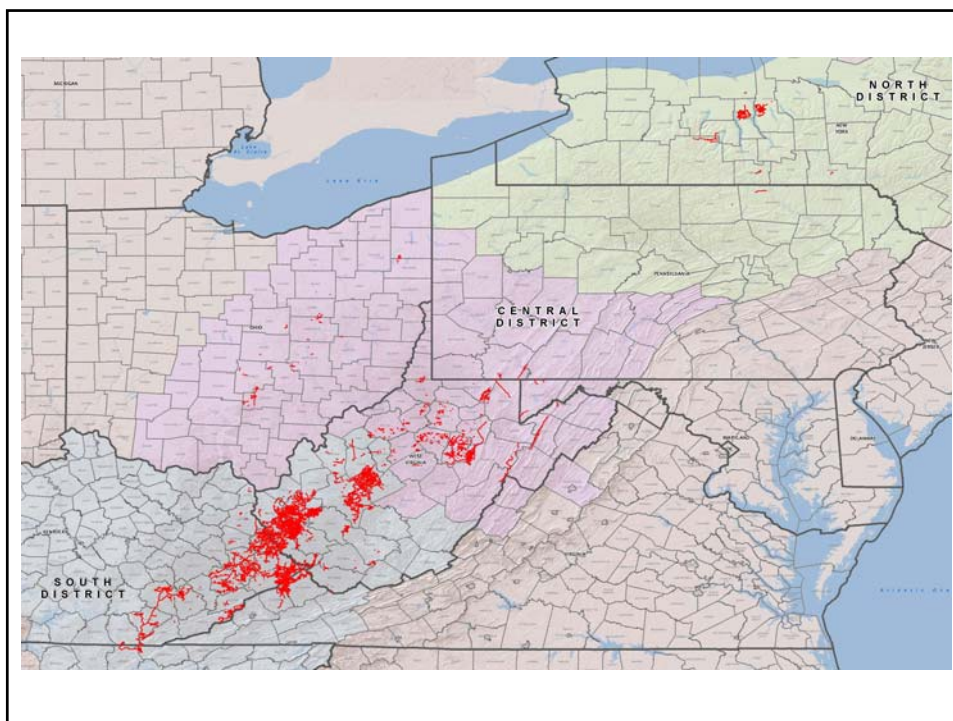


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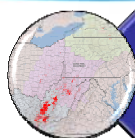
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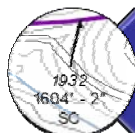
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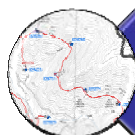
Reasoning for Helicopter Based “Sniffer” LDS:



Approx. 6500 Miles of
Active Pipeline



Vintage range from
1890's to Present



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

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.

5

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)

6

Truck Mounted LDS



7

ATV Mounted LDS



8

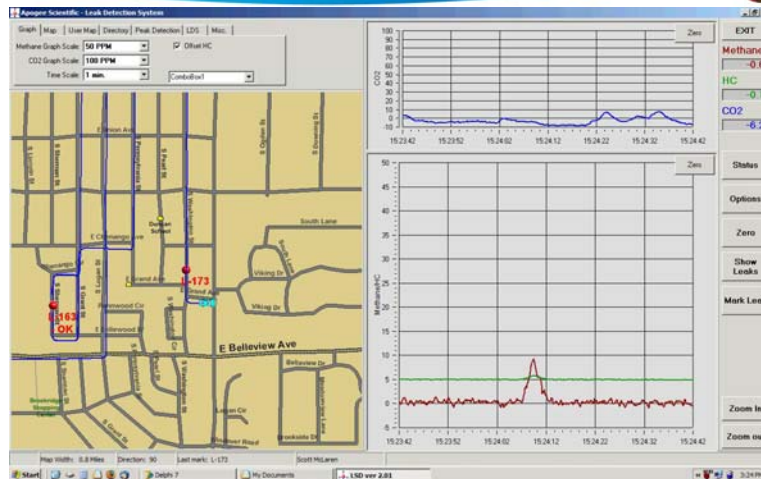
Helicopter Mounted LDS



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9

LDS Operating Software



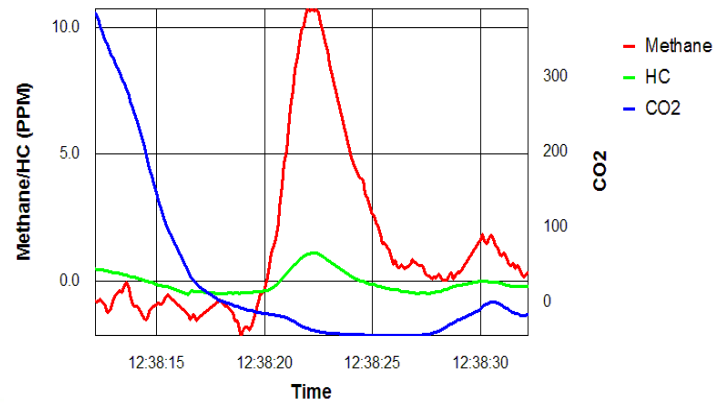
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10

Dry Gas



- Mostly methane, small amount of HC, No CO2
- Dry Gas leak



11

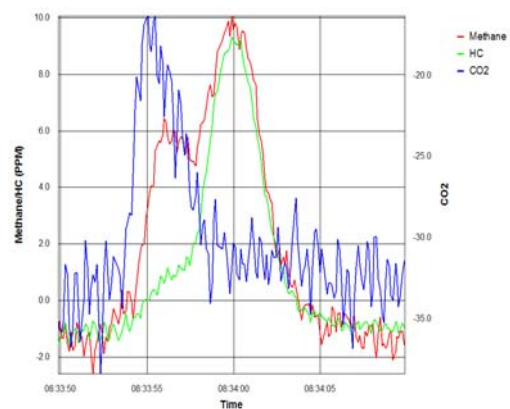


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Rich Gas



- Methane and HC, No CO2
- Rich Gas leak



12

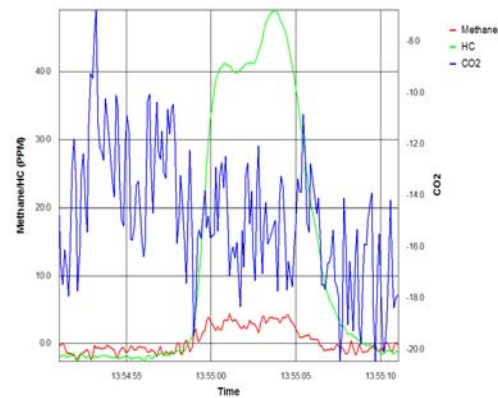


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Non-Methane Hydrocarbon Gas



- HC, no methane or CO2
- Propane or other HC leak



13

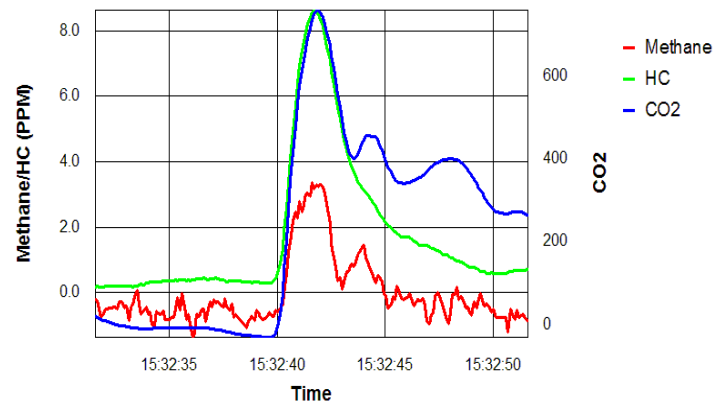


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Vehicle Exhaust



- Methane, HC, and CO2
- Exhaust Gas – Not a leak



14

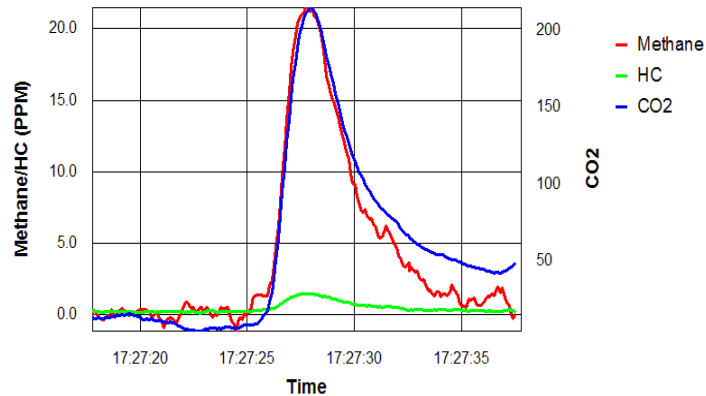


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Landfill Gas



- Methane and CO2, No HC
→ Landfill or Sewer Gas



15

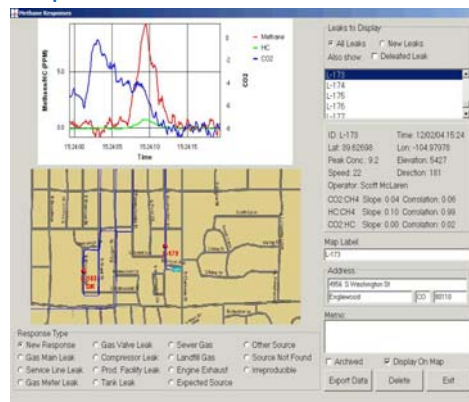


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LDS Database



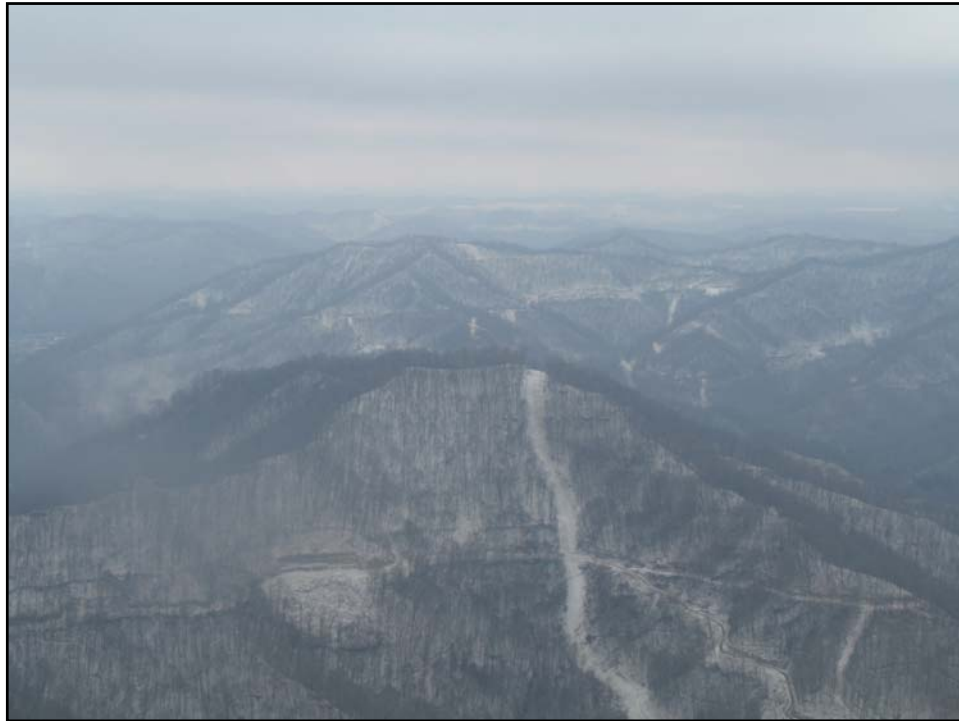
- All LDS data is stored in a database file
- Data can be exported into Excel or other format



16



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Video Sample


Chesapeake
Energy

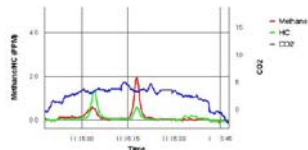
18

L-1208 (South District)



LDS Leak Report

Leak ID: L-1208
 Project Name: SDF
 Date/Time Found: 06/25/2008 11:15
 Max Methane Conc: 1.96 PPM
 HC:CH4 Ratio: 0.28:102 = 0.99
 Address: Not Found
 Lat: 37.827916
 Lon: -82.362768
 Altitude: 816 ft
 Vehicle Speed: 23 mph
 Operator: Manrol
 Comments:



Report generated on 7/16/2008

Page 18 of 131



19

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



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20

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 of detection
- 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.

21

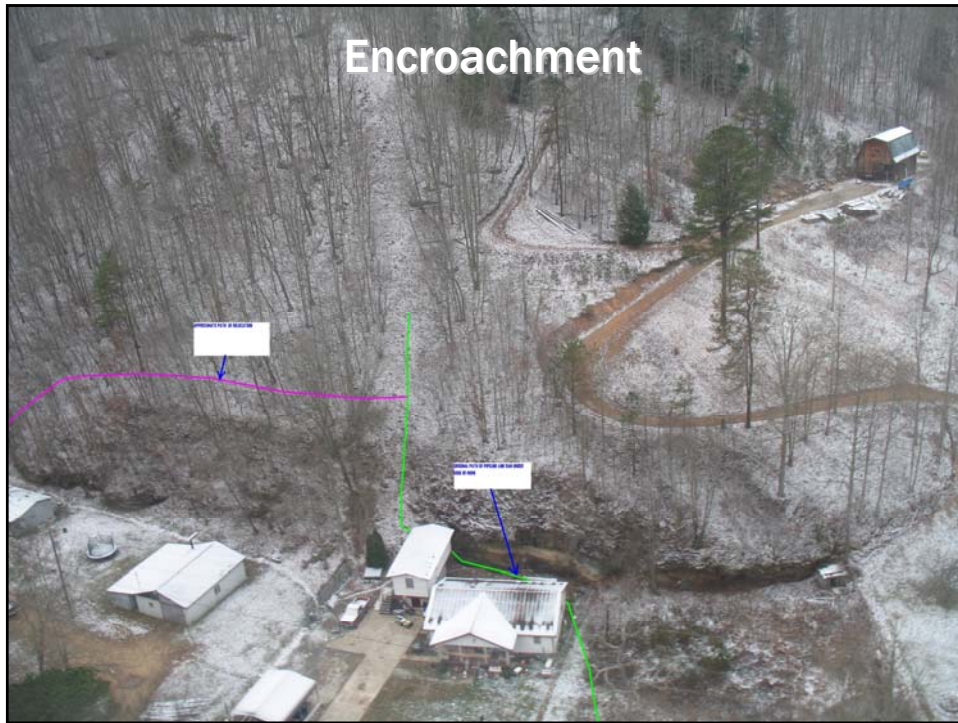
Additional Benefits of Aerial Patrols



- **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)

22

Encroachment

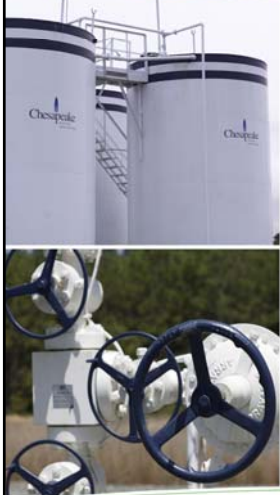


Exposed Pipeline





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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Q & A