# EPA Region 6 Air Investigator Conference: April 17-19, 2007

Galveston, Texas

# Overview

- GasFind IR (Hawk Camera) - Infrared Camera
- Texas Air Quality Study II (TexAQSII) flyover study
- Upstream oil and gas study
- Upcoming Differential Absorption Light Ranging and Detection (DIAL) project

# Specialized Infrared (IR) Camera aka Hawk or GasFind IR

- Specialized infrared camera can “see” volatile organic compounds (VOC)
- The camera can not determine concentration or speciate VOCs
- The camera has proven to be extremely effective in discovering unknown VOC plumes

# IR Camera


Luminance
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800
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304
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Video
Analog
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3/7/2003

# Measured Tank Vent

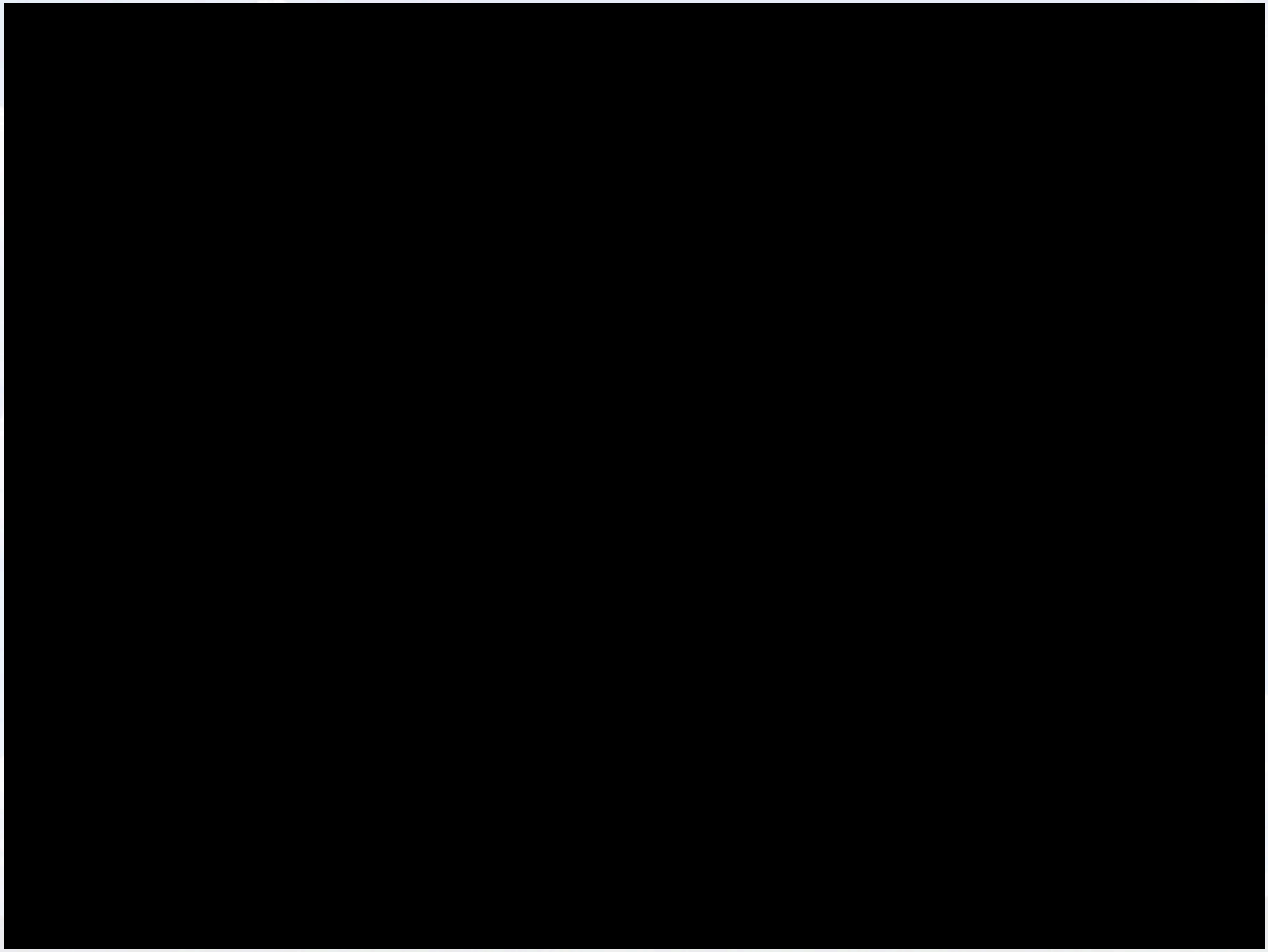
# Texas Air Quality Study II (TexAQSII) Flyover Project

- Project started and completed in July 2005 and used the IR camera from 4 platforms
  - Helicopter observations for 45 hours
    - **Most effective platform for this project**
  - Boat observations from the Houston Ship Channel for 2 days
  - Vehicle observations from public roads and access points for 2 days
  - San Jacinto Monument

# TexAQSII Remote Sensing Findings

- Storage tanks- <2% of tanks had visible plumes
  - Floating roof tanks
    - Landed roofs
  - Fixed roof tanks
  - Upstream oil and gas product tanks
    - Visible plumes identified from 10% of tanks
- Barge leaks
  - 1 out of 7 barges observed had visible plumes
- Loading operations
  - Sumps

# TexAQSII Video



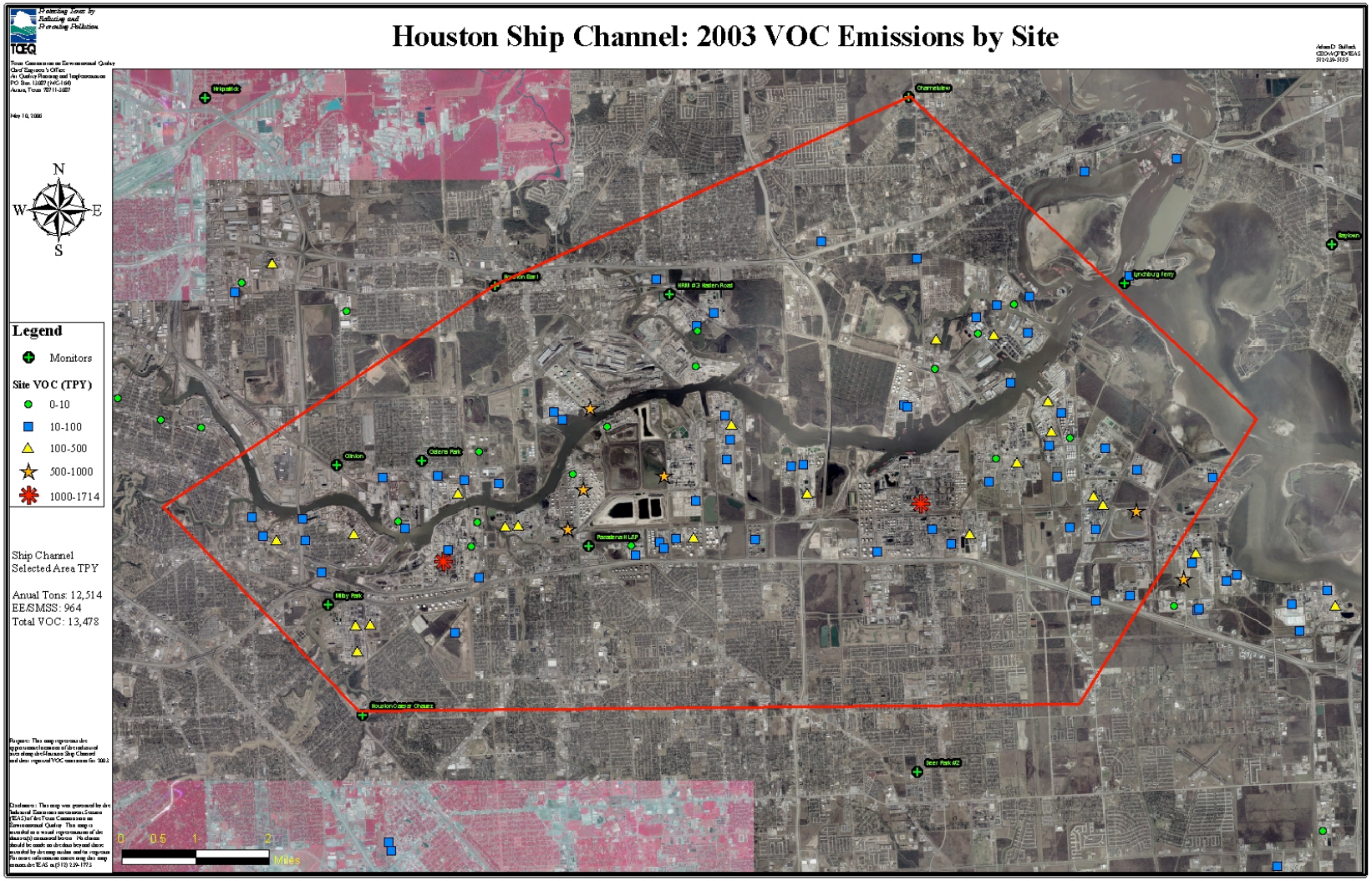
# Floating Roof Landings

- American Petroleum Institute (API) tentative methodology published in 2002 and updated in 2005
- 52 bulk terminal and tank for hire operations in the Houston 8 county nonattainment area were required by a special inventory request to resubmit 2002, 2003 and 2004 emission inventories
  - Other areas of Texas are currently submitting 2002-2004 emission inventories
- Landing loss memo from TCEQ to interested parties
  - http://www.tceq.state.tx.us/assets/public/permitting/air/memos/tank_landing_final.pdf

# Impact of Special EI

- Updated inventory data of landing loss emissions increased reported **total point source** VOCs by 50%, from 14,000 tpy to 21,000 tpy in the Houston Ship Channel area, not including Baytown.

# 50% Ship Channel VOC Increase



# Permitting/Decreasing Landing Losses

- Several bulk terminal operation companies are in process of revising air permits to include landing losses
- Some permit amendments or revisions will be challenging due to existing customer agreements
- Industry business practice changes have occurred to lower VOC emissions
- Effects screening limits (ESL) will restrict the number of roof landings

# Other Identified VOC Issues

- Storage tank degassing
  - Liquid heel
- Heated tanks
  - #6 fuel oil, bunker oil, marine grade fuel oil
- Tanks with hot products
- Tank cleaning
  - Liquid heels, cleaning solutions and steam cleaning residue pushed to wastewater operations
  - Vacuum truck emissions

# Proposed Tank Degassing Rule Changes

- Proposed rule changes for the Houston/Galveston (HGB) nonattainment area only
  - Current rules apply to storage tanks with a capacity of 1 million gallons or more
  - Storage tanks with capacity of 250,000 gallons or more would be subject to new degassing rule
  - Storage tanks with a capacity of 75,000 gallons or more would be subject if storing liquids with vapor pressure greater than 2.6 psia
- VOC levels must be reduced to less than 34,000 ppmv as methane before the tank can be vented to atmosphere, **regardless of the number of turnovers**

# Proposed Storage Tank Rule Changes

- More stringent controls on floating roof tank fittings and slotted guidepoles, consistent with 40 CFR Part 63, Subpart WW, by January 1, 2009

- Limitations on floating roof landings
  - Allowed for inspections or maintenance
  - Allowed if necessary for change of service to incompatible liquid
  - Allowed if landing emissions are controlled, authorized in permit emission limit or cap, or site-wide landing emissions less than 25 tpy

# Proposed Storage Tank Rule Changes (cont.)

- Exemption from storage tank rules for upstream oil and gas tanks with capacity less than 210,000 gallons no longer applies to HGB area after Jan. 1, 2009
- Crude oil and condensate storage tanks at upstream oil and gas sites and at pipeline breakout stations must control flash emissions if uncontrolled emissions equal or exceed 25 tons per year

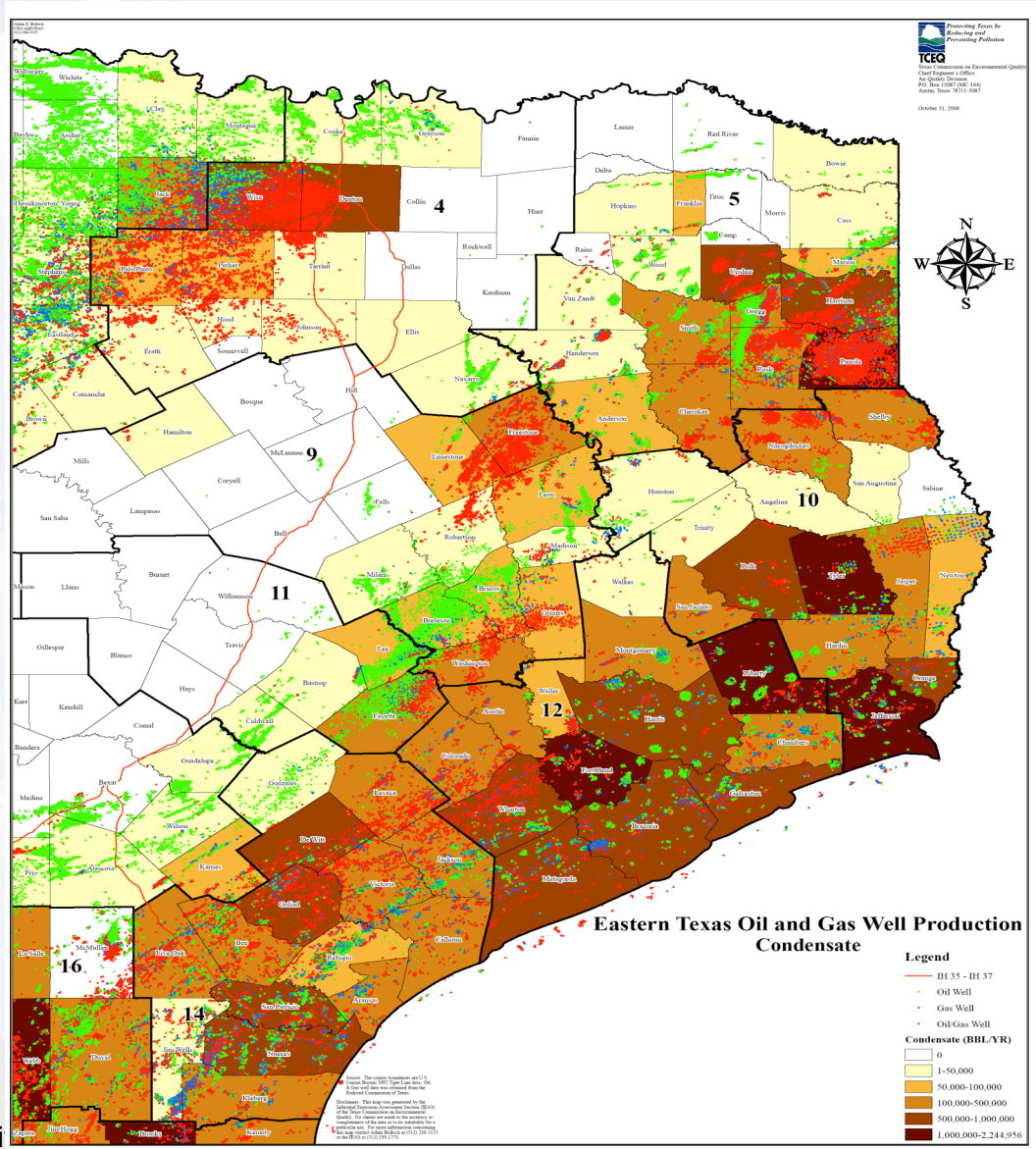
# Upstream Oil & Gas (UO&G) VOC Emissions

- TexAQS II aerial observations of UO&G product storage tanks between Beaumont & Houston
  - 500 tanks observed from helicopter
  - 10% of tanks had visible hydrocarbon plumes

# Oilfield Flash Emissions

- Oilfield flash emissions occur when dissolved gasses entrained in the produced liquid are released when the liquid reaches atmospheric pressure in the storage tank
  - Opening a hot soda is a good example of flash emissions as the CO2 is being released from the soda to atmospheric pressure when opened

# Condensate Production



# Condensate

- Condensate is a valuable liquid by-product of natural gas production and often called drip or natural gasoline and is very volatile and readily evaporates in fixed roof storage tanks

# Houston Area Research Center (HARC) Research Projects

- HARC funds environmental research projects
- Pressurized tank car study (HARC 51A)
  - Developed a loading/unloading fugitive factor for pressurized rail car operations
- Upstream well head oil & gas product tank batteries (HARC 51C)
  - Utilized low flow meters to determine a combined flash, working and breathing loss factor per barrel produced

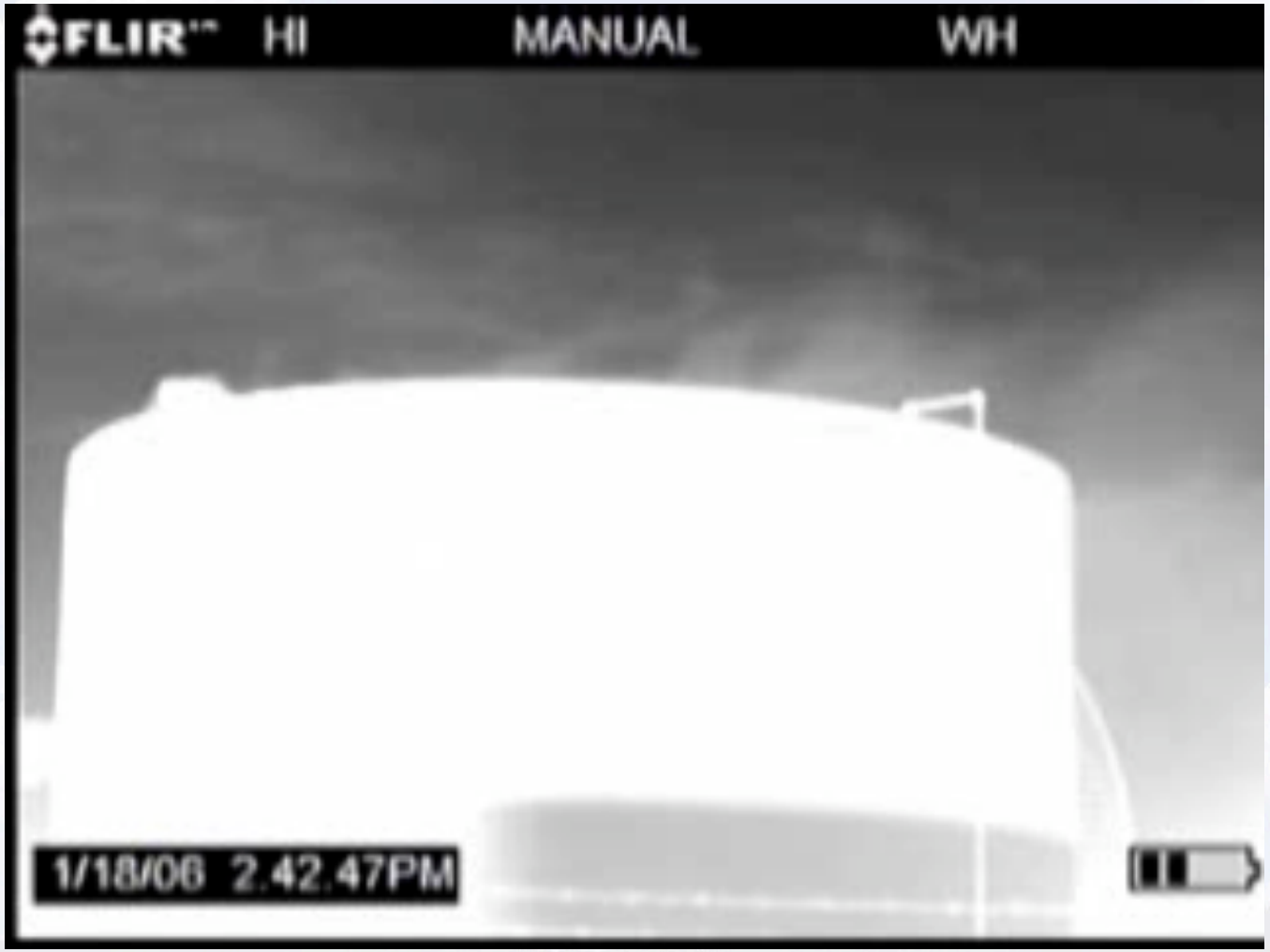
# HARC 51C Goals

- Develop an emission factor based on liquid production, pound VOC per barrel produced
- Emission factor includes
  - Working losses, losses due to product vapor being pushed out of tank during filling
  - Standing/breathing losses, losses due to evaporation of product due to ambient temperature change
  - Flash losses, losses of dissolved gas entrained in a pressurized liquid exposed to ambient pressure in a storage tank
- Obtain extended speciation profiles of vapor

# HARC 51C Project

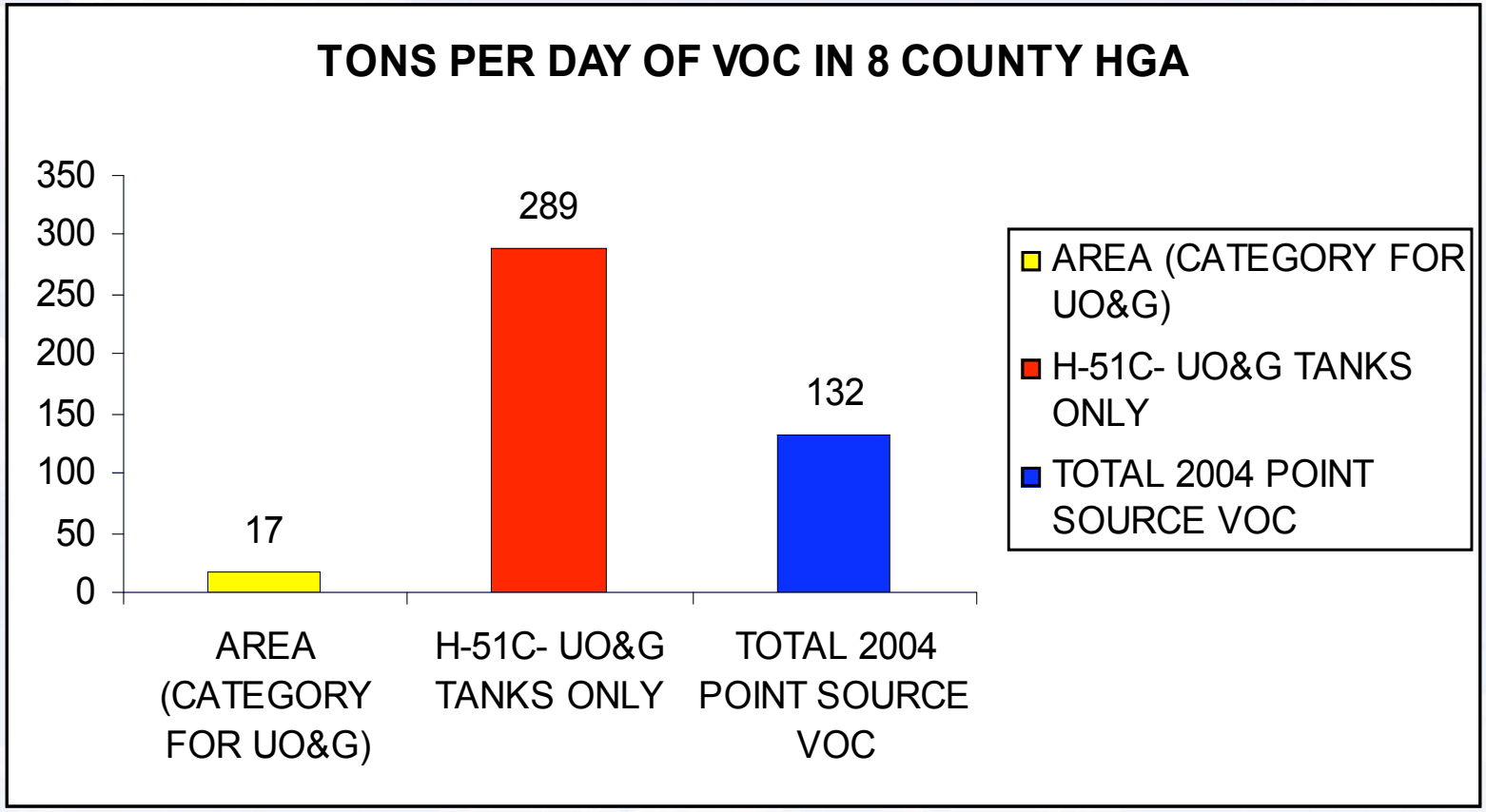
- Upstream oil and gas storage tank project
  - 33 storage tank “battery” operations at wellhead and gathering sites were “stack” tested
  - Developed an emission factor that includes working, breathing, and flash losses
  - Condensate factor is 33.3 pounds of VOC per barrel of condensate produced
  - http://files.harc.edu/Projects/AirQuality/Projects/H051C/H051CFinalReport.pdf

# Upstream Pipeline Tank



# Condensate Tank Flash Emissions

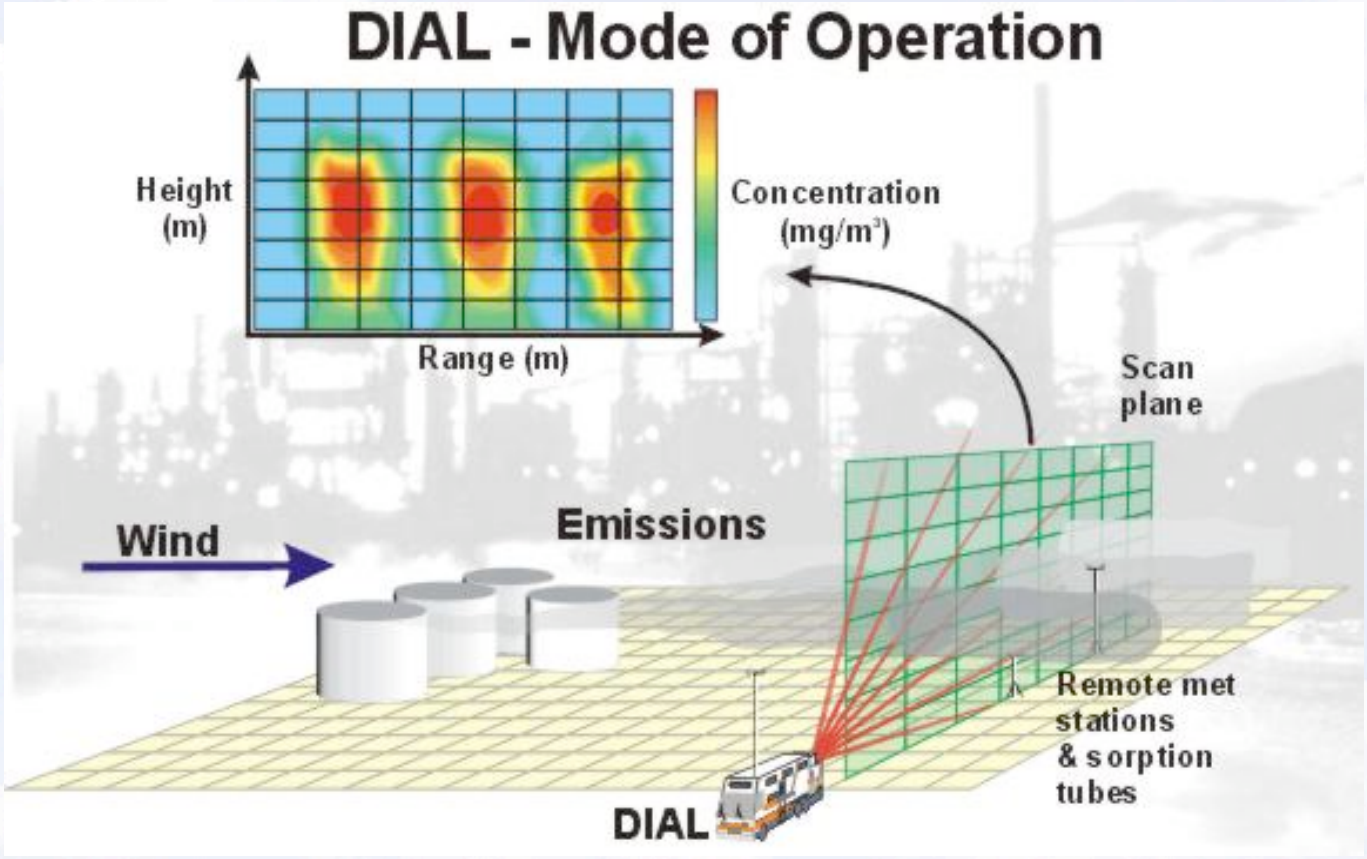
# Houston Area VOC Potential Impact From UO&G Tank Emissions



# Differential Absorption Light Detection and Ranging (DIAL)

- DIAL is a remote sensing tool developed in Europe and is capable of measuring mass of emission plumes remotely
- TCEQ received an EPA grant to conduct a study using the DIAL system in the Houston Ship Channel area during the summer of 2007
- TCEQ is requesting participation from industry to host the DIAL project
  - Refinery, chemical plant, wastewater plant, bulk terminal tank farm

# DIAL Visual Concept



# Canadian Refinery DIAL study

- DIAL measurements of refinery storage tanks showed significant differences from EPA TANKS program - >10X differences
- Cooling towers were identified as a significant VOC emissions source
- Coker units were identified as a source of VOC and benzene emissions
- A copy of this report and other Canadian DIAL projects can be found at: http://www.arc.ab.ca/Index.aspx/ARC/8300

# Texas DIAL Project

- The DIAL project will focus on measuring difficult-to-measure (DTM) sources
  - Storage tanks
  - Flares: steam and air assisted
  - Wastewater process areas
  - Coker units
  - Cooling towers
- Compare DIAL measurements to emissions determined using traditional EPA methods

# Texas DIAL Project (cont.)

- Use the Hawk (Gasfind IR) camera on the ground and in the air to locate VOC plumes for DIAL measurements
- Use the DIAL to locate and measure VOC plumes and then identify the plume's source with the Hawk camera
- Additional meteorological data and upwind/downwind VOC canister samples to be collected by TCEQ

# Texas DIAL Project (cont.)

- Proposed DIAL experiments
  - Measure storage tanks with and without visible plumes identified by the Hawk camera
  - Compare EPA TANKS estimates for floating and fixed roof tanks to DIAL measurements
  - Compare EPA wastewater model estimates to DIAL measurements
  - Measure flare plumes and compare to emission rates calculated using flow and speciation monitors on the flare

# Texas DIAL Project (cont.)

- Proposed DIAL experiments
  - Compare assisted flare efficiencies under various steam and air assist rate conditions
  - Field test DIAL $NO_x$ or $SO_2$ measurements against combustion units with continuous emission monitors
  - Measure VOC and benzene emissions from coker units
  - Measure $NO_x$ from flare plumes
  - Measure smoking flare plumes

# DIAL Project: Industry Participation

- Industry participation is critical to the success of the DIAL project
- This research project is concentrating on evaluating VOC emissions determination methods, not regulation or permit compliance
- Enforcement discretion is being sought for sites participating in the project

# DIAL Project: Industry Participation (cont.)

- Provide physical access for the DIAL unit and project personnel inside the fence upwind and downwind of sources to be measured
- Provide operations and emissions calculations data to TCEQ to be compared to DIAL measurements
- Conduct plant operations in a normal manner
- Cooperate with project personnel

# Probable Outcome of DIAL Project

- DTM emission sources may be identified as being under represented using traditional EPA methodologies and assumptions
- Demonstrate EPA methods for DTM sources are accurate under normal, well maintained operations
- More effective and targeted rulemaking and permit requirements
- Reevaluation of best available control technology requirements
- Reevaluation of TCEQ procedures
- Potential savings of valuable VOC products

# To Participate

- Contact Russ Nettles, Air Quality Division, Chief Engineer's Office, TCEQ at (512) 239-1493 or e-mail rnettles@tceq.state.tx.us