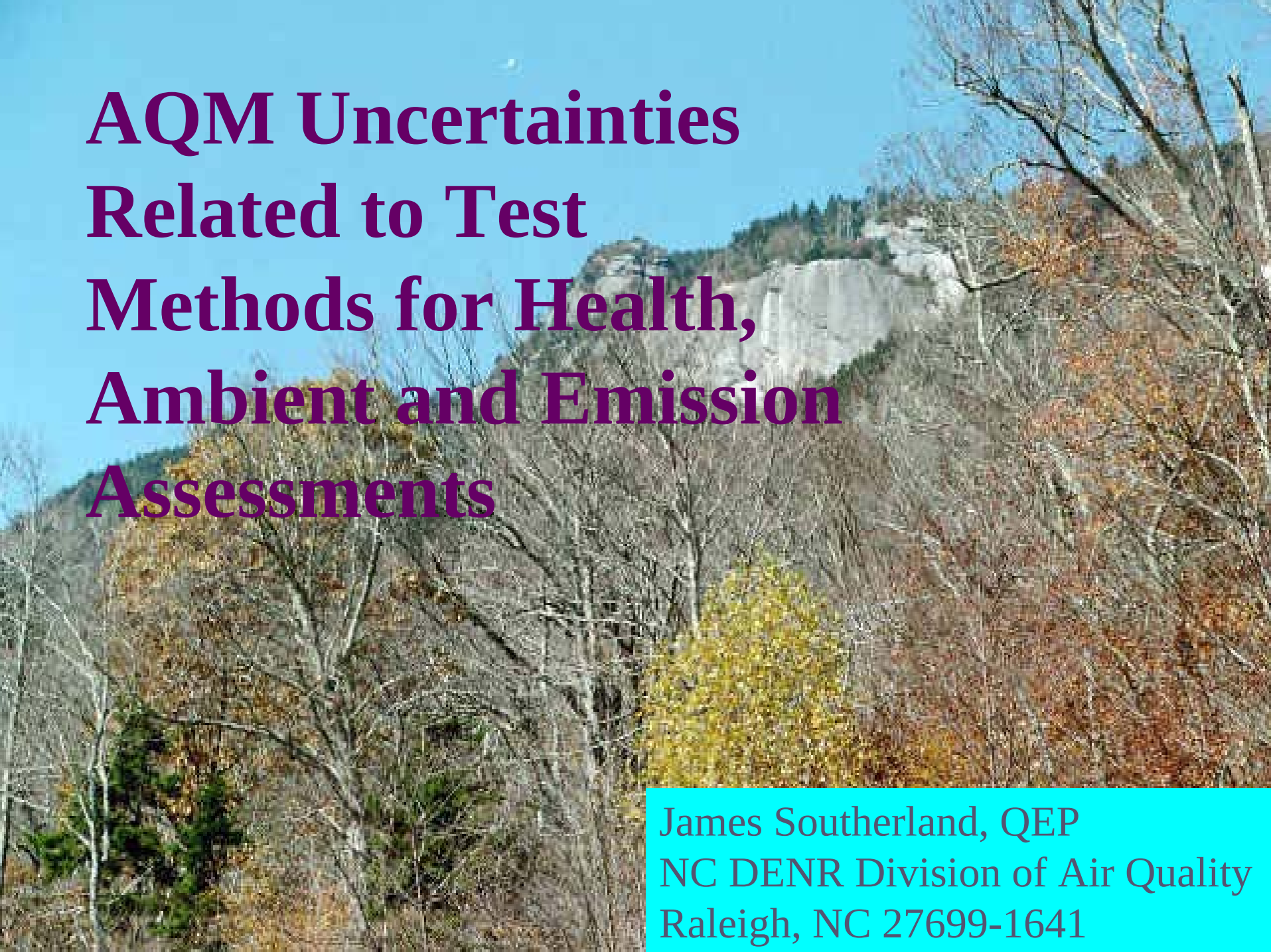
AQM Uncertainties Related to Test Methods for Health, Ambient and Emission Assessments



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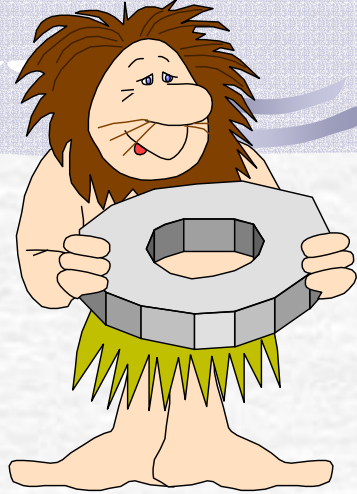


From History

- Shakespeare's inventory was that he was surrounded by a "congregation of foul and pestilent vapours." – Probably 'accurate,' but NOT quantitative or precise
- Not sure who tried first, but California, especially Los Angeles APCD takes credit -

Plan for this Presentation

- This presentation will briefly review a few areas in the inventory where uncertainties are commonly introduced and review some past discussions on these areas.
- Aspects of measurement or test methods used for health assessment, ambient monitoring and emission estimation (factors) will be discussed that suggest potential uncertainties and incongruities.
- Suggestions to remedy some of these problems will be made.

Early References to Accuracy

- The 1962 USPHS (but California-written) field manual describes the inventory as "intended to specifically provide some accurate data (emphasis added) on all equipment sources of air pollution in all industrial-commercial establishments in the pollution zone," lending an implied measure of quality and validation.

Point Source Emphasis

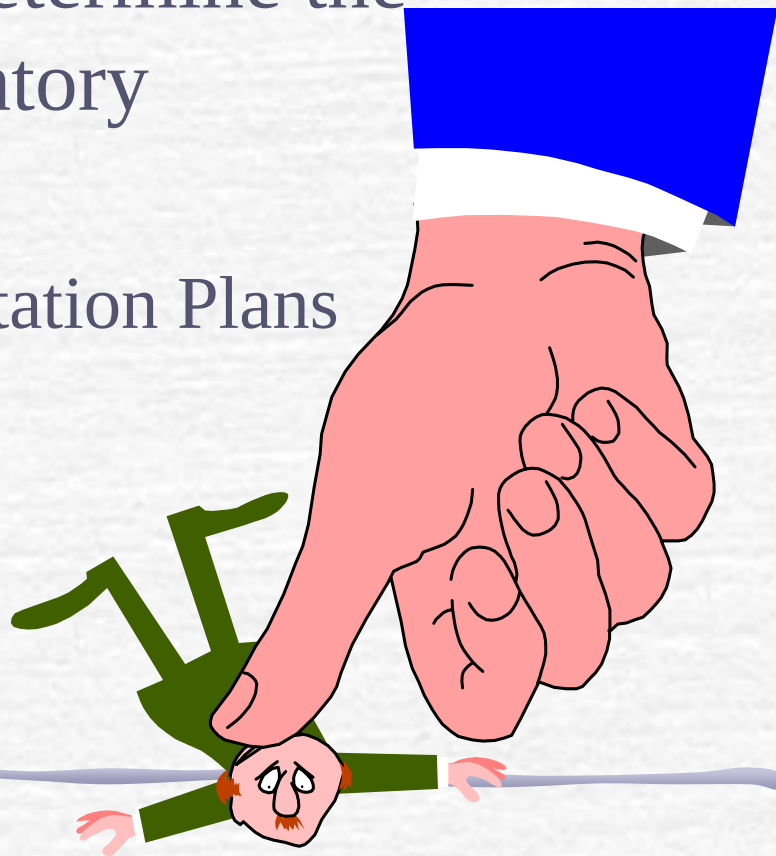
- All inventories seem to start with a point source emphasis (less today) - Why?
  - They are obvious
  - In the earlier days, they were obvious and ‘easily’ controllable
  - Area sources, including mobile, were soon added as refinements
  - Some still only dwell on point sources

Inventory Validation & QA

- Basically, it is an attempt to determine if the emission estimates are made properly and provide a reasonable surrogate for measured emissions and properly serve the AQM (especially modeling) functions
- The concept may be referred to as Quality Assurance or Uncertainty Analysis

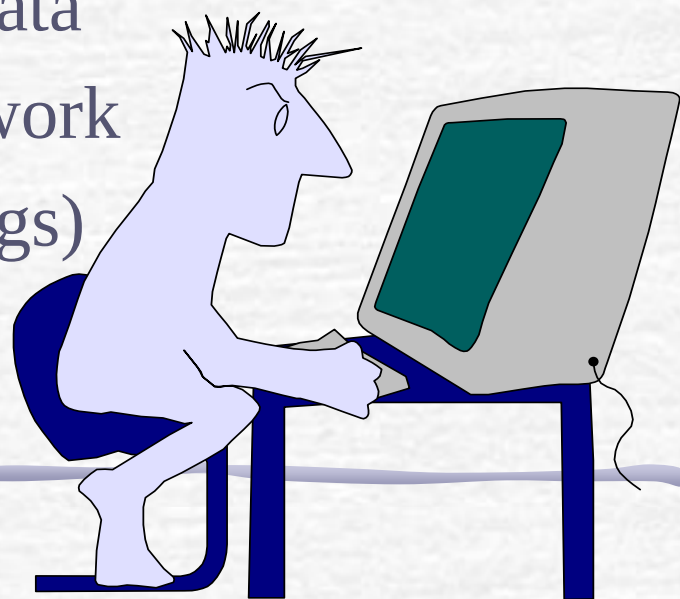
Customers?

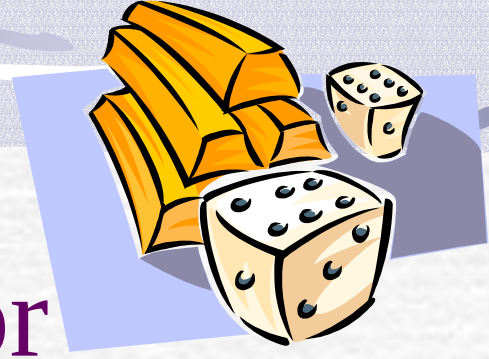
- Users of the data should determine the characteristics of the inventory
  - Permitting
  - Planning – State Implementation Plans
  - Modeling
  - Emissions Trading
  - Risk Assessment
  - ETC



Sources of Inventory Error

- Major/Basic Types of Errors
  - Wrong Activity level
  - Incorrect Emission Factors
  - Inaccurate control efficiency data
  - Data entry mistakes – sloppy work
  - Software errors or glitches (bugs)





Incorrect Emission Factor

- No emission factor is absolutely correct!!!!!!
- All have error bands
- May be unique with no factors and tests that are not parametrically designed and executed for all conditions
- Commonly accepted “wisdom” that if a factor is within 50% plus or minus, that it is pretty good - again no proof

Emission Factors

- Emissions are frequently tested for purpose of compliance and are set up and running at their optimum performance levels
- Parametric testing of a single facility for multiple operating scenarios and input variables could cost million$ of Dollar$
- The test methods may not measure what is desired or envisioned

Emission Factors

- Combustion facilities may have 100 reliable tests for a given type boiler and fuel, especially for the pollutants covered by National Ambient Air Quality Standards (NAAQS) pollutants
- Some other emission sources may have no test method for pollutant of interest and it may be unique with many variables

Control Device Efficiency

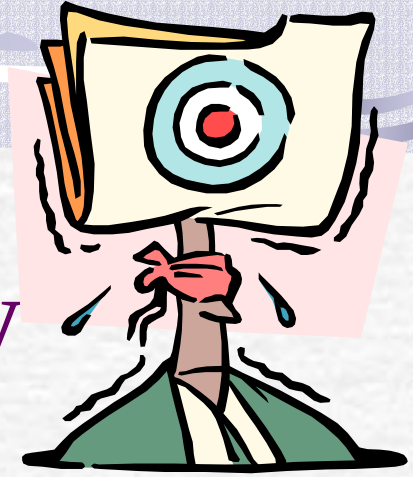
- Tests are most frequently done when operation is ‘text book’
- Many changes in pressures, production rates, raw materials, etc. cause variability
- A break down can cause more emissions in a couple of hours than the rest of the year for a high efficiency device
- May measure an entirely different quantity than the ambient or health measure envisioned

Control Device Efficiency

- Many facilities tend to assume manufacturer's efficiency which may be for specific set of circumstances, somewhat different than for the facility

- Fugitives that escape the collection system sometimes may be significant – but not tested
- Assumptions that efficiency for one pollutant applies to another are sometimes made

Control Device Efficiency



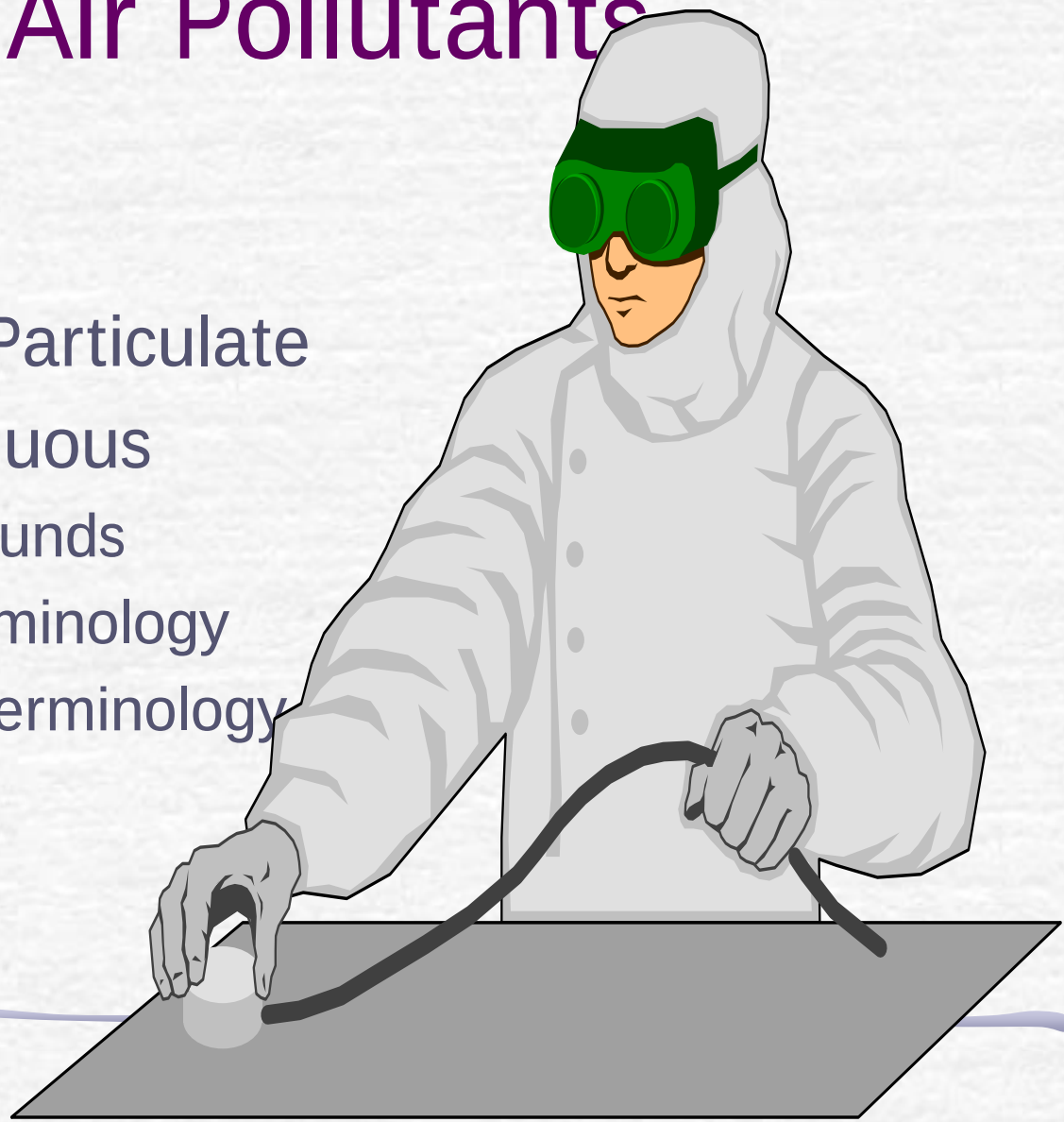
- Small differences in Control Efficiency measured or estimated can make large differences in emissions

(e.g. 99.999% efficiency vs 99.90%)

- Sophisticated process (e.g. chemical mfg.) with toxic pollutants are more likely to have good information than simple, such as woodworking

Hazardous Air Pollutants

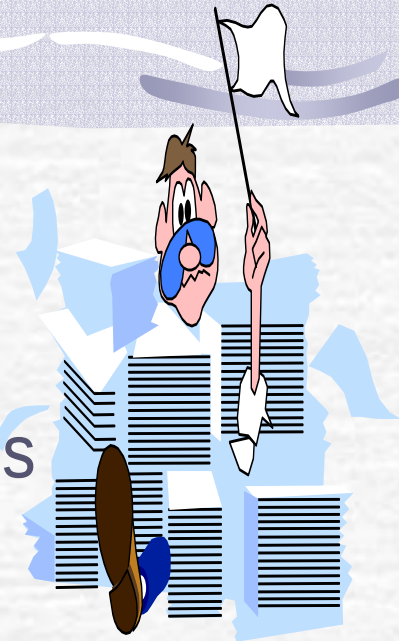
- Attributes
  - Most are VOC or Particulate
  - Sometimes ambiguous
    - families of compounds
    - imprecision in terminology
    - inconsistency of terminology
  - Not Inclusive



‘Looseness’ in Chemical Methods and Terms

- E.G. Mercury, Chromium, Other Metals -
  - 1) elemental metal mass,
  - 2) “xxx and compounds,” excluding the element (total mass)
  - 3) all individual compounds that sum up to #2 (total mass of each)
  - 4) CAA definition is usually #1 PLUS #2

Problems, eg. PM 2.5



- too little information & emission factors
- condensables are important
- little data to use for development of factors
- sources are different and not always intuitive
- variables that effect emissions may not be known or understood

- RELATION BETWEEN STACK AND AMBIENT DATA ARE A BLUR
- LITTLE LIKELYHOOD THAT SOURCE FACTORS WILL IMPROVE DRAMATICALLY IN TIME TO MEET SIP NEEDS

Method Environment (Concept Level)

Method type / Parameter	Clinical	Ambient	Stack
Temperature	Ambient 60-80 degrees F	60-80 degrees F	Ambient to ≥ 2,000, commonly ~300° F
Humidity	50 – >90% RH	5 – >90% RH	<5 to ~ 100%
Velocity	Indoor or 'Controlled' Ambient 1 to ~5 mph	Ambient (0 to >25 mph	Varies Considerably 0 to supersonic, but mostly ~10 to 300 mph
Pressure	Ambient 14.7 psi ±	Ambient 14.7 psi ±	Ambient to ~20 psi
Traverse	NA	NA	None to Full

Bottom Line/Recommendations

Starter List

1. Conduct a careful and thorough analysis of the chemistry of the process(es) involved to establish what pollutants are likely and even possible to be emitted.
   - Use available test data
   - Don’t be limited by existing data
   - Use some chemical knowledge and imagination to develop reasonable hypothesis on what should be present

Bottom Line/Recommendations

Starter List

2. Complete a screening analysis of substances emitted before a final list of pollutants is determined.
   - not limited to pollutants in AP-42 - or the CAA
   - evaluate what substances present that may be interact or form others

Bottom Line/Recommendations

Starter List

3. Design the analysis plan to determine the species, including the isomers
   - For inorganic, test plan should quantify the cations and anions
   - Establish de minimus emission rates at the state, local or federal level with corresponding emission rate (i.e., below what level does it become “unimportant?”
   - Establish detection levels based on or below this minimum target.

Bottom Line/Recommendations

Starter List

3. Analysis Plan Continued
   - If an element or compound is below detection, say so, with minimum detection estimated during the test
   - For organic compounds, screening analyses (e.g., gas chromatograph - mass spectrometer) should be included that will provide identification and speciation of all expected or potential HAPs (suggest no less than 90% of the mass of the total emissions)
   - Provide such analyses clearly in the reports so users of the data can used and interpret

Bottom Line/Recommendations

Starter List

4. Carefully monitor the process variables

- Report on the basis of raw material/input
- Report on the basis of product/output
- If energy related, report on the basis of the heat input & output
- Report operation rate before & during the test
- Report design parameters and conditions relative to test conditions
- Provide details on the control devices & their operating parameters.
- If possible, provide ‘before-and-after-controls’ results

Recommendations
for EPA EF Program Development and Enhancement

EPA establish a fund to assist paying for supplemental tests beyond level normally required for regulations compliance

- Define funds as a ‘bounty’ to be provided as an incentive for more complete and detailed testing
- Require submittal of copy of data/results to EPA
- States administer these as a grant with authority to make decisions on priorities and use of funding to the facilities or their testing consultants

Recommendations
for EPA EF/Testing Program Development and Enhancement

EPA establish a fund (Continued)

- EPA should design a reporting template for the data to be reported
- Provision of such data via paper, or electronic means into central database
  - accessible and searchable by states, facilities, consultants and others
    - for use in generalized emission factor development
    - as basis for a facility-specific emission estimate
  - automatic running update of statistics of data in database

Recommendations
for EPA EF/Testintg Program Development and Enhancement

- **EPA should consider establishing a "user group" of federal, state and local agency representatives to**
  - further develop and refine a list of testing requirements
  - further define a process for grants and bounties to enable collection and reporting of data
  - establish a means of notification and opportunity enhancement for communities to be able to work together to get better information on a specific industry as a better and less expensive means than working alone

Recommendations
for EPA EF/Testintg Program Development and Enhancement

- EPA should Develop an “inter-method” review group to
  - Review equivalence of health, ambient, and stack test results – same pollutant; same causes and effects
    - Each pollutant
    - Each method
    - Review over time (5 & 10 year reviews)


Work in Pr

THE END