Fort Worth Natural Gas Air Quality Study

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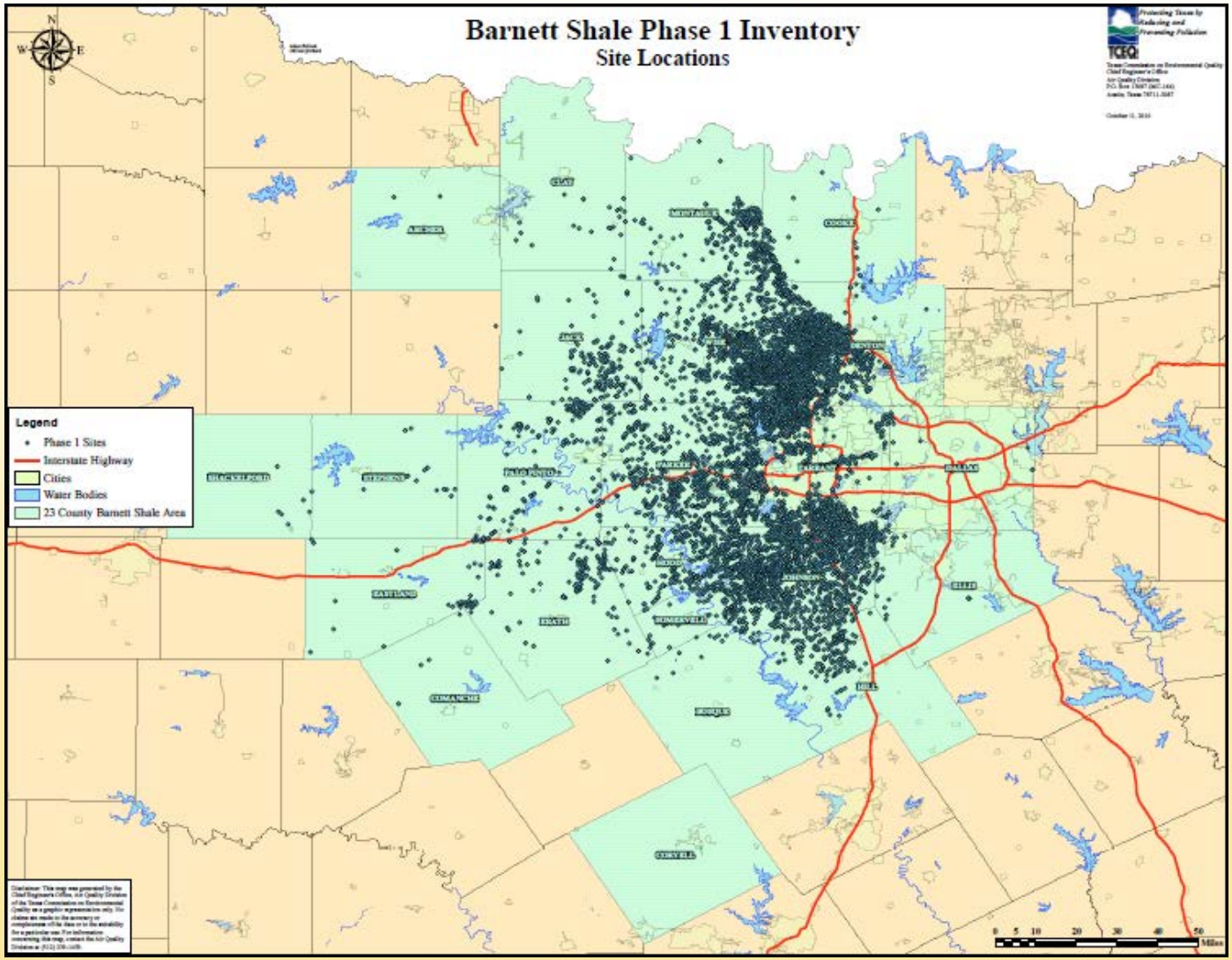
Overview of Presentation

- Background
- Ambient Air Monitoring
- Point Source Testing
- Dispersion Modeling
- Public Health Evaluation
- Conclusions

Barnett Shale



Urban Drilling

Hydraulic Fracturing

Principal Tasks

Fort Worth Natural Gas Air Quality Study

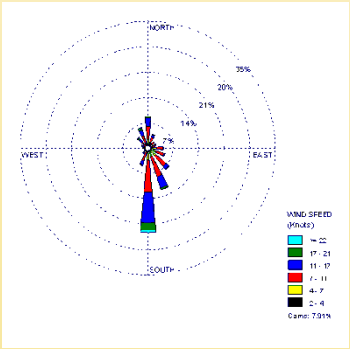
- **Ambient Air Monitoring**
- **Point Source Testing**
- **Air Dispersion Modeling**
- **Public Health Evaluation**

Ambient Air Monitoring

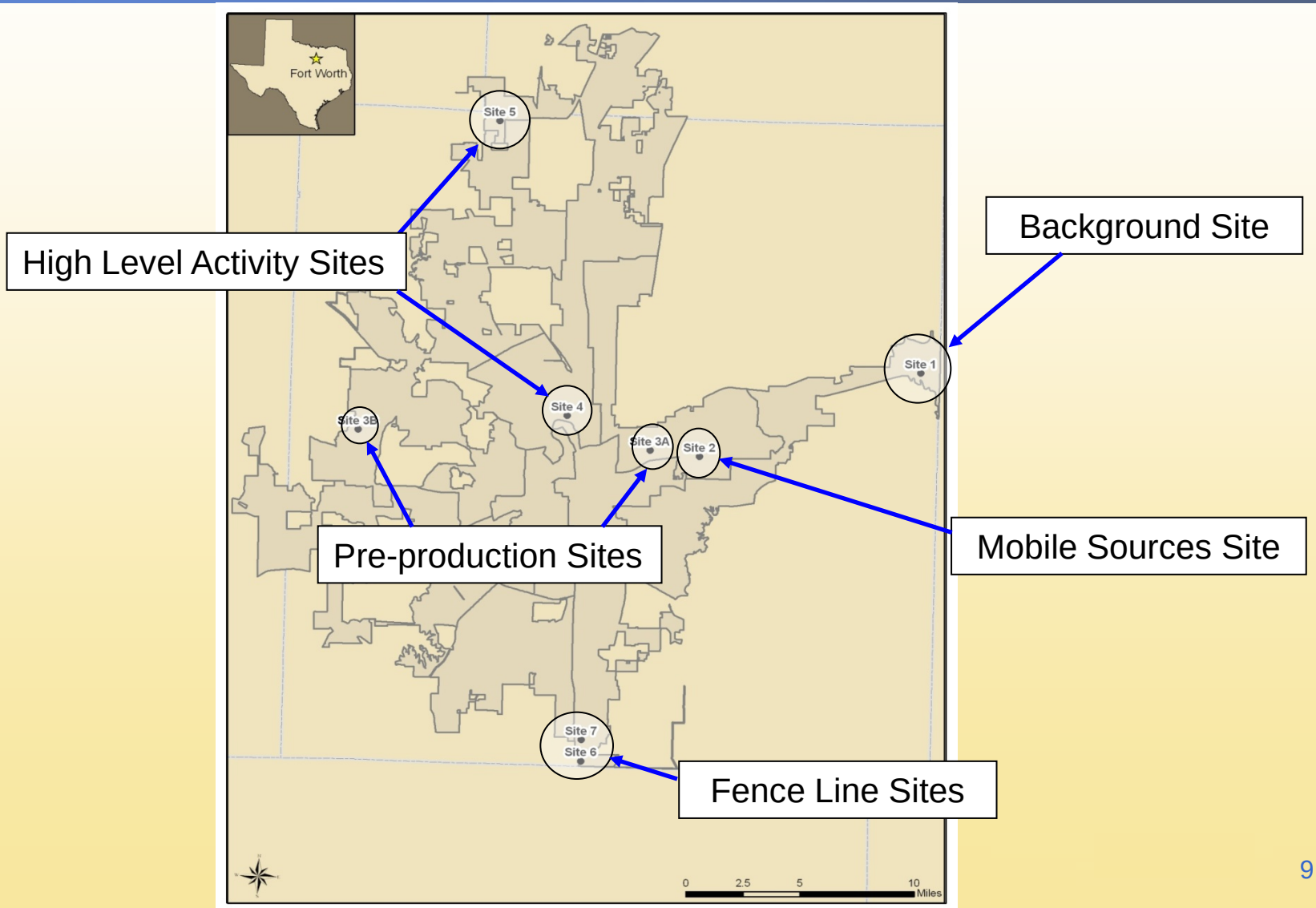
- Measure pollutant concentrations in ambient air downwind from natural gas activities

Ambient Air Monitoring

- Approved in the ***Ambient Air Monitoring Plan***
- Presented in September Public Meeting
- Data Sources
  - Meteorological Data (NWS/EPA): 2001-2009
  - Active, permitted, and applying gas well locations
  - Compressor station locations
  - City boundaries/properties
  - Major roadways
  - 2010 natural gas production



Ambient Air Monitoring



Ambient Air Monitoring

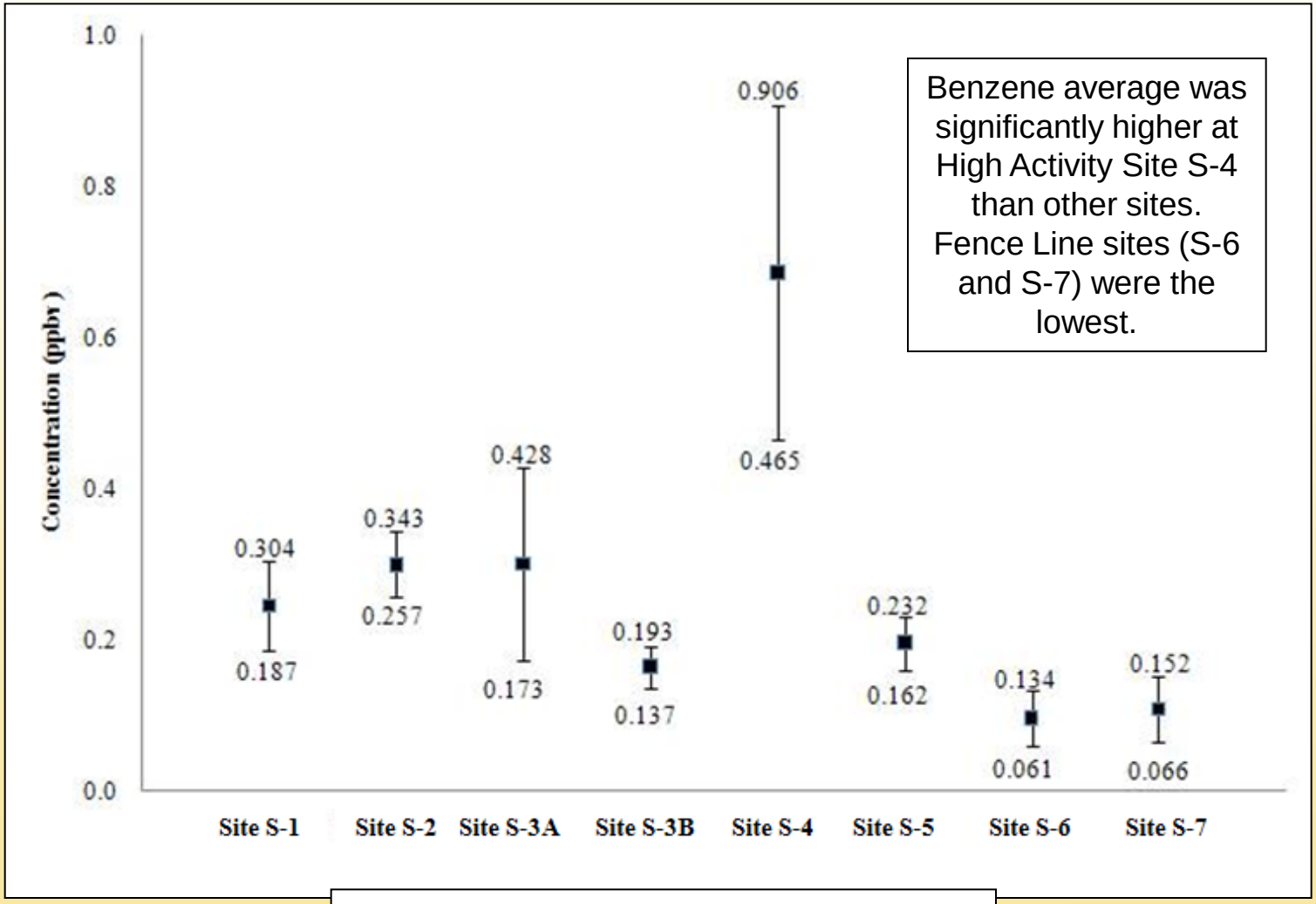
- 8 sites
- Sampled for 2 months
- Sampled once every 3 days
- Over 140 different pollutants
- High Level Activity Sites
  - 11 additional air pollutants
  - Including formaldehyde, acetaldehyde
- Fence Line Sites
  - Also sampled for methane

Results - Concentrations

- High Activity-Level Site just north of City Center (Site S-4) was generally higher than other sites
- Fence Line Sites (S-6 and S-7) were generally lower relative to other sites

- Background Site (S-1) and Mobile Sources Site (S-2) were similar
- Pre-Production sites (S-3A and S-3B) typically did not display higher pollutant concentrations than the background and mobile sources sites

Results - Benzene



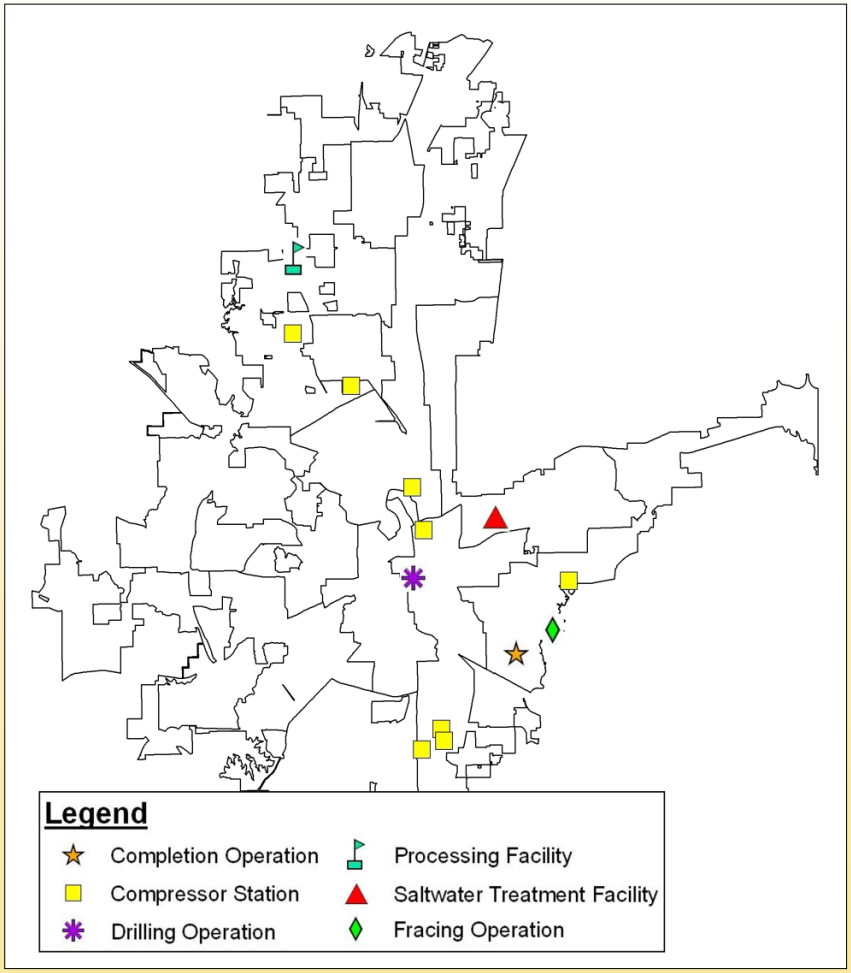
Benzene average was significantly higher at High Activity Site S-4 than other sites. Fence Line sites (S-6 and S-7) were the lowest.

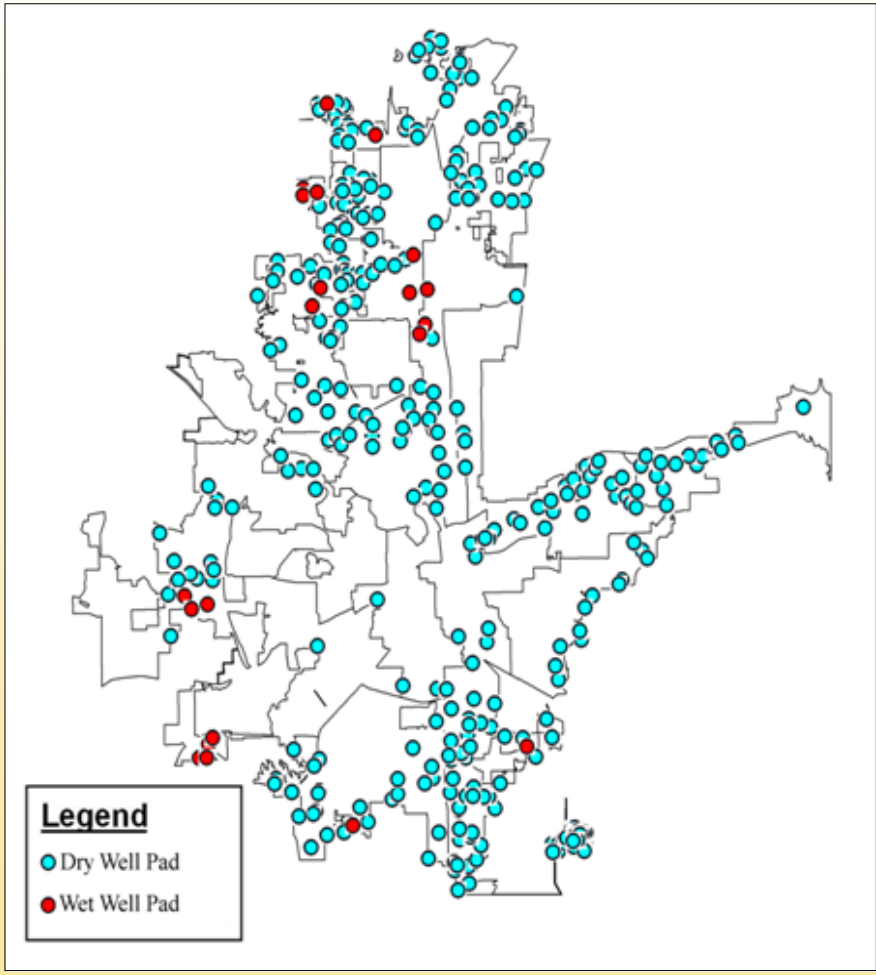
Benzene Averages By Site (ppbv)

Point Source Testing

- **Objective:** Characterize emissions from natural gas production sources
- Survey 75% of active well pads, well pad with compression and compressor stations
- Survey various stages of well development
- Measure emissions with:
  - Infrared Camera
  - Toxic Vapor Analyzer
  - HiFlow Sampler (with Canisters)

Point Source Testing





Point Source Testing

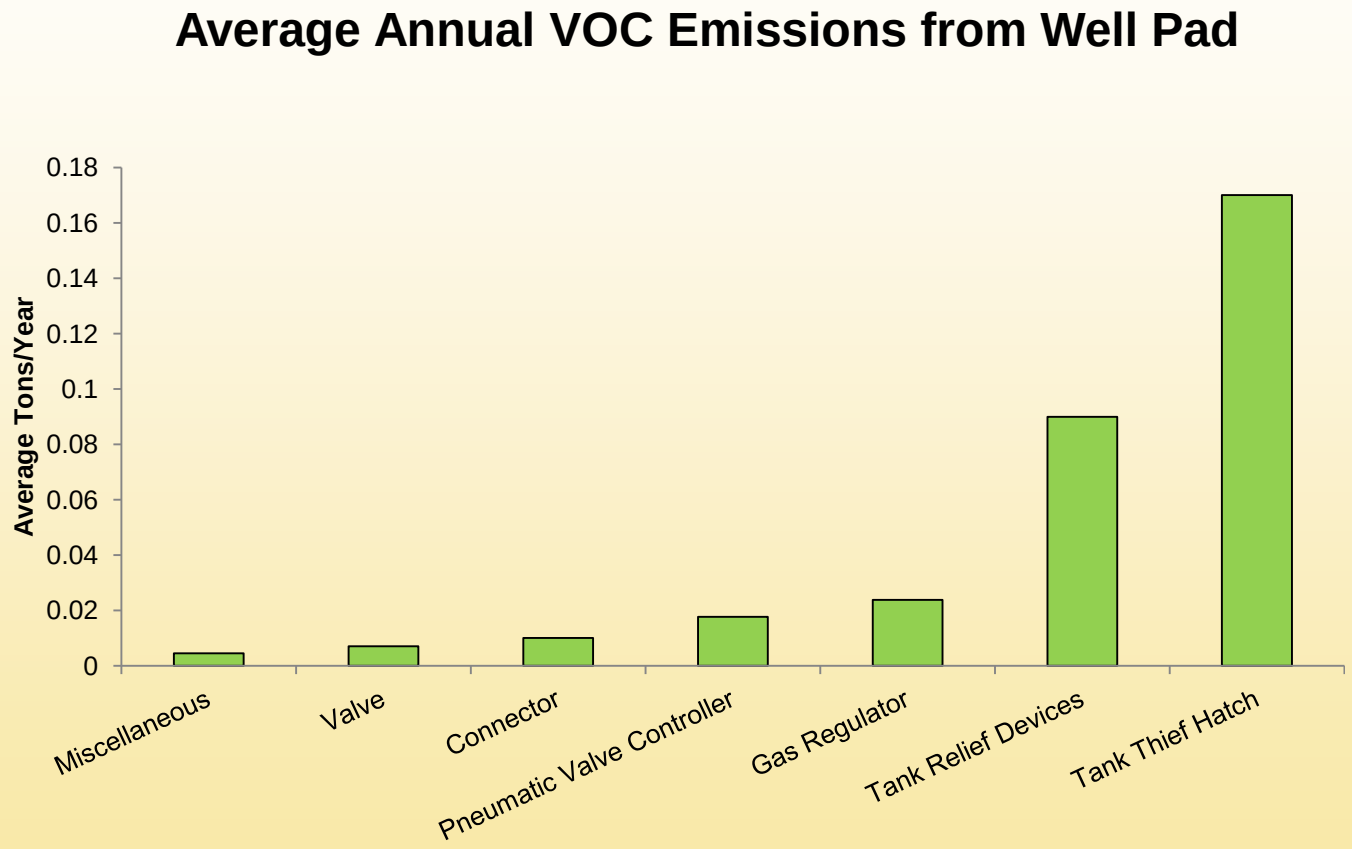
Infrared (IR) Camera

HiFlow Sampler

Toxic Vapor Analyzer
(TVA)

Canister

Point Source Testing

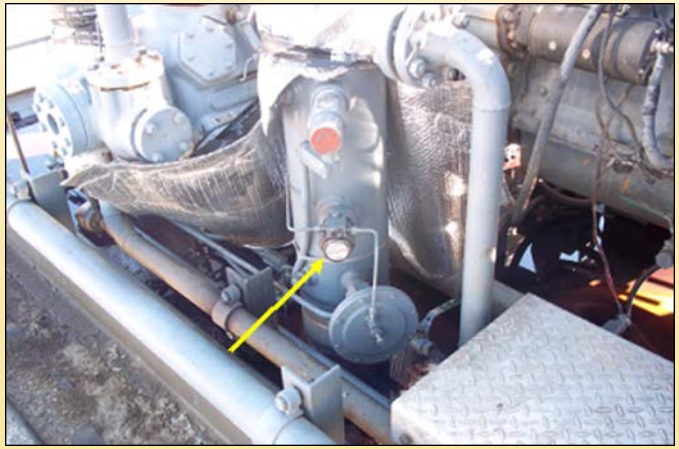


Point Source Testing

Tank Thief Hatch

Pneumatic Valve Controller

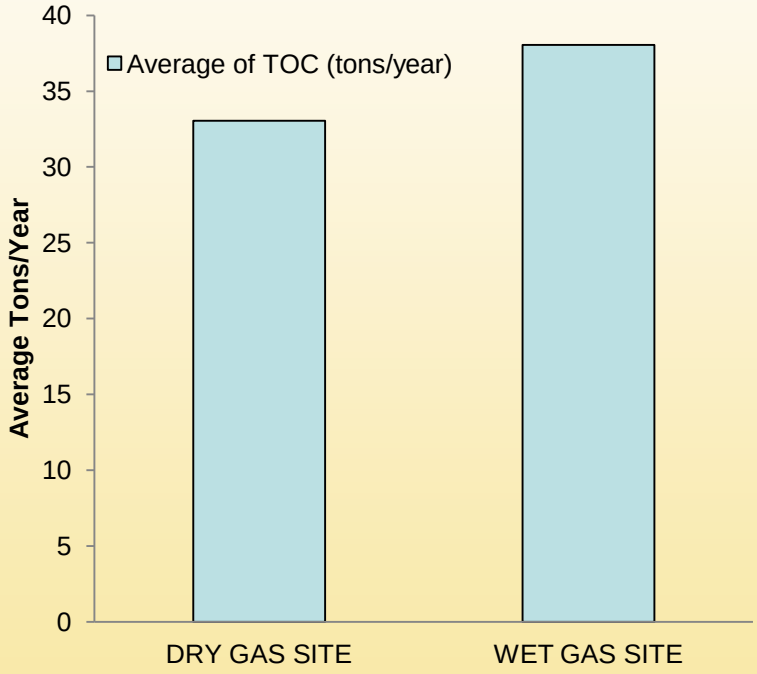
Storage Tank Vent

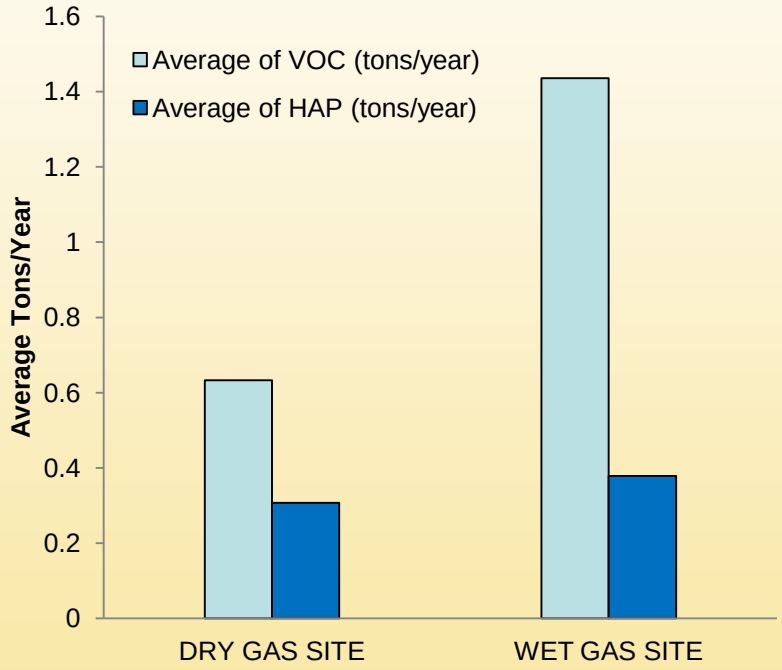


Pressure Regulators

Point Source Testing

Annual Average Wet Gas and Dry Gas Emissions at Well Pads

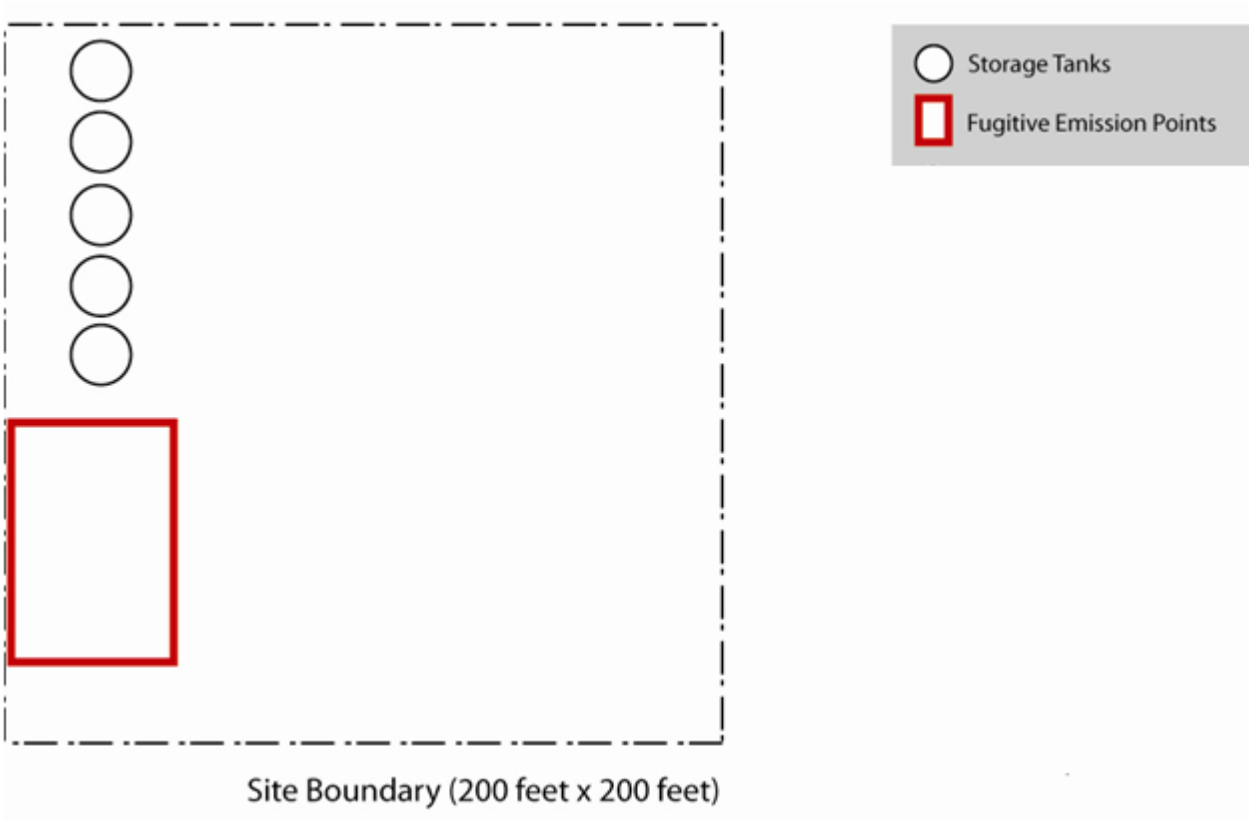




Air Dispersion Modeling

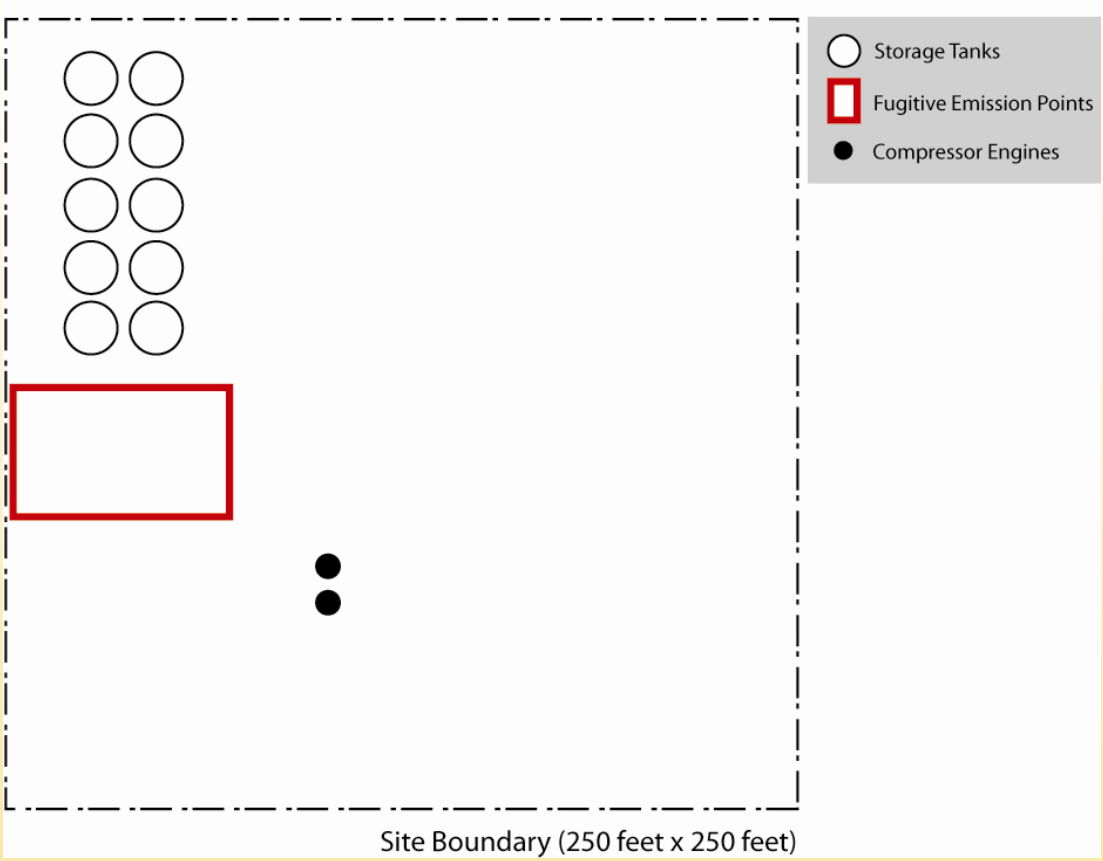
- Emissions data from point source testing program
- Meteorological data from DFW Airport
- Used EPA-approved model (AERMOD)
- Receptors out to 2 kilometers
- Predict short- and long-term impacts
- Four scenarios considered

Modeling Scenario 1



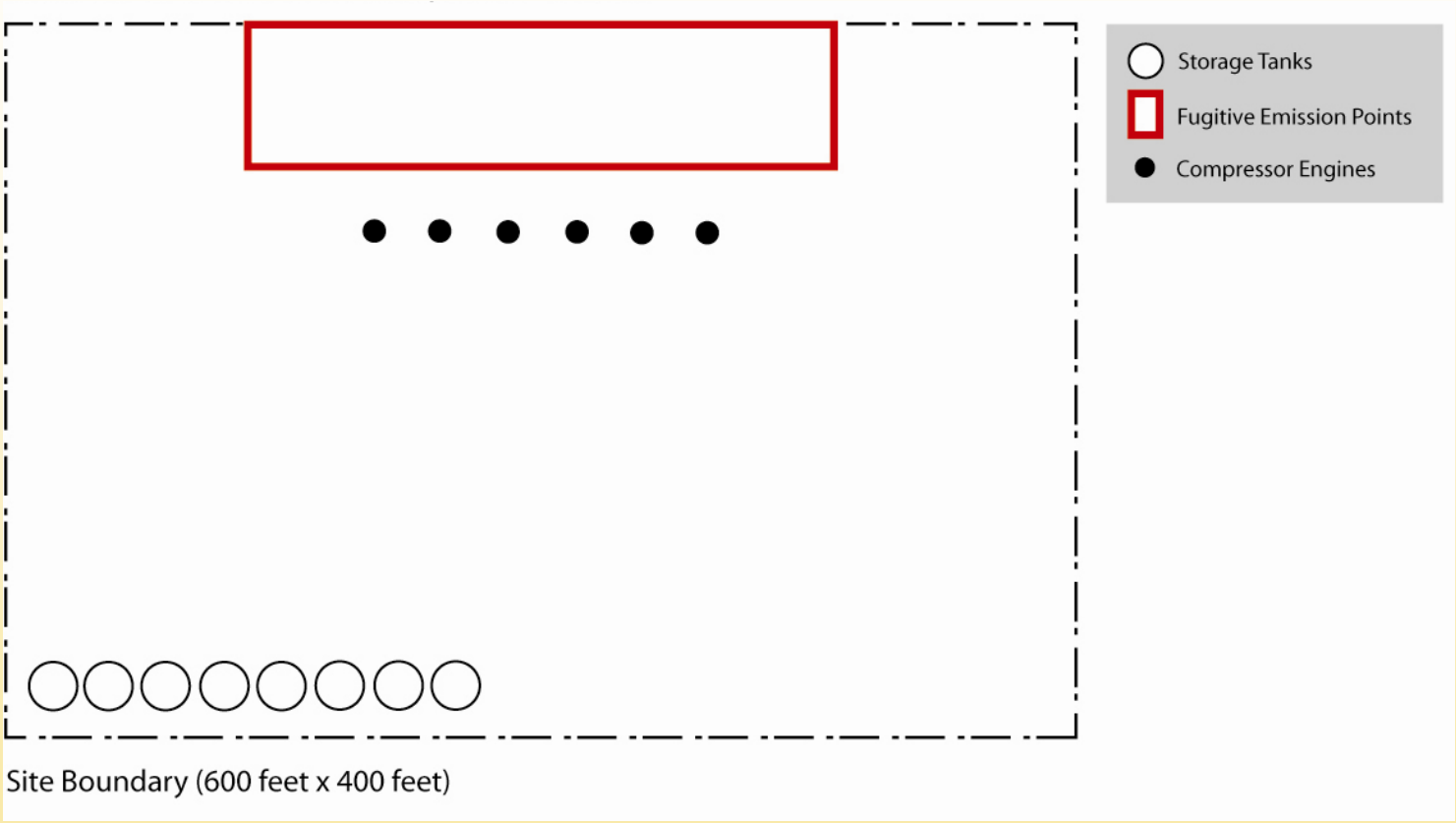
- *Average* well pad emission rates

Modeling Scenario 2



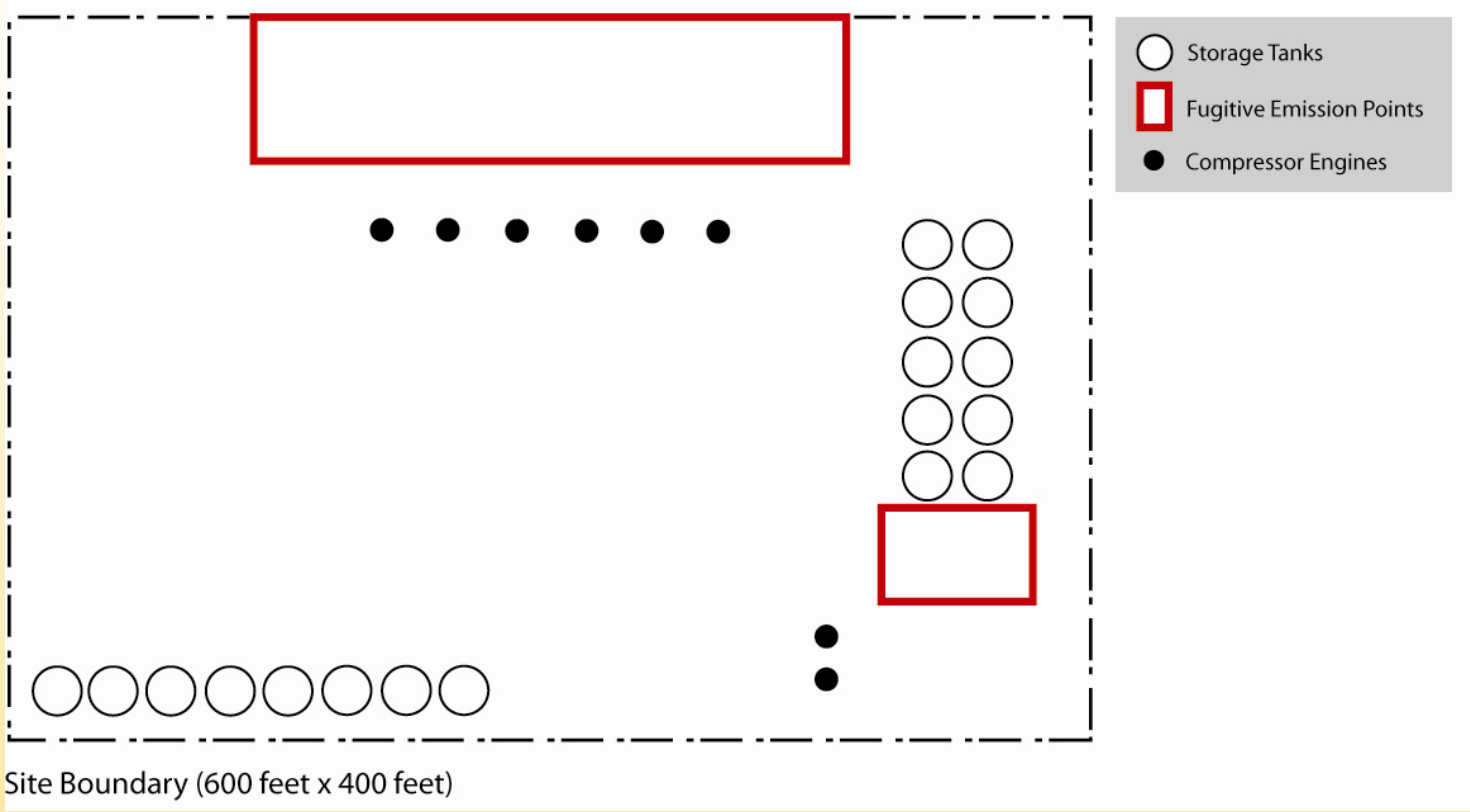
- *Highest* well pad emission rates

Modeling Scenario 3



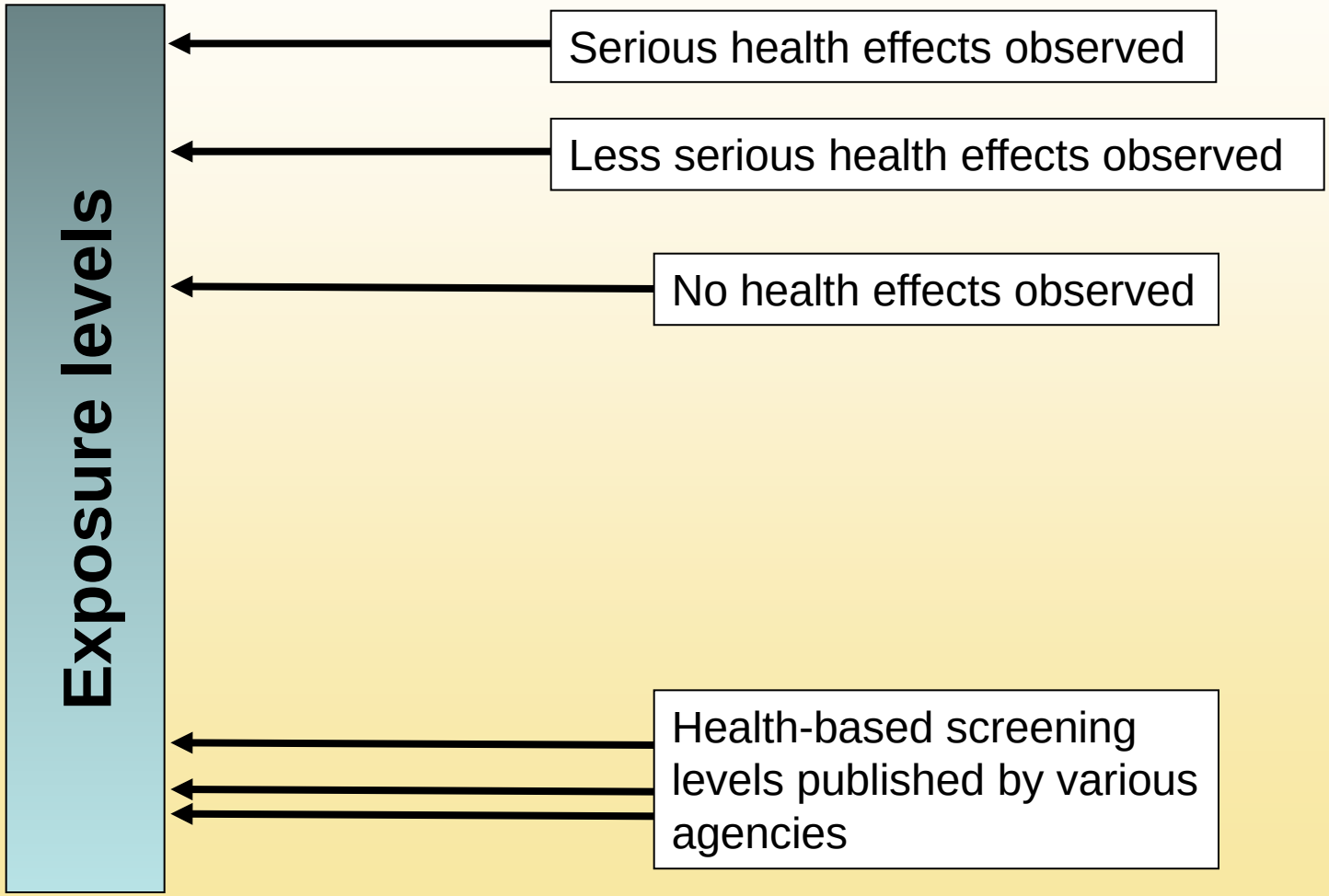
- *Highest* compressor station emission rates

Modeling Scenario 4



- *Co-located* well pad and compressor station (worst-case)

Public Health Evaluation

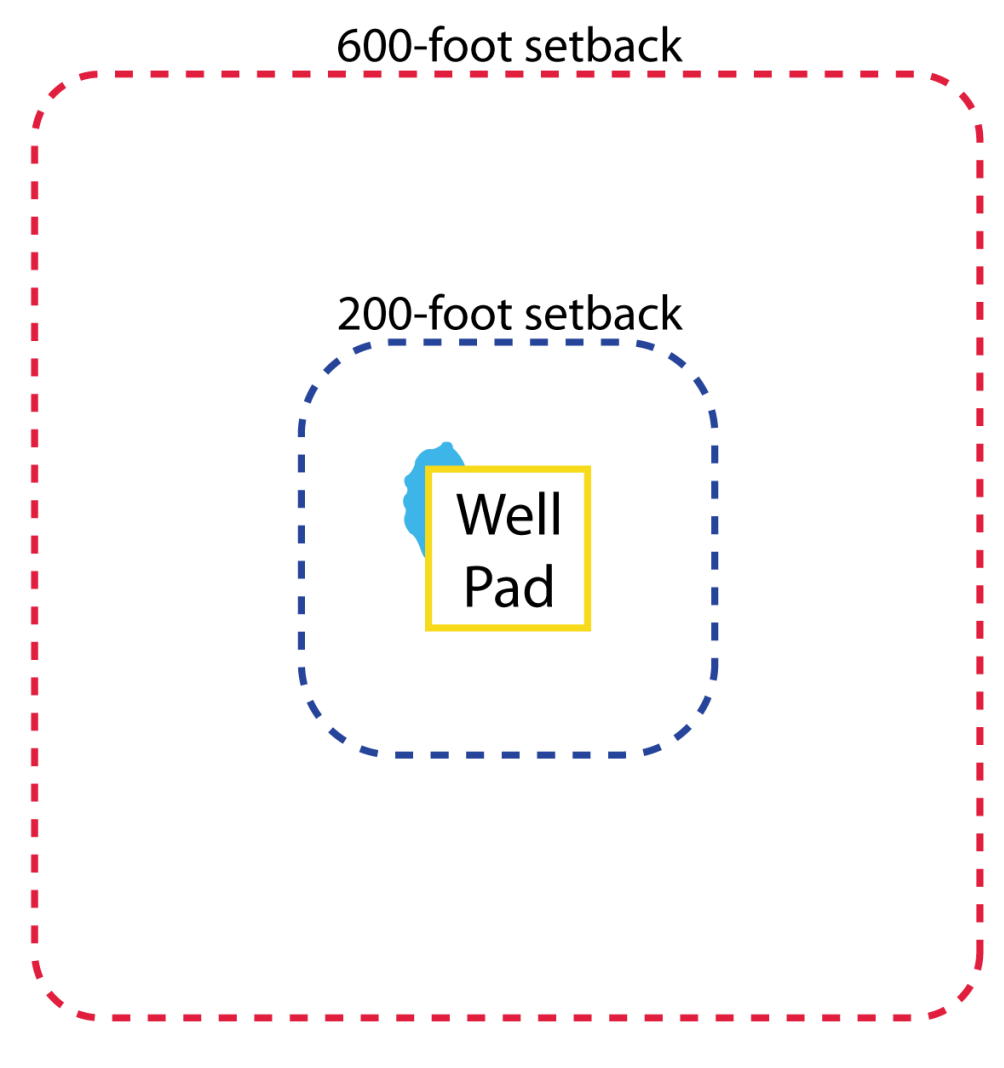


Public Health Evaluation

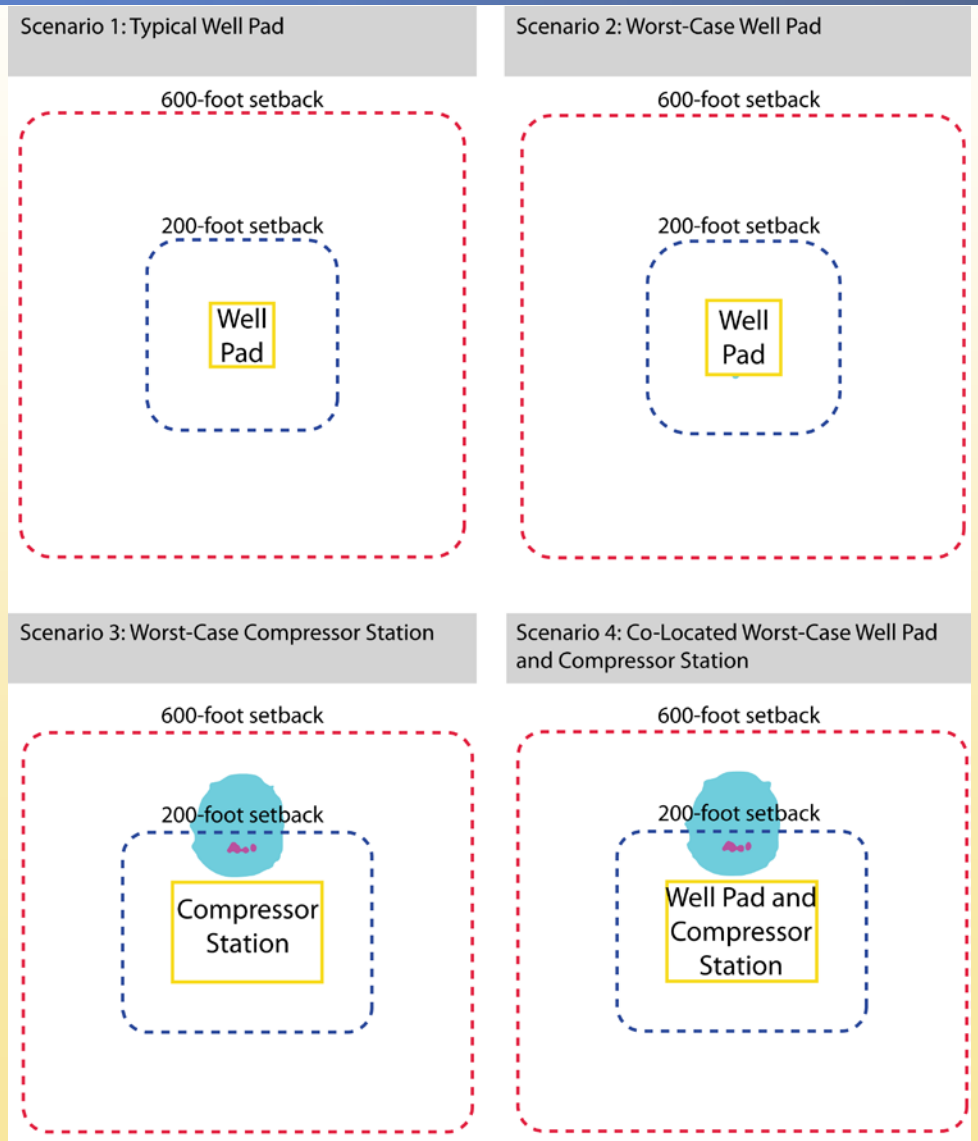
Dispersion Modeling

- Scenario 1
  - No estimated air quality impacts above screening levels
- Scenario 2
  - Estimated concentrations above screening levels for acrolein, benzene, and formaldehyde, but only in highly localized areas
- Scenarios 3 and 4
  - Estimated concentrations above screening levels for acrolein and formaldehyde extend beyond property boundaries and beyond setback distances

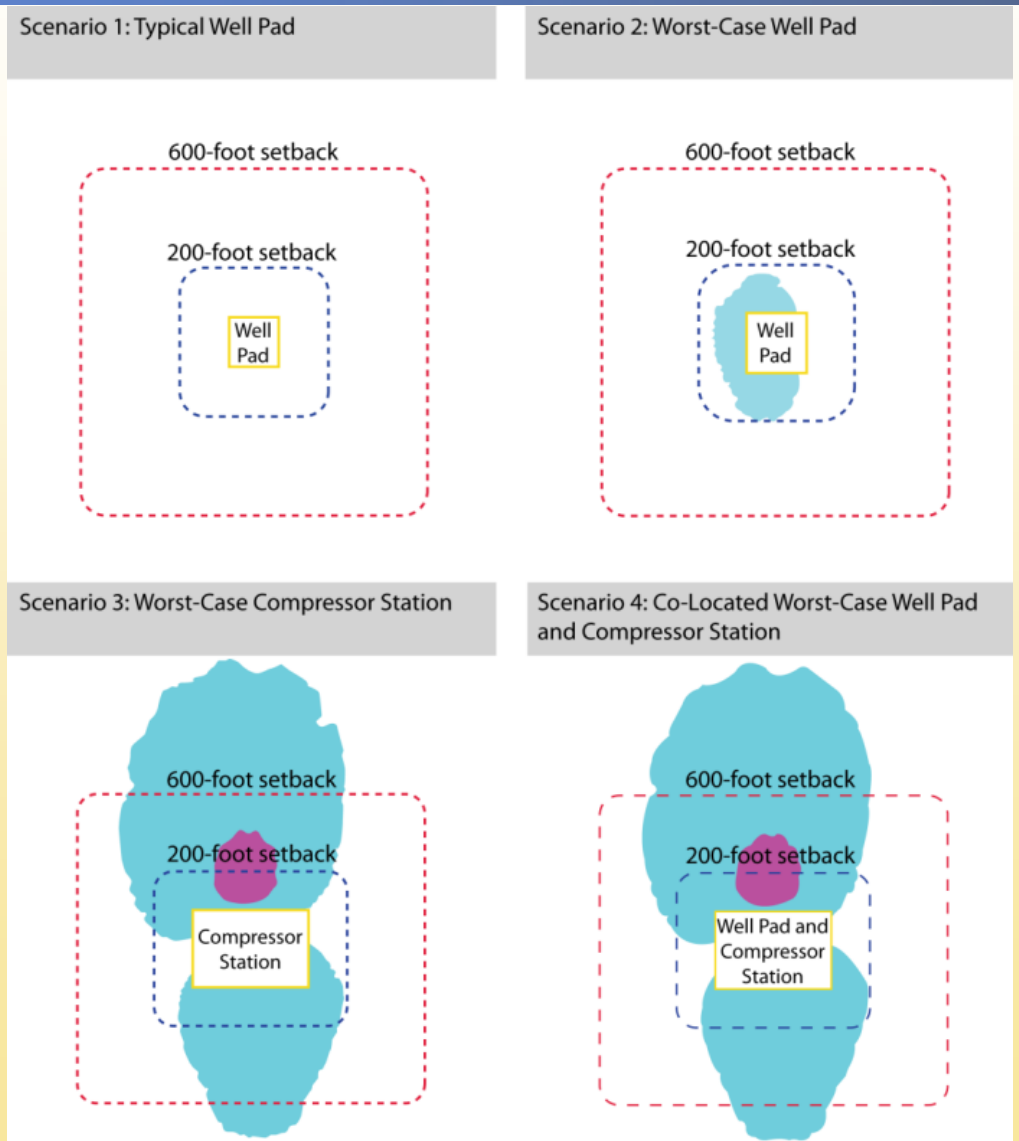
Benzene Modeling Results



Formaldehyde Modeling Results



Acrolein Modeling Results



Public Health Evaluation

Ambient Air Measurements

- 24-hour average concentrations
  - All below short-term health-based screening levels (one exception of “limited reliability”)
- Program-average concentrations
  - All below long-term health-based screening levels (one exception of “limited reliability”)
- No health hazard associated with continued exposure to measured levels

Conclusions

- Monitoring and modeling data indicate that setback distances are adequate
  - For overwhelming majority of sites, no pollutants were found to exceed screening levels beyond setback distances
  - For sites with multiple, large engines, *estimated* acrolein and formaldehyde concentrations exceed protective screening levels, but do not reach levels expected to cause adverse health effects

Recommendations

- Encourage the use of air pollution control strategies
  - Catalytic oxidizers on large compressor engines
  - Electric-driven compressor engines
  - Low bleed or no bleed pneumatic valve controls
  - Vapor recovery units on storage tanks
- Implement enhanced inspection and maintenance of well pads and gas handling operation equipment
- Conduct additional research evaluating acrolein and formaldehyde emissions
- Continue ambient air monitoring

Questions?

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Final report posted at:
http://fortworthtexas.gov/gaswells/default.aspx?id=87074