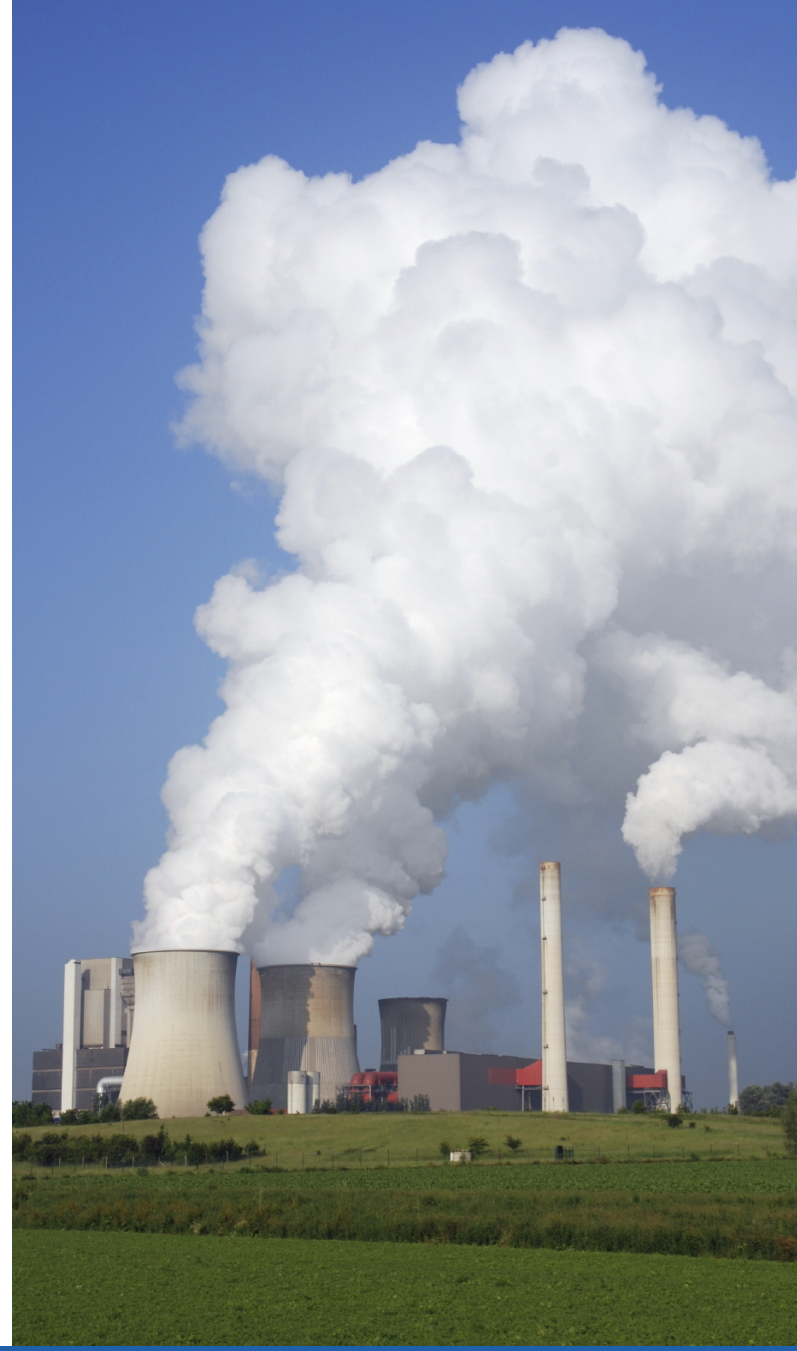
Performing a Successful Stack Test
Part 1: Pre-Test



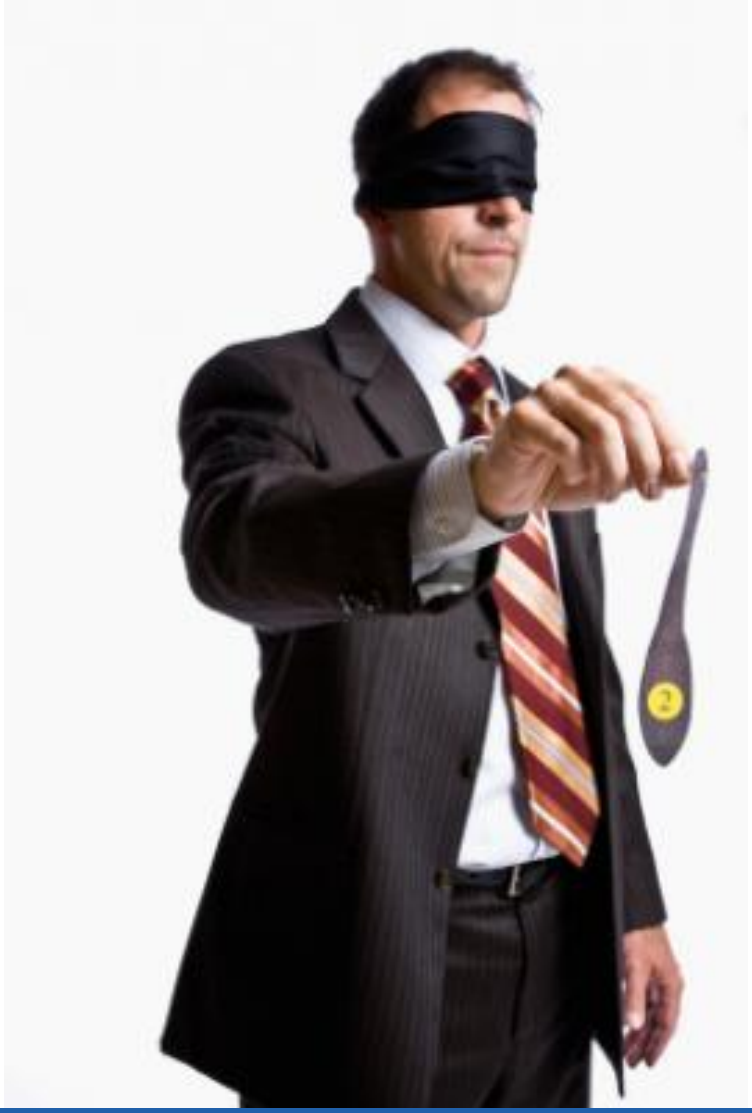
Jim Guenthoer
Sr. Environmental Engineer
Clean Air Engineering


Sears
GMC

Why Test?

- My Permit Says I Have To! Demonstrate Compliance
- Prove equipment meets the vendor's guarantee
- Something's wrong and we need understand what it is
- We need to collect data to modify existing equipment or design new equipment
- Need real data for Ambient Air Quality Modeling

How Do You Choose A Testing Company?



A Better Way

Put together a List

- Pre-approved internally
- Recommendations from other plants of same company
- Recommendation from industry technical entity
- Recommendation from other companies
- Agency approved list

Evaluate the List

- Have they performed satisfactorily for you before?
- Ask for references and follow up on them
- Inquire about similar testing they have done
- Find out who will be on your test crew
- By who and how will the samples be analyzed
- Only when all other factors are equal should you ask, “Who is cheapest?”

Source Test Overview

- **Pre-Test Events**
  - Creating a Test Plan
  - Safety Planning
  - Site Access
  - Client Site Support
  - Other Related Issues
- **Testing Events**
  - Equipment Mobilization & Set-up
  - Sampling
  - Analysis of Results (real-time)
  - Tear Down & Demobilization
- **Post-Testing Events**
  - Analysis of Results (gravimetric, wet chemistry, etc.)
  - Data Entry
  - Writing the Test Report

Pre-Test: Creating a Test Plan

The Driving Force For The Testing and the Schedule

- **Purpose of the Testing**
  - Vendor guarantee
  - Permit compliance
  - Engineering/Diagnostic
- **Nature of the Source**
- **Type of Process Cycle**
  - Continuous
  - Batch
- **Testing Parameters**
  - Sample Type
  - Pollutant Sampled
  - Sampling Method(s)
- **Number of Runs for completed test**
- **Sample Run Times**
- **Sampling Location(s)**
  - Schematic drawings
  - Stack/Duct shape & size
  - Flow direction, Pressure, Temperature
  - Disturbances- upstream & downstream
  - Sampling location elevation & access
  - Configuration of sample ports
    - Number of ports
    - Port diameter
    - Nipple length
- **Process Parameters & Samples**
- **Analytical Method / Laboratory**
  - In House or Subcontract Lab
  - Analytical options
  - Turn Around Time

Pre-Test: Choosing a Test Method - Formaldehyde

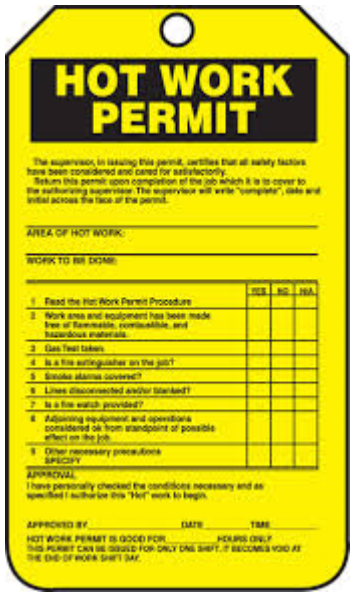
- **SW-846 0011**: High flow isokinetic test method using dinitrophenelhydrazine (DNPH) absorbing solution and high performance liquid chromatography (HPLC) analysis.
- **NCASI 94.02:** Low flow non-isokinetic test method using chilled water and silica gel tubes as the collection media and acetylacetone derivatization spectrophotometric analysis of the water
- **NCASI 98.01:** Low flow non-isokinetic test method using chilled water as the collection media and acetylacetone derivatization spectrophotometric analysis.
- **NCASI 99.02:** Low flow non-isokinetic test method using chilled water and evacuated canister as the collection media and the acetylacetone derivatization spectrophotometric analysis of the water and gas chromatography/mass spectroscopy of the canister contents
- **NCASI 105.01:** Low flow non-isokinetic test method using chilled o-benzylhydroxylamine as the collection media and the resulting aldehyde oximes are analyzed by a gas chromatograph equipped with a nitrogen-phosphorus dectector
- **CARB 430:** Low flow non-isokinetic test method using DNPH as the collection method and HPLC analysis
- **EPA CTM 323:** Low flow non-isokinetic test method using chilled water as the collection media and acetylacetone derivatization spectrophotometric analysis. (Specified for Natural Gas-Fired Stationary Sources Only)
- **EPA 320:** Direct injection of stack gas into a Fourier Transform Infrared Spectrophotometer (FTIR). Method utilizes real time dynamic spiking.

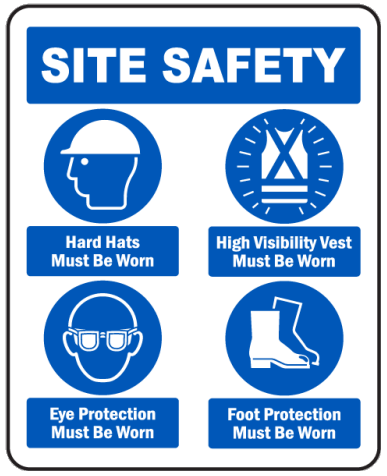
Pre-Test: Safety Planning
Common Stack Sampling Hazards

- **Physical Hazards**
  - Fall Hazards
  - Electrical Hazards
  - Lifting
  - Burns
  - Compressed Gases
  - Noise
  - Plant Traffic
  - Mechanical Hazards
  - Pressure of Source
  - Cuts
- **Chemical Hazards**
  - Flue Gas
  - Process Chemicals
  - Sampling Reagents
  - Cleaning Agents
- **Psycho-social Hazards**
  - Fatigue
  - Working Alone
  - Shift work (Disrupted Sleep Patterns)
- **Weather & Environmental Hazards**
  - Wind
  - Rain/Snow/Hail
  - Heat/Cold
  - Humidity
  - Sun
  - Lightning
  - Sandstorm
  - Earthquake

Pre-Test: Safety Planning (continued)

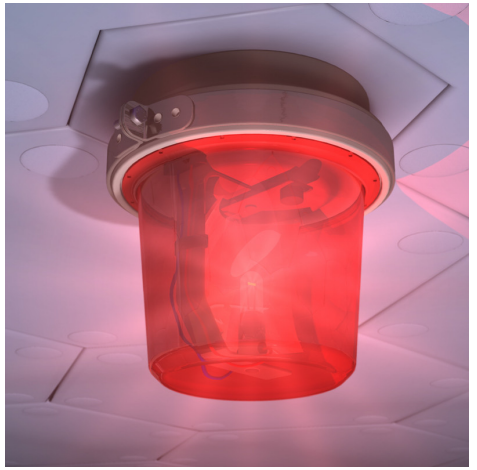
Safety Checklist





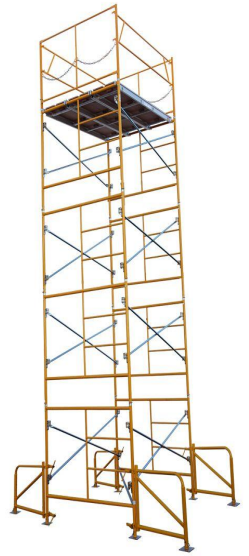
General Issues

- JSA
- PPE needed
- Safety training required
- Hot/cold work permits needed?
- Plant emergency phone #'s
- Emergency meeting point
- Plant alarms/evacuation procedures
- Nearest First Aid station and shower



Site Specific Issues

- Clear access to work site?
- Sampling access: ladder, stairs, scaffolding
- Clear work area?
- Adequate lighting night testing?



Pre-Test: Site Access

- Safety Training: Offsite/Onsite
- Personnel Passes/Badging
- Vehicle/Equipment Passes
- Security Notification / Clearances
- List of Contacts and Phone Numbers
- Entry Time
- Travel & Lodging Information (if applicable)

Pre-Test: Client Site Support

- Electrical Hook-ups, connections and power
- Air supply needs for testing equipment
- Ensure a space is cleared for the Mobile Laboratory/Instrument Van if being used.
  (i.e. pallets, drums, containers not in the way)
- Does the plant need to provide a room for sample train recoveries?
- Scaffolding?
- Crane?

Pre-Test: Other Issues

Notifications of Regulatory Authorities

- Test plan submittals
- Pre-test meetings
- Permit modifications and deviations to test methods
- Audit samples needed? Ordered?

Operational Issues

- Will unit be running during scheduled testing?
- Will it be running at target rate and product?
- How long can it operate at needed operational level
- Batch process or continuous process?
- Is all associated equipment functioning properly? (e.g., flowmeters calibrated)
- Any last minute access issues (i.e. construction, etc.)?

Testing: Equipment Mobilization & Set-Up

- Calibrate, pre-weighs, select standards, assembly of needed equipment & supplies
- Audit samples?
- Equipment shipment to site (Air? Boat? Truck?)
- Travel to site (Air? Drive?)
- Site entry
- Work Permits (Safe and Hot)
- Set-up of mobile laboratory/instrument van and stack sampling equipment
- **Electrical hook-up!!!**

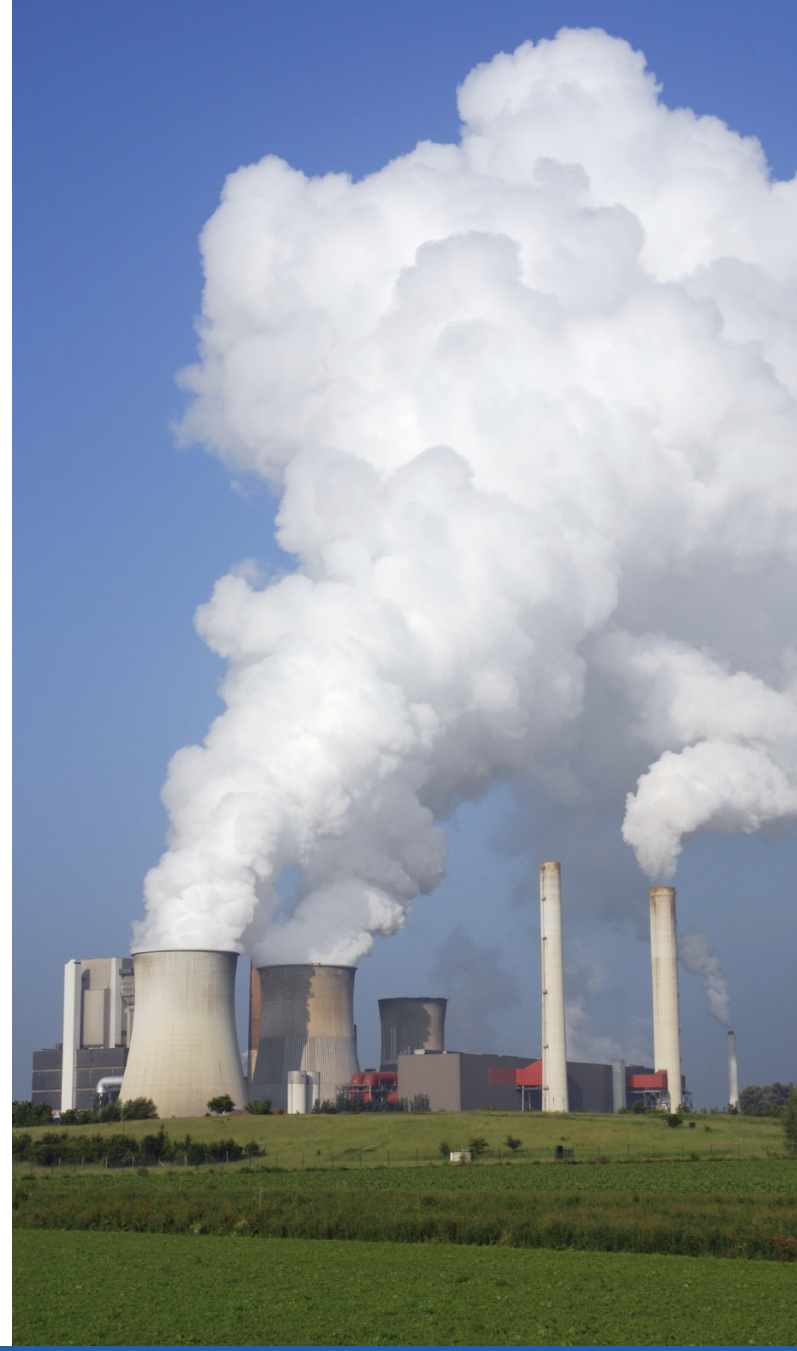
REMEMBER

P6

Proper Pre Planning Prevents Poor Performance

THANK YOU!
Jim Guenthoer
253-470-8015
jguenthoer@cleanair.com

Performing a Successful Stack Test
Part 2: The Test



Jim Guenthoer
Sr. Environmental Engineer
Clean Air Engineering

Testing: Equipment Mobilization & Set-Up

- Calibrate, pre-weighs, select standards, assembly of needed equipment & supplies
- Audit samples?
- Equipment shipment to site (Air? Boat? Truck?)
- Travel to site (Air? Drive?)
- Site entry
- Work Permits (Safe and Hot)
- Set-up of mobile laboratory/instrument van and stack sampling equipment
- **Electrical hook-up!!!**

Testing: Equipment Mobilization & Set-Up

- Calibrate, pre-weighs, select standards, assembly of needed equipment & supplies
- Audit samples?
- Equipment shipment to site (Air? Boat? Truck?)
- Travel to site (Air? Drive?)
- Site entry
- Work Permits (Safe and Hot)
- Set-up of mobile laboratory/instrument van and stack sampling equipment
- **Electrical hook-up!!!**

Testing: Sampling/Data Collection

- **On Site Equipment Calibration**
- **Testing according to the Test Plan**

  Each run is followed by calibration and/or sample recovery and documentation.

  Each **test** typically has at least three **runs** to demonstrate repeatability of approach, method, and analyst.

  Each test will typically take at least eight hours
- **Process Samples/Data**
- **Analysis of Results (real-time)**

Testing: Wrapping Up

- Sample Recovery, Labeling, Packing
- Chain of Custodies
- Clean-up area (Remove chemical waste)
- Tear-down, clean and store equipment for transport
- Obtain supporting process data
- Turn in permits
- Exit Plant (Equipment exit passes)

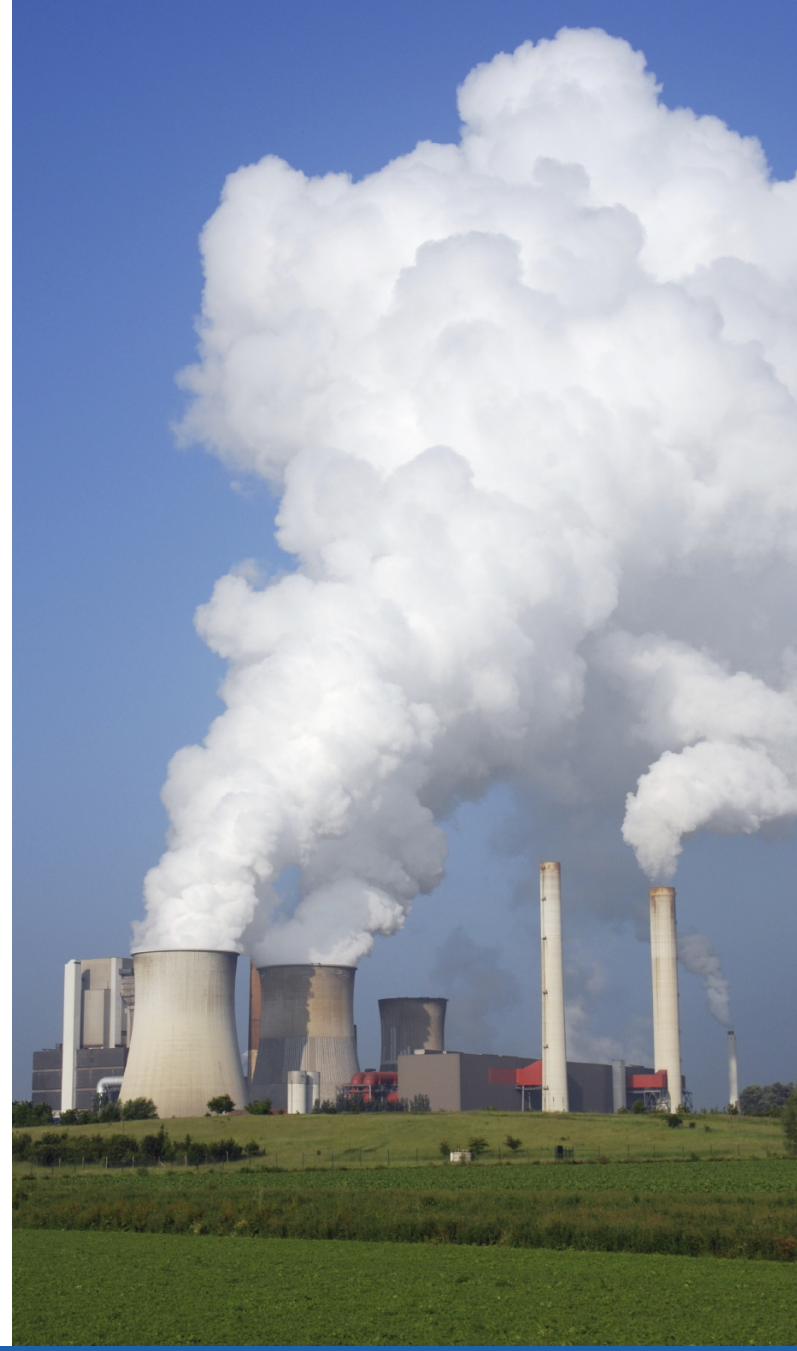
REMEMBER

P6

Proper Pre Planning Prevents Poor Performance

THANK YOU!
Jim Guenthoer
253-470-8015
jguenthoer@cleanair.com

Performing a Successful Stack Test
Part 3: Post-Test



Jim Guenthoer
Sr. Environmental Engineer
Clean Air Engineering

Post-Test: Analyses and Report Preparation

- In-house Sample Analysis
- Subcontract Laboratories
- Data Entry
- Calculation of Final Results from Data
- Report Preparation
- Report Results
  (Format? Number of Copies? To Whom?)

Post-Test: Formal Test Report

- **Cover Page**
- **Introduction**
  - Permit #'s
  - Applicable regulations – why the test was conducted
  - Source information – max and normal operating parameters
  - Test team and others present during the testing
- **Results summary**
- **Process Description – including a diagram or schematic**
- **Problems encountered during the test**
- **Testing Methodology**
- **Calculations used – all of them!!**
- **Results**
- **Appendices – list of equipment used, field data sheets, Certificates of Analysis (COA's), Chain of Custody, Process data, analytical data.**
- **Certifications**
- **Quality Assurance**

In Conclusion, to Improve the Probability of a Successful Test

- Select a reputable testing firm qualified to do the work
- Provide all required site information to testing firm in a timely manner
- Provide adequate lead time to testing firm
- Know their utility requirements well in advance
- Inform testing firm of any special plant entry requirements prior to day of testing
- Make sure all plant personnel whose jobs may affect the test are aware of the plan for executing the test.
- Communicate continuously with testing firm before, during and after test
- Provide plant data needed by testing firm to complete the calculations and formal report

REMEMBER

P6

Proper Pre Planning Prevents Poor Performance

THANK YOU!
Jim Guenthoer
253-470-8015
jguenthoer@cleanair.com