LAB TESTING

The Test of Time

33rd ANNUAL
TEXAS ENVIRONMENTAL SUPERCONFERENCE
Environmental and Natural Resources Law Section of the State Bar of Texas

Presented by:
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Agenda

- Generating Environmental Data
- Environmental Data Supply Chain
- Field Sampling and Laboratory Blunders
- Quality and Quantity of Data
- The Risks of Assuming Good Data Quality
- The Commercial Laboratory Marketplace
- Assessing Data Quality - Data Validation
- Transforming Data into Information
- Environmental Forensics – Data Mining

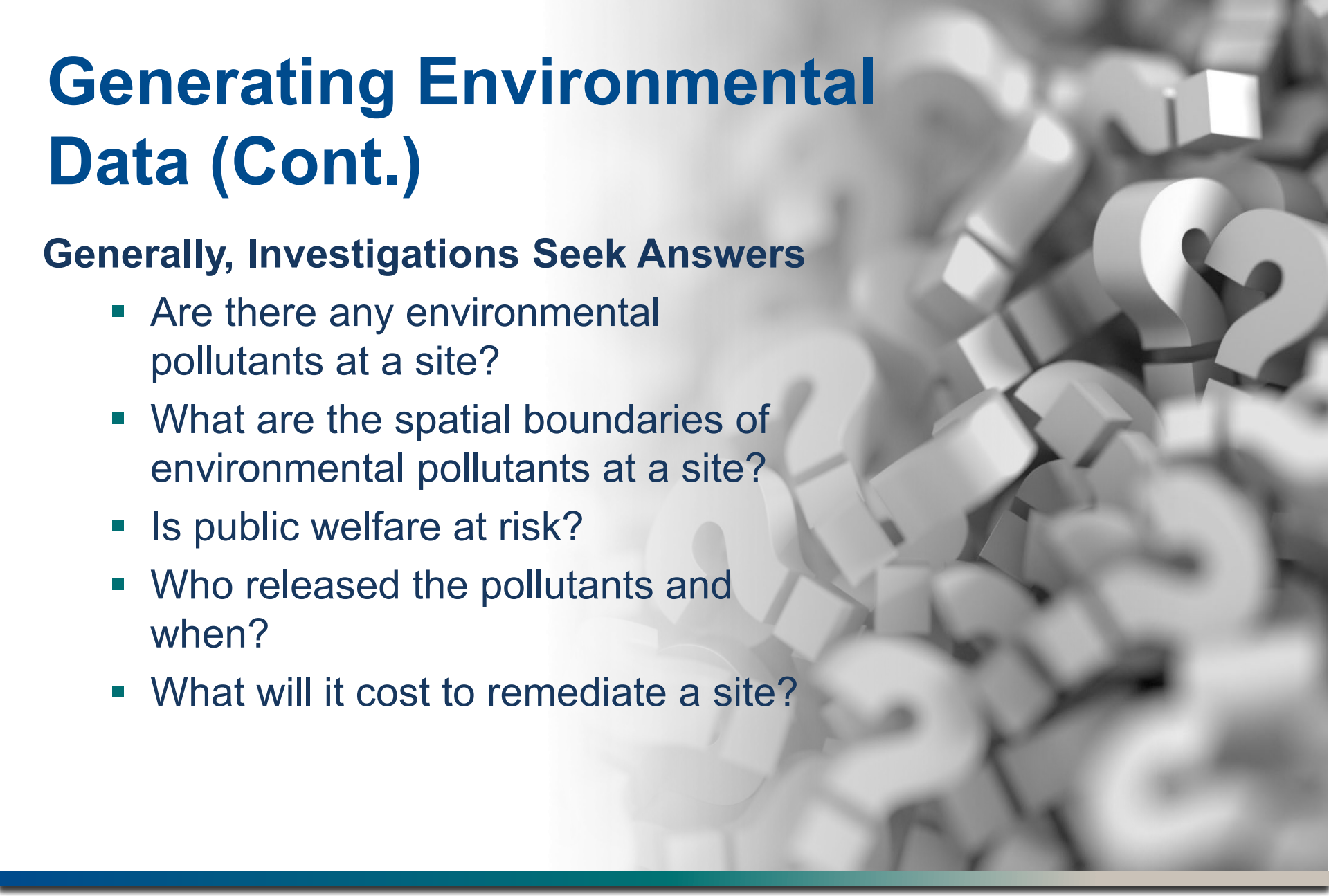
Generating Environmental Data

- For centuries, pollutants have been released to the environment. Many pollutants are inert, while others have varying degrees of toxicity.
- Almost every environmental matter involves laboratory/analytical measurement of data of varying quality, quantity and *vintage.* Matters include:
  - Property damage
  - Personal/health damage
  - Environmental damages – *e.g.,* NRDA
  - Cleanup cost/allocations

Generating Environmental Data (Cont.)

- Environmental investigations are initiated through a variety of ways:
  - Complaints – Water tastes funny, air smells bad
  - Similar health-related issues in a geographic area
  - Visible pollution
  - Emergency responses/NRDA
  - Property/facility transfer – due diligence
  - RCRA – Assessing currently operating facilities
  - Superfund – Assessing old abandoned facilities

Generating Environmental Data (Cont.)

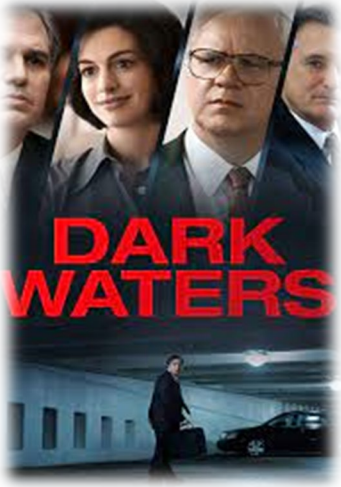


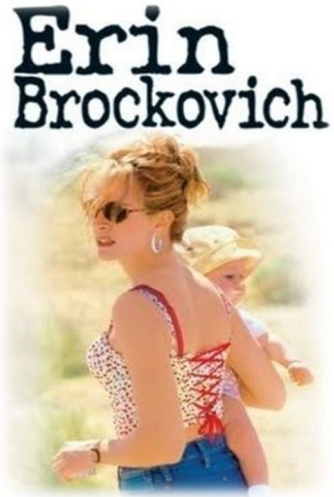
Generally, Investigations Seek Answers

- Are there any environmental pollutants at a site?
- What are the spatial boundaries of environmental pollutants at a site?
- Is public welfare at risk?
- Who released the pollutants and when?
- What will it cost to remediate a site?

… and then there was the Media

‘Forever chemicals’ found in drinking water in dozens of cities.





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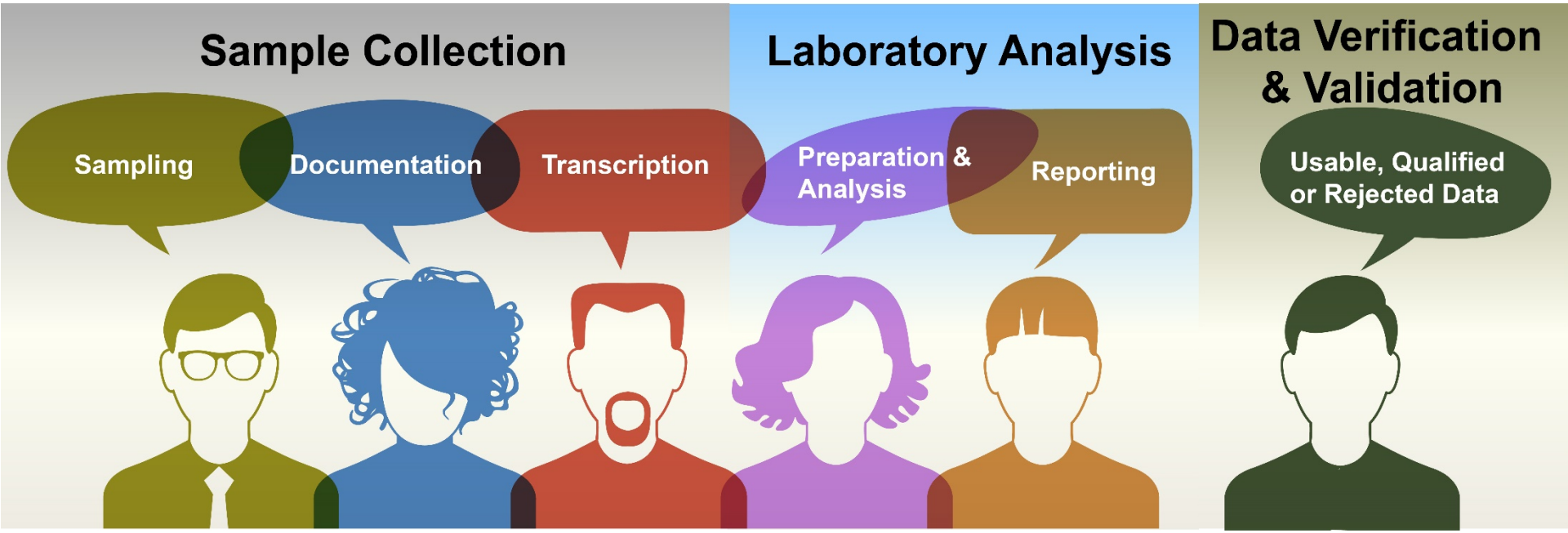
Generating Environmental Data (Cont.)

Environmental Data can be ...

A. Big, Really BIG
B. Confusing/Misleading
C. Molded like Play-Doh (to appear a certain way)
D. Factual information used as a basis for reasoning, discussion, or calculation
E. All the above

Environmental Supply Chain

- Many steps are involved in producing data.
- Many individuals are involved in generating data.



Humans make mistakes. How many hands touch this process?

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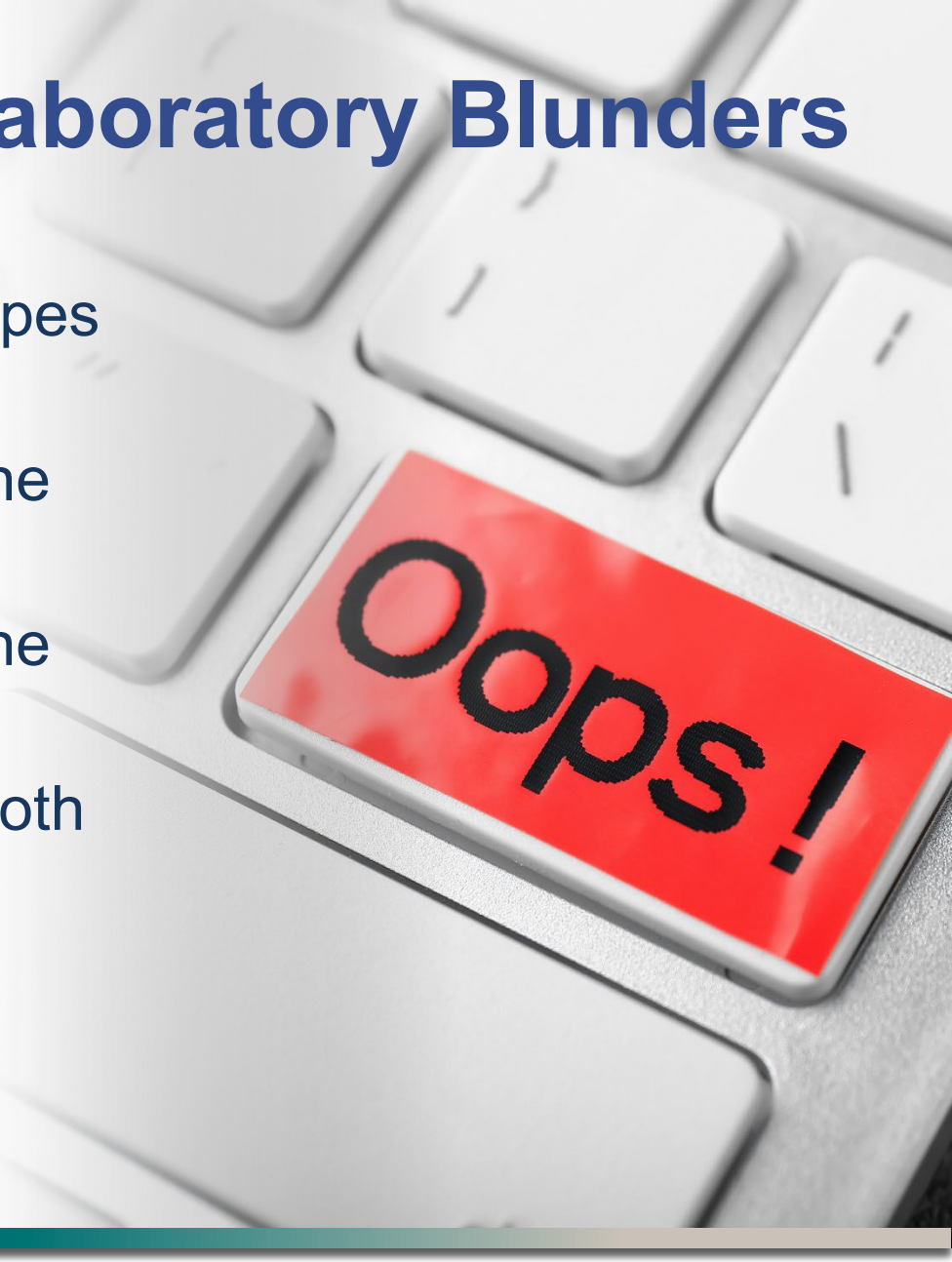
Field Sampling & Laboratory Blunders

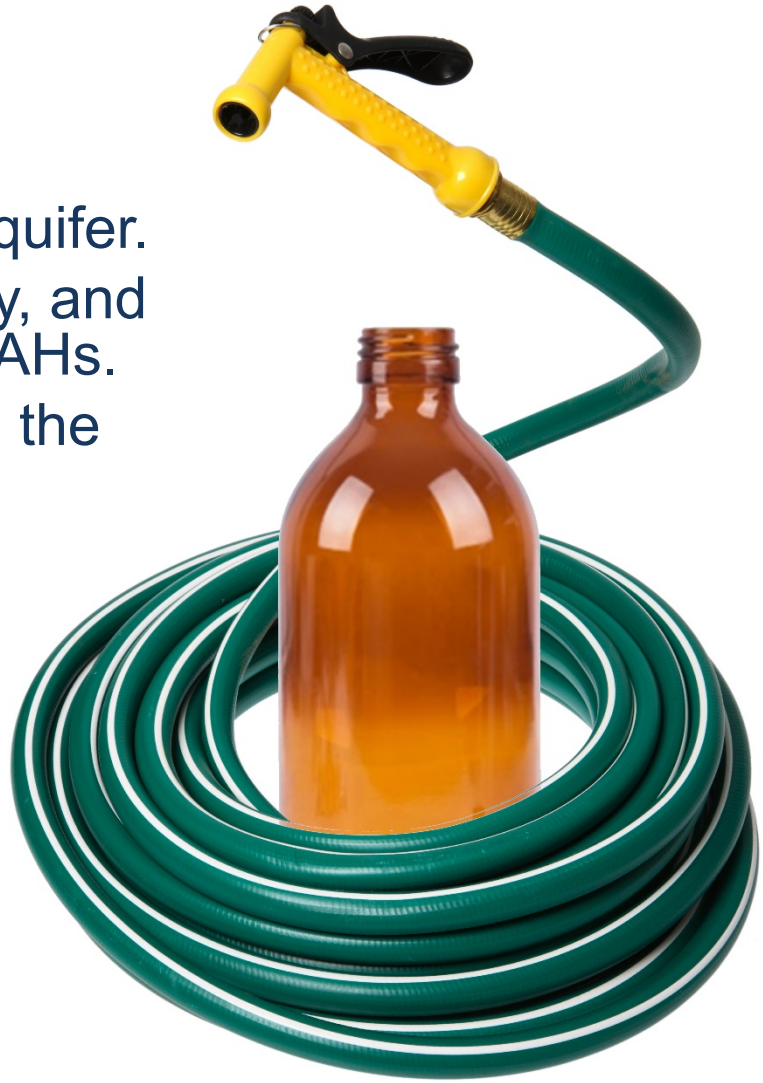
- Blunders come in various shapes and sizes.
  - Sometimes originating in the field
  - Sometimes originating in the laboratory
  - Sometimes originating in both
  - Sometimes reverberating back and forth



Field Blunders

The Lowes Hose

- Flowback water was released to the aquifer.
- Residential wells were sampled weekly, and four of the wells revealed consistent PAHs.
- The laboratory blanks were clean, and the bottles were certified for PAHs.
- No field blanks were collected since samples were collected directly in bottles – *or so the plan said*.
- But it seems that the spigots at the four locations were too low to the ground to fit the bottles under, so personnel bought and used new sections of hose.



Laboratory Blunders

Does it DING when it's DONE?

- In a remote part of Alaska, there are small laboratories, which serve a very important function – discharge-compliance monitoring.
- Several major industrial clients were being issued a series of NOVs for TDS in their effluent. The NOVs between all the industrial parties had one thing in common – the local accredited laboratory being used.
- When an on-site audit was funded, it was discovered that the laboratory TDS oven was out of service, and instead, a Toastmaster® kitchen broiler and a 5-degree increment thermometer was being used for this 104°C +/- 2°C compliance parameter.

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Quantity and Quality of Data

- How many data points do you need to make in order to answer the question?
- The delicate balance of generating meaningful information relates to obtaining “enough” data of “good enough” quality.
- ***Captain Obvious - The quality of data has a profound effect on the quality of the information.***
- Sometimes bad data can be “cloaked” once transformed into information.
- Relying on data of unknown quality is related to the user’s risk tolerance.

The Risk of Assuming Good Data Quality – Taking Data at Face Value

- Misguided investigations - wrong rabbit hole
- Wasted time/wasted money
- Incorrect conclusions
- Lost “good will” and trust with client

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The Commercial Laboratory Marketplace

As it relates to litigation (or the potential), there is comfort in knowing that laboratory data are legally defensible.

“Legally Defensible” Data ... What is it?

- Data generated from an “accredited” laboratory?
- Data generated by exactly following a published method?
- Data that can be technically defended?
- Audience of Regulators? Attorneys? Citizens?

The Commercial Laboratory Marketplace (Cont.)

Some Bad Assumptions

- For historical data, the laboratory and/or the meta data records still exist (in a usable form, or at all).
- Laboratory data quality is constant and has a long shelf-life.
- Degreed, experienced Chemists are performing analyses, and there are layers of critical internal review before data are released to clients.
- Accreditation (NELAC) means the laboratory will produce correct answers and high-quality data by which to base important decisions.

The Commercial Laboratory Marketplace (Cont.)

- Laboratory accreditation does not adequately assess proper Chemist training and proper/ethical practices.
- Data falsification and fraud still occurs despite the efforts of many laboratory management teams.
  - Analysts without credentials or proper training and little oversight taking unacceptable short cuts *on their own* due to:
    - Ignorance
    - Pressure to complete work in a short period of time
    - Desire for recognition/promotions (“amazing” output)
    - The feeling of omnipotence (no one will catch me) and/or
    - Sheer boredom

The Commercial Laboratory Marketplace (Cont.)

- Process failures, lack of planning, and lack of resources have created opportunities for unethical practices that include:
  - “Time Travel” (changing date/times)
  - “Dry Labbing” (inventing results)
  - “Peak Shaving” (making calibrations pass)
  - “Cherry Picking” (picking points/ignoring others to pass)
  - Method Shortcuts (gray zones)

Assessing Data Quality - Data Validation

What is Data Validation?

- Process of critically examining laboratory data
-  of 

Verification or Correctness

Compliance

Usability

What is Data Validation?

- Correctness Assessment
  - All samples collected/requested were analyzed and reported
  - All analytes that were analyzed/requested were reported
    - Correct methods, method detection limits (MDLs)/reporting limits (RLs), units
  - Confirm *qualitative* identification of target compounds
    - The result in Aroclor 1248 and not Aroclor 1260
  - Recalculate reported concentrations from raw data – *quantitative* assessment
    - The result for Aroclor 1248 is 30 ppb and not 300 ppb

What is Data Validation?

- Compliance Assessment
  - Compliance with the published analytical method
  - Compliance with the expensive project control documents
    - Quality Assurance Project Plan (QAPP)
    - Sampling and Analysis Plan (SAP)
    - Work Plan
    - Project Specifications
  - Compliance with permit requirements
  - Compliance with regulatory requirements

Transforming Validated Data into Information

- At some point, data are transformed into information
- Direct Data Comparison
  - Does the measurement exceed a benchmark or not?
- Predictive Health-based Modeling
  - Risk Assessment
- Spatial Modeling and Transport Studies
  - Visualization
- Environmental Forensics
- Technical and Legal

Environmental Forensics – The Data Mining Process

Strategies

- Define the question, evaluate age and types of existing data, identify lines of evidence and gather additional (current) data

Types of Data

- Historical, hydrological, chemical, isotopic

Data Handling and Analysis

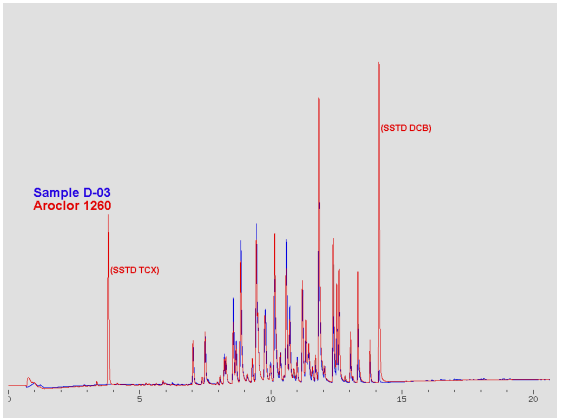
- Validation, conditioning, framing, mixing/unmixing

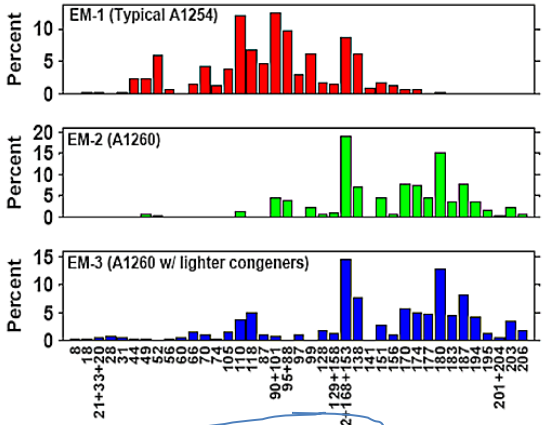
Communication

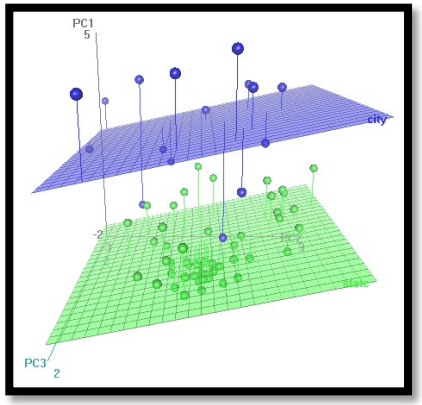
- Graphics and simplification for expert report/testimony

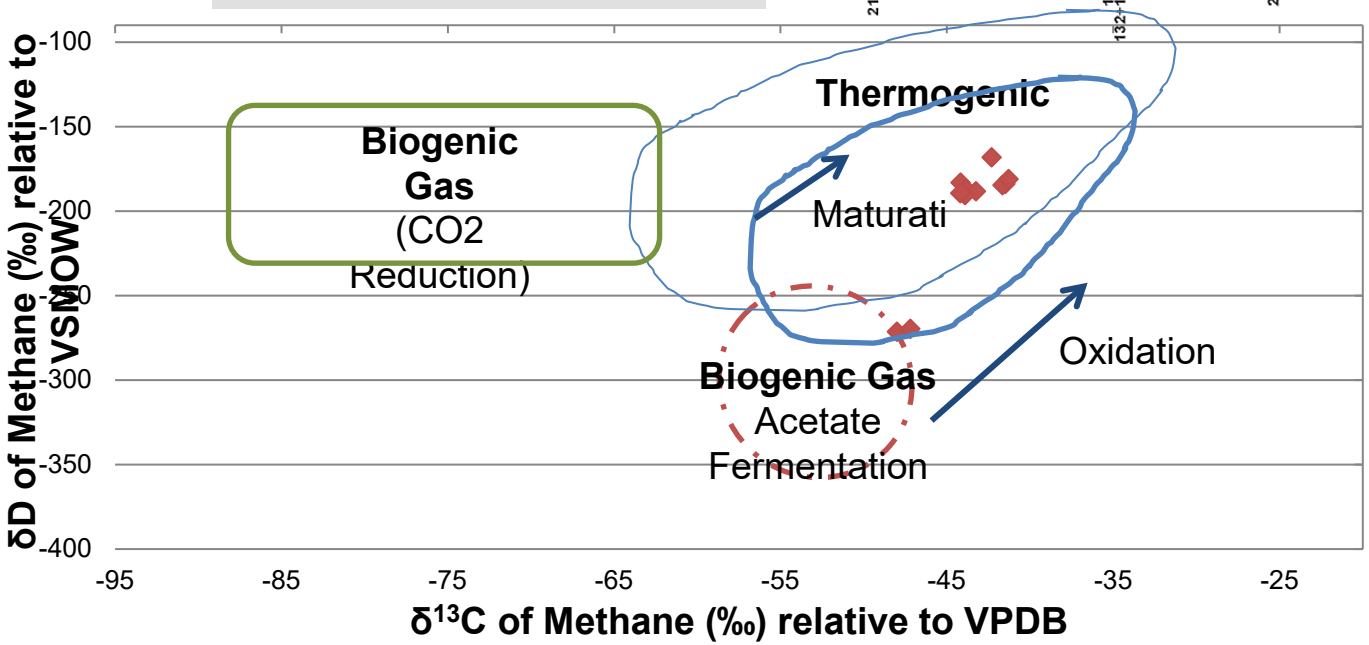
Environmental Forensics – Communicating

- $\Delta^{13,12}C$ (PAHs, TCE, MTBE)
- $\Delta^{37,36,35}Cl$ (TCE, perchlorate)
- $\Delta^{2,1}H$ (PAHs, MTBE, TCE)
- $\delta^{18,17,16}O$ (MTBE, perchlorate)









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Thank You

QUESTIONS?

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