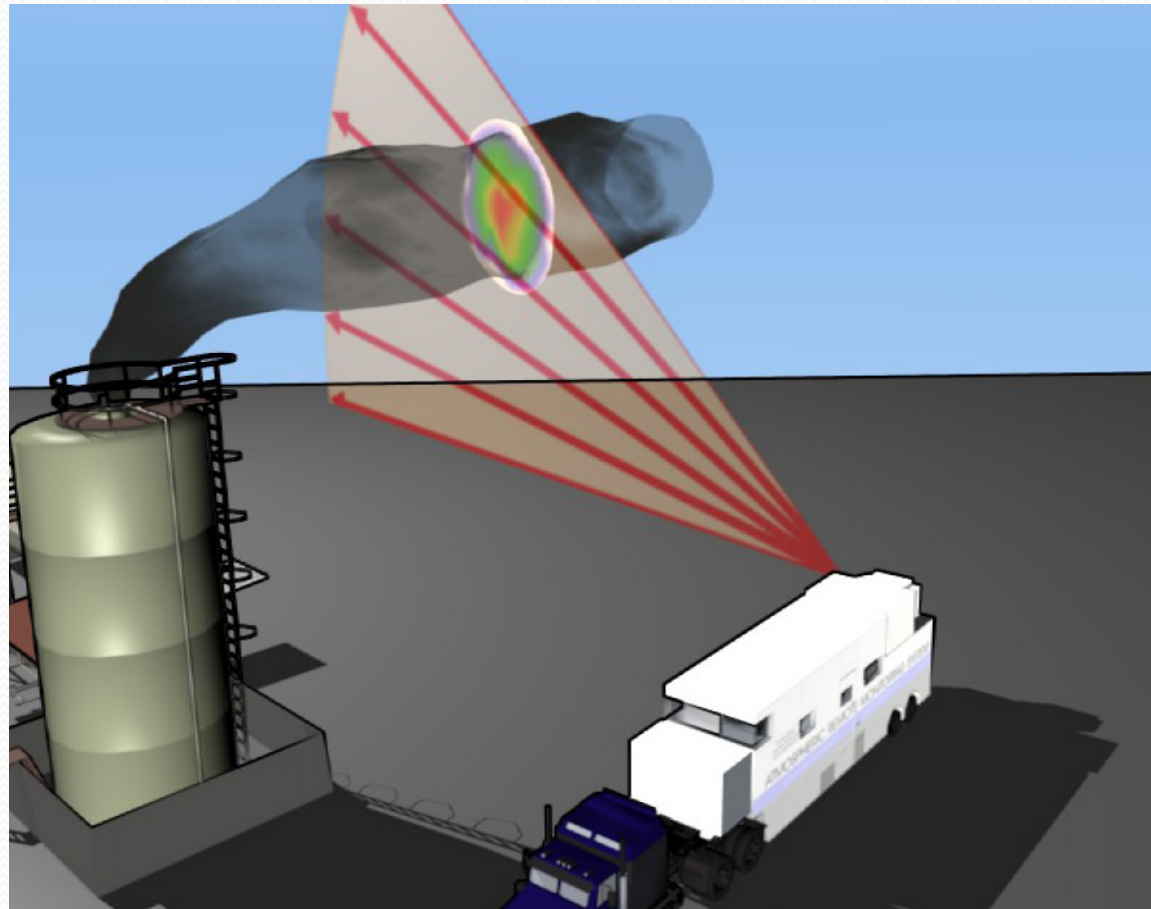
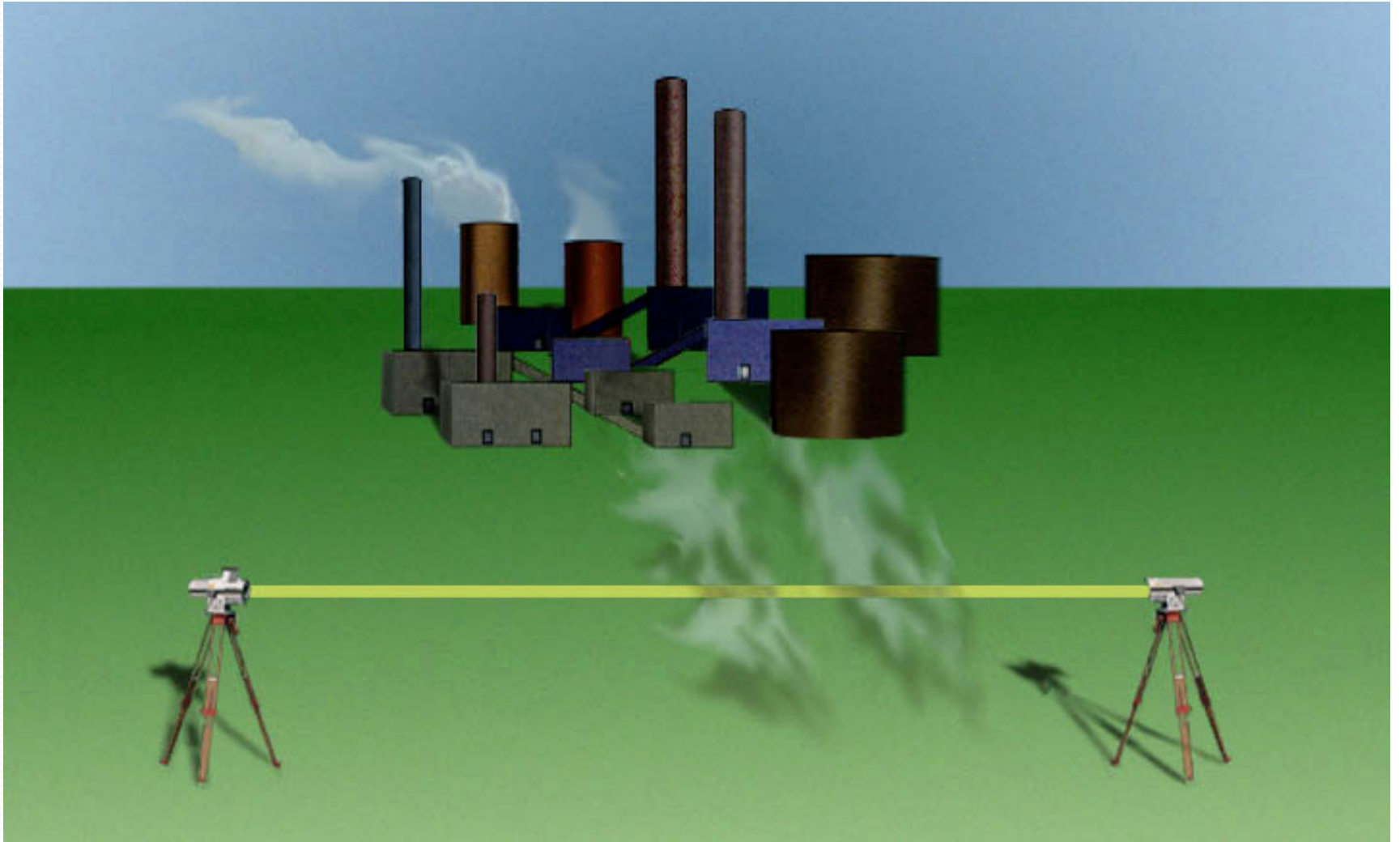


Air Pollution Enforcement Tools: Emerging Monitoring Methods

Greg Fried, Air Enforcement Division



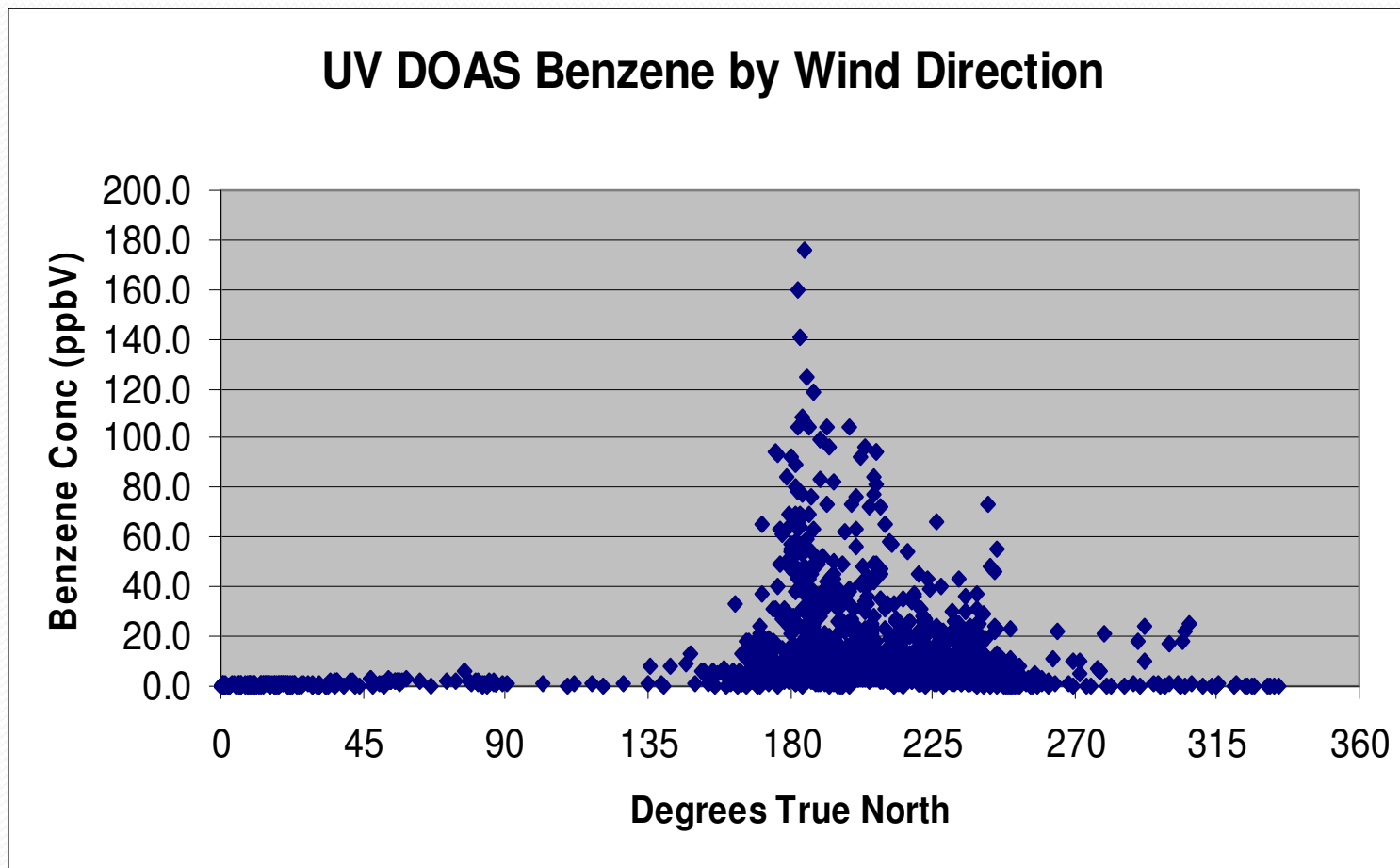
Ultraviolet Differential Optical Absorption Spectroscopy (UV-DOAS) – for Targeting



UV DOAS At Tonawanda Coke (04/09)



TCC UV DOAS Data: Benzene by Wind Direction





UV DOAS Data at TCC

- ▶ Conclusively showed that TCC was a significant source of benzene in Tonawanda
- ▶ TCC's claim that it was a "minor source" of HAPs was almost certainly wrong
- ▶ Provided justification for ordering whole-facility benzene emissions testing by DIAL

Differential Absorption Light Detection and Ranging (DIAL) Benzene Test at TCC (May 2010)





TCC DIAL Test Results

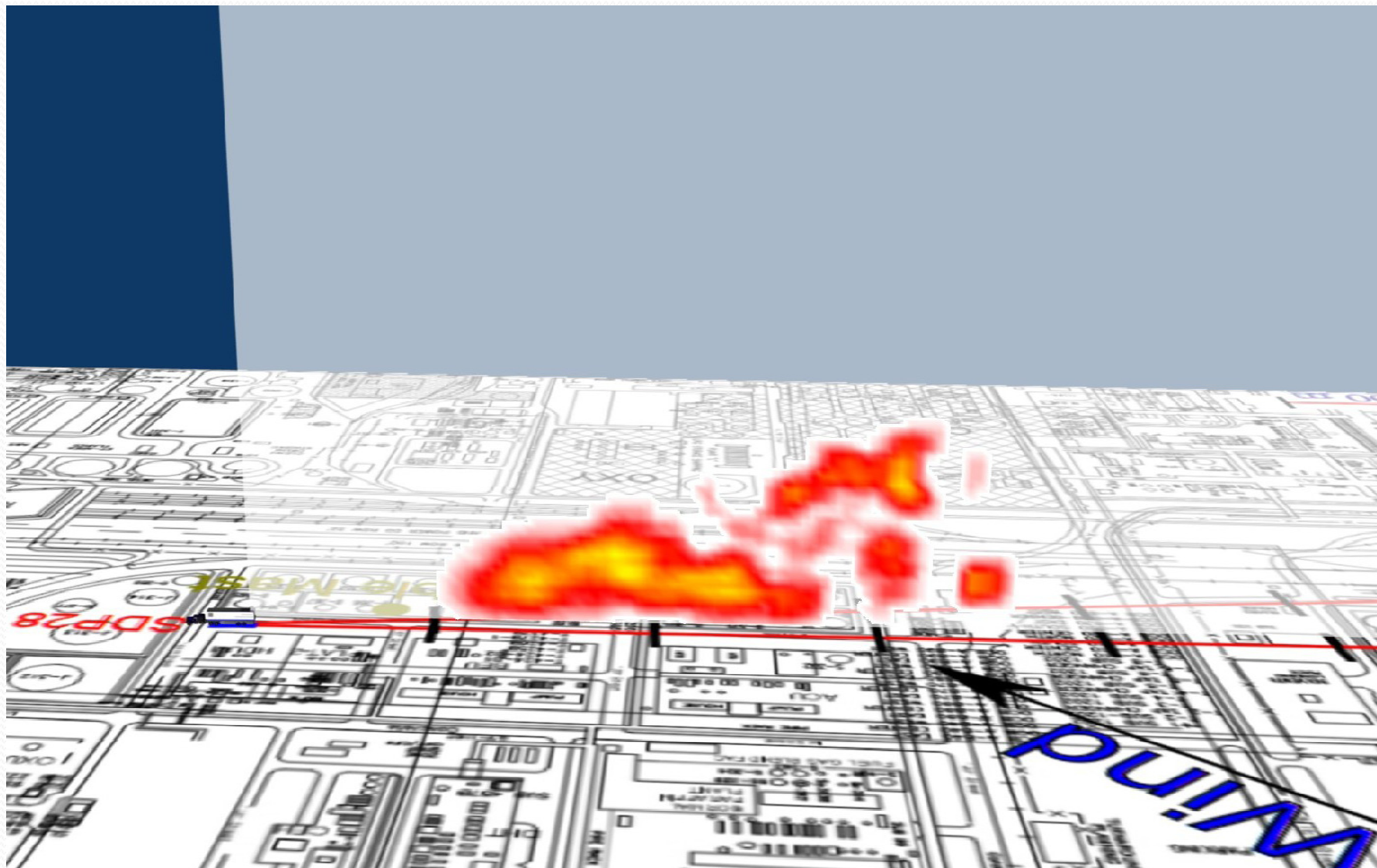
- ▶ TCC emits 90.8 tons of benzene per year, not 6 tons as it claimed based on AP-42 Factors
- ▶ 2/3 of the emissions come from the process area, 1/3 from the ovens
- ▶ October 2010 LDAR investigation focused on process area (LDAR, FLIR, PID surveys) to mitigate benzene emissions and health risk
- ▶ Many benzene leaks were found in the aging process area which largely needs to be re-built

DIAL at Shell Deer Park (Spring 2010)

- ▶ 874 DIAL scans were completed, VOCs and benzene
- ▶ Examples of benzene emissions include:
 - Refinery Coker
 - Measured...3.3 to 48.9 lbs/hr
 - Texas Flexible Permit...0.005 lbs/hr
 - Chemical plant pyrolysis gasoline storage tank
 - Measured...12 lbs/hr
 - Texas Flexible Permit...1.83 lbs/hr
 - Benzene emissions also appeared to originate from an unpermitted tank
 - Refinery Wastewater Treatment Basins
 - Measured...5 lbs/hr
 - Texas Flexible Permit...0.82 lbs/hr
- ▶ It appears that these and other sources emit much more benzene than stated in Shell's permit

DIAL Benzene Scan Plane

(Shell Benzene Extraction/Aromatics Concentration)



DIAL at BP Texas City (Summer 2007)

- ▶ Crude oil tank VOC emissions measured with DIAL were more than 5 times the hourly tank emissions estimated using AP-42 emission factors
- ▶ DIAL measured 1.5 to 2.1 lbs/hr of benzene emissions during the coking process
- ▶ VOC emissions from a flare were 88 to 326 lbs/hr
- ▶ VOC emissions from wastewater treatment area were 30 lbs/hr



Photo-ionization Detectors for Inspectors

- PIDs: highly sensitive, hand held detectors
 - Sensitive to 1 ppb
 - Measured concentrations are real-time
 - General VOCs, or benzene or butadiene-specific
- PIDs alert inspectors to presence of...
 - Emissions from storage tanks, wastewater, etc
 - Equipment leaks
- For LDAR, PIDs can detect process equipment leaks tens of feet away for further identification using FLIR cameras and TVAs
- PIDs can be used to screen leaks for benzene or butadiene