# *Educational Workshops*
## *for the*
# *Camp Minden Site*

- Air Sampling and Monitoring for Baseline Characterization
  - April 16, 2015
- Preparedness
  - April 23, 2015
- Data
  - Date to be determined
- Ideas for additional workshops
  - Please make suggestions on the response cards provided or
  - email us at: R6_Camp_Minden@epa.gov

# *Air Sampling & Monitoring for Baseline Characterization*

Educational Workshop

16 April 2015

Site: Camp Minden

Minden, Webster Parish, Louisiana

Presenters:

EPA: Adam Adams

EPA START Contractor: Steve Mauch

# *Agenda*

- Introductions / Welcome
- What is a Baseline Characterization?
- Outline
  - Why is this Baseline Characterization important?
  - Air Sampling and Monitoring Methods, Equipment and Analyses
    - Sampling Methods, Equipment, and Analyses
    - Monitoring Methods, Equipment, and Analyses
  - Draft Sampling Plan
    - Equipment
    - Location Requirements
    - Proposed Locations
  - Questions and Answers

## *Why is this Baseline Characterization important?*

Last week, EPA posted a Draft Quality Assurance Sampling Plan (QASP) to the EPA Camp Minden website
www.epa.gov/region6

04/20/15 – Deadline for feedback.

- Summary of Proposed Sampling Plan:
  - 6 Sample locations off Camp.
  - 2 Sample locations on Camp.
- Air Sampling and monitoring conducted simultaneously.
- Baseline sampling will begin in about 3 weeks.
- Please comment:
  - R6_Camp_Minden@epa.gov

# *Air Sampling and Monitoring*
## *(Methods, Equipment, and Analyses)*

## *Objectives*

- Provide descriptions of following elements of a baseline air surveillance program:
  - Ambient air samplers
  - Ambient air monitors
  - Sampling & analytical methods
  - Meteorological monitoring

# *Key Terms*

- *Ambient Air* – Outdoor air, outside of industrial facilities. Generally low concentrations of pollutants.
- *Sampling* – Collecting pollutants onto/into sampling media (filters, canisters) over set time periods. Samples are sent to lab for analysis. Data are averages over period sampled (e.g., 24 hrs)
- *Monitoring* – Measuring pollutants continuously in real time using pollutant-specific analyzers. Data show variations of pollutants over periods of an hour or less.

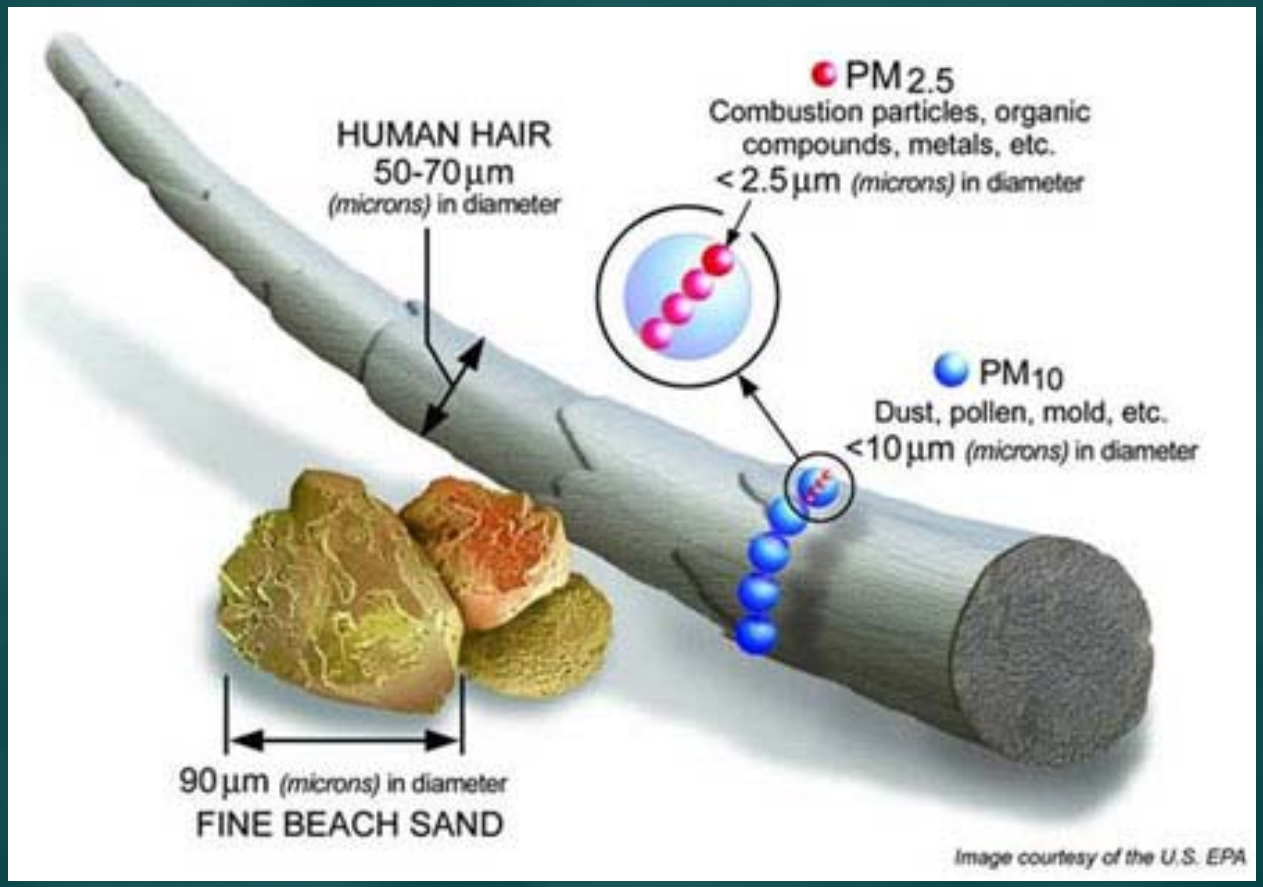
# *Key Terms*

- *SVOC* – Semi-volatile organic compounds. Boiling point higher than water, and may vaporize when exposed to temperatures above room temperature. Can be present in air as both solid and gas.
- *VOC* – Volatile organic compounds. Composition makes it possible for them to evaporate under normal indoor atmospheric conditions of temperature and pressure. Present in air as a gas.

# *Key Terms*

- $PM_{2.5}$ – Particles less than 2.5 microns aerodynamic diameter. Primarily associated with combustion (power plants, diesel engines, etc.). Can travel deeper into lungs.
- $PM_{10}$ – Particles less than 10 microns aerodynamic diameter. Primarily associated with suspended soil-derived dust (roads, erosion, etc.), or fugitive emissions from industrial materials handling. Mainly affects the upper respiratory system. Also includes $PM_{2.5}$

# *Perspective on Particle Size*



# *Next Section: Air Sampling Methods, Equipment, and Analyses*

- Any questions on Key Terms?

# *Sampling Methods*

- Particulates ($PM_{2.5}$ , $PM_{10}$)
  - Pump draws in air, collects specific-sized particles onto filters
  - Sampling rate = 16.7 Liters/minute
  - Sampling time = 24 hours
- Semi volatile Organic Compounds (SVOC)
  - Can be particle, gas, mixture
  - Vacuum motor draws air through filter (particles) and adsorbing media (gases)
  - Sampling rate = 225 Liters/minute
  - Sampling time = 24 or 48 hours

# *Sampling Equipment*

- GMW PS-1

- SVOC

BGI PQ-200

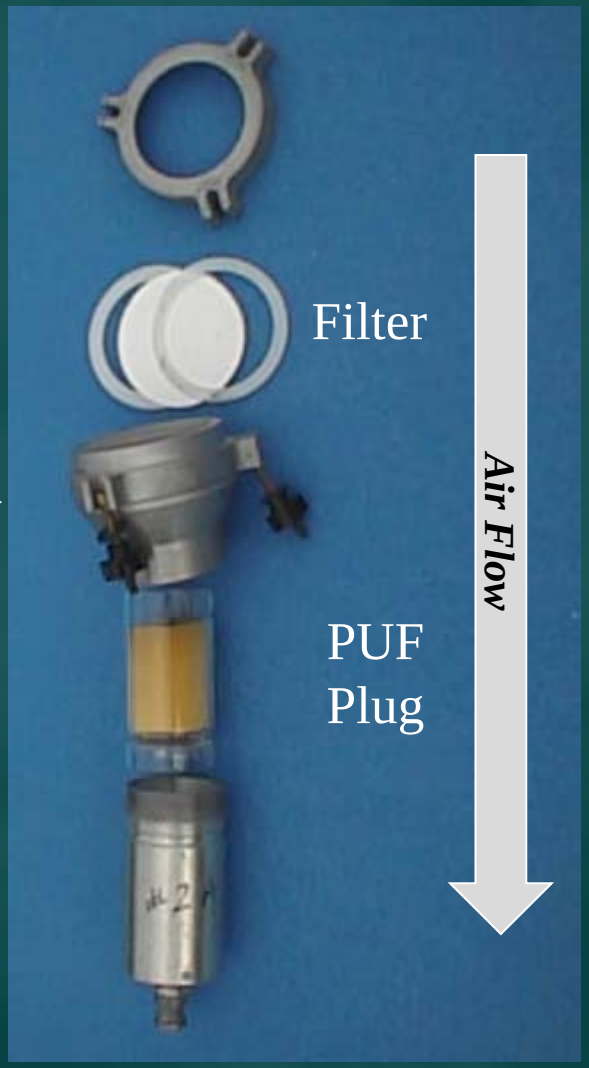

Particulates

# *Sampling Equipment*


Example of PQ-200 and other air monitors

# *Sampling Equipment*

- PS-1 Sampling Module

# *Sampling Methods*

- Volatile Organic Compounds (VOC)
  - Specially polished stainless steel canisters, start evacuated, use internal vacuum to pull in whole-air sample
  - Sampling rate = 3.5 Milliliters/minute
  - Sampling Time = 24 hours

# *Sampling Equipment*

- Canister Sampler

- VOC

# *Sample Analysis Methods*

- Laboratory measures mass of pollutant(s) collected
  - Typically micrograms (µg)
    - Microgram = 1 / 1,000,000 of a gram
    - Sand grain (0.2 mm dia) has mass ~ 10 µg
- Air volume is calculated
  - Sampling rate * time (L/min * min)
  - Convert to cubic meters ($m^3$)
    - 1,000 L = 1 $m^3$
- Concentration is mass over volume
  - Micrograms per cubic meter (µg / $m^3$)

# *Sample Analysis Methods*

- $PM_{2.5}$ & $PM_{10}$
  - Microbalance for total mass
  - Sensitivity:  1 µg / sample
  - Volume:  24 $m^3$

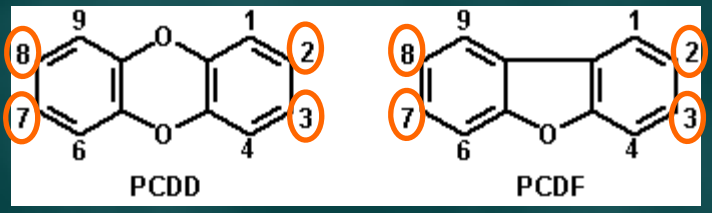
# *Sample Analysis Methods*

- SVOC (TO-13A)
  - Particles and/or vapors
  - Two-stage sample media
    - Filter
    - Polyurethane foam (PUF) plug
  - Analyzed by combination of
    - Gas chromatography (GC)
    - Mass Spectroscopy (MS)
  - PAH, DNT, DBP, and DPA
  - Sensitivity: 1 – 20 µg (varies by compound)
  - Volume: 324 $m^3$

# *Sample Analysis Methods*

- Dioxins/Furans (TO-9A)
  - Analyzed by combination of
    - Gas chromatography
    - Mass Spectroscopy
  - High resolution
    - 2,3,7,8-substituted compounds
  - Sensitivity: 10 – 100 pg
    - 1 picogram = 1 pg = 1 / 1,000,000 µg
  - Volume: 648 $m^3$ (48-hour)

*Dioxin & Furan Molecules: Chlorine at all four 2,3,7,8 locations are toxic*



# *Sample Analysis Methods*

- VOCs (TO-15)
  - Analyzed by combination of
    - Gas chromatography
    - Mass Spectroscopy
  - VOCs condensed out of air sample
  - Sensitivity: 0.5 – 5 ppb
    - 1 ppb = 1 part per billion volume
    - 1 $m^3$ compound / 1,000,000,000 $m^3$ air
    - µg/$m^3$ calculated from molecular weight
  - Volume: 5 L (0.005 $m^3$)

# *Next Section: Air Monitoring*

- Any questions on Air Sampling Methods, Equipment, or Analyses?

# *Monitoring Methods*

- Criteria Pollutants
  - National Ambient Air Quality Standards (NAAQS)
- Gases
  - Nitrogen Dioxide ($NO_2$)
  - Sulfur Dioxide ($SO_2$)
  - Carbon Monoxide (CO)
- Particles
  - $PM_{10}$ (sampling)
  - $PM_{2.5}$ (sampling + monitoring)

# *Monitoring Methods*

- Focus on combustion-related pollutants
  - Common to various thermal treatment options
- $PM_{2.5}$ focus, rather than $PM_{10}$
  - Monitor for $PM_{2.5}$ indirectly for time variation
  - Sample for $PM_{2.5}$ directly for standards
- Carbon Dioxide ($CO_2$) as complement
  - Fingerprint of combustion in general
  - No NAAQS

# *Monitoring Methods*

- Analyzers selected
  - $NO_2$ : Thermo Model 42i
  - $SO_2$ : Thermo Model 43i
  - CO : Thermo Model 48i
  - $CO_2$ :
    - Thermo Model 410i
    - Teledyne Model 360E
  - $PM_{2.5}$ : Met One BAM-1020

# *Monitoring Methods*

- $CO_2$ analyzers are equivalent
  - Same technique
  - Models differ due to availability
- All analyzers are EPA designated as Reference or Equivalent methods
  - Applies to criteria pollutants (not $CO_2$)
  - Methods used by regulatory agencies
  - Reference methods developed to have high accuracy and reliability
  - Equivalent methods may use different technology, but must be as accurate

# *Monitoring Methods – $NO_2$*

- Thermo Model 42i
- Uses chemiluminescence
  - Nitrogen oxide (NO) reacts with ozone, emits tiny amount of infrared light
  - Detector collects light, processed to concentration
- Analyzer converts $NO_2$ to NO
  - Reacts incoming air (some NO, some $NO_2$)
  - Reacts after converting all $NO_2$ to NO
  - Difference is $NO_2$

# *Monitoring Methods – $SO_2$*

- Thermo Model 43i
- Uses pulsed fluorescence
  - Pulse of ultraviolet (UV) light at one wavelength energizes electrons in $SO_2$ molecules
  - When the electrons return to lower energy state, small amount of UV light is emitted at a different wavelength
  - Detector collects the emitted UV light, converts to concentration

# *Monitoring Methods – CO, $CO_2$*

- Analyzers
  - Thermo Model 48i (CO)
  - Thermo Model 410i ($CO_2$)
  - Teledyne Model 360E ($CO_2$)
- Use optical filter correlation
  - Gases absorb infrared light beam in instrument
  - Rotating wheel alternates cells of clean (zero) and reference gas (CO or $CO_2$) into beam path to detector
  - Variations in light strength as cells alternate are used to get concentration

# *Monitoring Methods – Gas Analyzers*

- Mount on rack in trailer
- Air pulled into a glass manifold from outside
- Each analyzer pulls from manifold

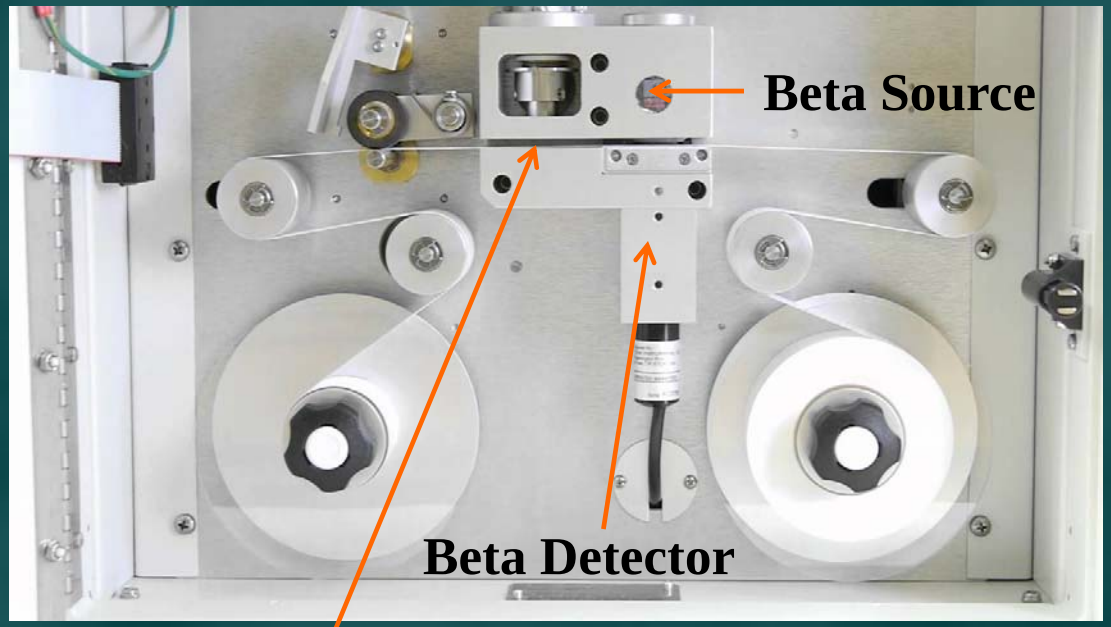
# *Monitoring Methods – $PM_{2.5}$*

- Met One BAM-1020
- Beta Attenuation Monitor
  - $PM_{2.5}$ particles collected on filter tape
  - Particles absorb weak beta particle beam in instrument
  - Particles absorbed proportional to particle loading
  - Filter tape moves to clean spot periodically
  - Longer counting periods provide more sensitivity
    - Units make one measurement per hour

# *Monitoring Methods – $PM_{2.5}$*

- Met One BAM-1020

Interior View



# *Next Section: Monitoring Methods for Meteorology*

- Any questions on Air Monitoring Methods, Equipment, or Analyses?

# *Monitoring Methods – Meteorology*

- Wind crucial to understand relationship of data to possible sources
  - Direction + Speed = transport
  - Turbulence = dilution
- Temperature & barometric pressure needed for sampling
  - Density of air changes
    - Cubic meter contains more/less air
    - Affects flows
  - Correct volumes to standard conditions
- Precipitation affects dust

# *Monitoring Methods – Wind*

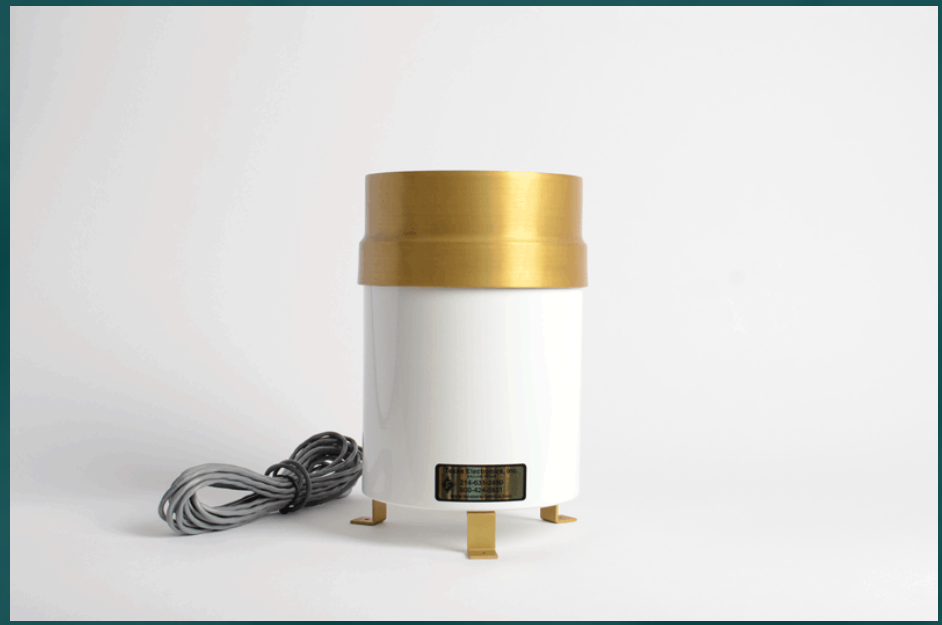
- R.M. Young Wind Sonic
- Sonic anemometer
  - No moving parts
- Uses travel time of sound pulses
  - Compensates for temperature
  - Measures N-S and E-W components
  - Vector calculations of speed, direction, turbulence
  - Samples 40 times per second
    - Signal out is 1-second average

# *Monitoring Methods – T & RH*

- Campbell Scientific CS-215 Air Temperature / Relative Humidity
- Electronic chip measuring both temperature (T) and relative humidity (RH)
- Housed in shield to prevent solar heating

# *Monitoring Methods – Rainfall*

- Tipping bucket rain gauge
  - Pair of calibrated see-saw buckets tip when one fills with 0.01” of rain
  - Tipping causes a magnetic switch to create an electric pulse



# *Monitoring Methods*

Example of Sonic Anemometer & Solar Radiation Shield

# *Monitoring Methods*

Example of Tripod Weather Station

# *Next Section: Draft Sampling Plan*

- Any questions on Monitoring Methods for Meteorology?

# *Draft Sampling Plan*

- Equipment (for 1 location):
  - 1 Monitoring trailer (5 monitors)
  - 5 Samplers
- Location requirements
  - Space
  - Electrical
  - Security / Access
  - Population

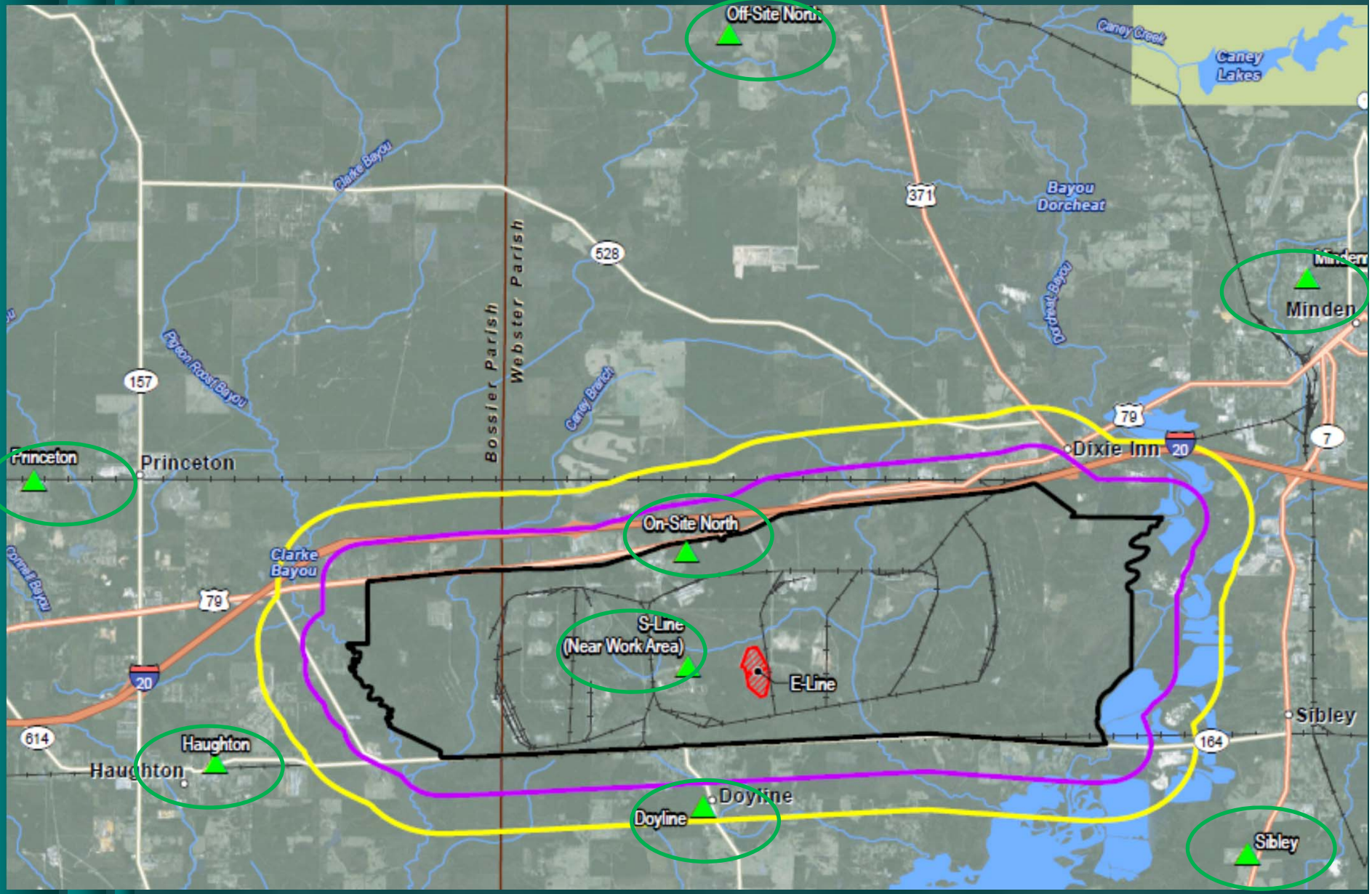
# *Air Monitoring Trailer*

- Example of a monitoring trailer

# *When and Where will this happen?*

- When?  In about three weeks after finalizing the Draft Sampling Plan.
- How long?  About three days at each location.
- Where?  (Proposed locations)
  - Six locations around Camp Minden
  - Two locations on Camp Minden

# *Where are the proposed locations?*



# *Summary of Proposed Air Sampling and Monitoring Baseline Characterization*

**Sampling**

- SVOC
  - (PS-1 PUF Sampler)
- Dioxin/Furans
  - (PS-1 PUF Sampler)
- PM2.5
  - (BGI PQ200)
- PM10
  - (BGI PQ200)
- VOC
  - (Summa Canister)

**Monitoring**

- PM2.5
  - MetOne BAM1020
- NO2
  - Thermo 42i
- SO2
  - Thermo 43i
- CO
  - Thermo 48iTLE
- CO2
  - Teledyne-API Model 360E

# *Questions* R6_Camp_Minden@epa.gov

- Additional questions?

- We need your feedback on:
  - 1) Proposed Draft Sampling Plan (by 04/20/15)
  - 2) Future Workshop Topics

Email: R6_Camp_Minden@epa.gov

Info: www.epa.gov/region6 (click on Camp Minden) or www2.epa.gov/la/camp-minden

Thank you again.