Desert's Eleven: Don't Let Flawed Data Heist Your Project

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Agenda

Risks

Top Concerns ~ 11 total examples

- Contaminations
- Not Following SOP/Method
- Documentation
- Traceability
- Equipment

System Control

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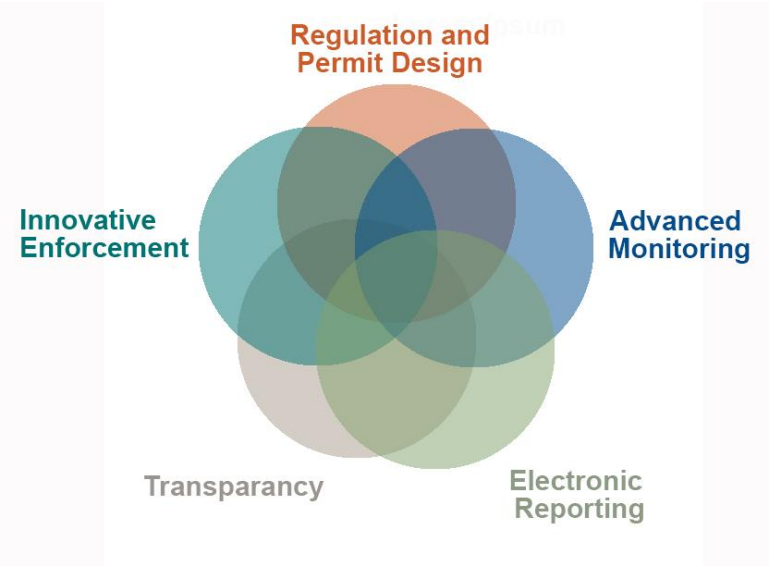
Risks



- US EPA “Next Gen” – Data Mining.
- The U.S. Navy found widespread radiological data falsification, doctored records and supporting documentation, and covered-up fraud at the Hunters Point Naval Shipyard cleanup project in San Francisco, California.
- Alleged misconduct and data manipulation at a USGS laboratory may have affected thousands of environmental quality measurements processed between 2008 and 2014, according to the U.S. Interior Department’s Office of Inspector General (OIG).
- The costs to an Environmental Manager are huge.

Contamination

- Field techniques
- Laboratory techniques and monitoring
- Reagents and blanks sources

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Preservative

- Sixteen residential wells were sampled weekly, and the first 3 weeks of sampling revealed ALL 16 wells had glycol detections.
  - The regulatory authority and the client were VERY concerned.
- Laboratory blanks all ND. No field blanks were collected - samples were collected directly in 40-mL HCl-preserved vials
- Upon inquiry, it was determined that the 40-mL HCl-preserved vials were never assessed or certified for use for glycol analysis, AND the laboratory used UNPRESERVED 40-mL vials for its method blanks.
- Tracking the lot number of the vials verified the HCl was the source of glycol contamination in all 45 samples.

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Field Blank Source

- Using convenience store “drinking water” without first assessing the purity for its intended purpose.

Analyte (metals by 6010B*, anions by 9056A)	De-ionized (Milli-Q, µg/L)
Calcium	<45
Magnesium	<15
Lead	<14
Barium	<2.0
Sodium	<100
Chloride	<50
Nitrate	<23
Sulfate	<75

* Lower reporting limits with 6020

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Field Technique

- Weeks of sampling in accordance with strict SAP.
- Filtered metals - nine metals were consistently present at the same levels in all filtered samples and the filtered blanks, but not in the total samples.
- Dedicated filters, with new tubing used with each well.
- No one followed the SAP by flushing these with sample before collection.
  - Flushing the tubing and filters was specified in the QAPP.
- New tubing/filters confirmed the origin of the nine metals.

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Not Following the SAP, SOP, QAPP, and/or Method

- Field
- Laboratory
- Data Analysis
- Data Validation

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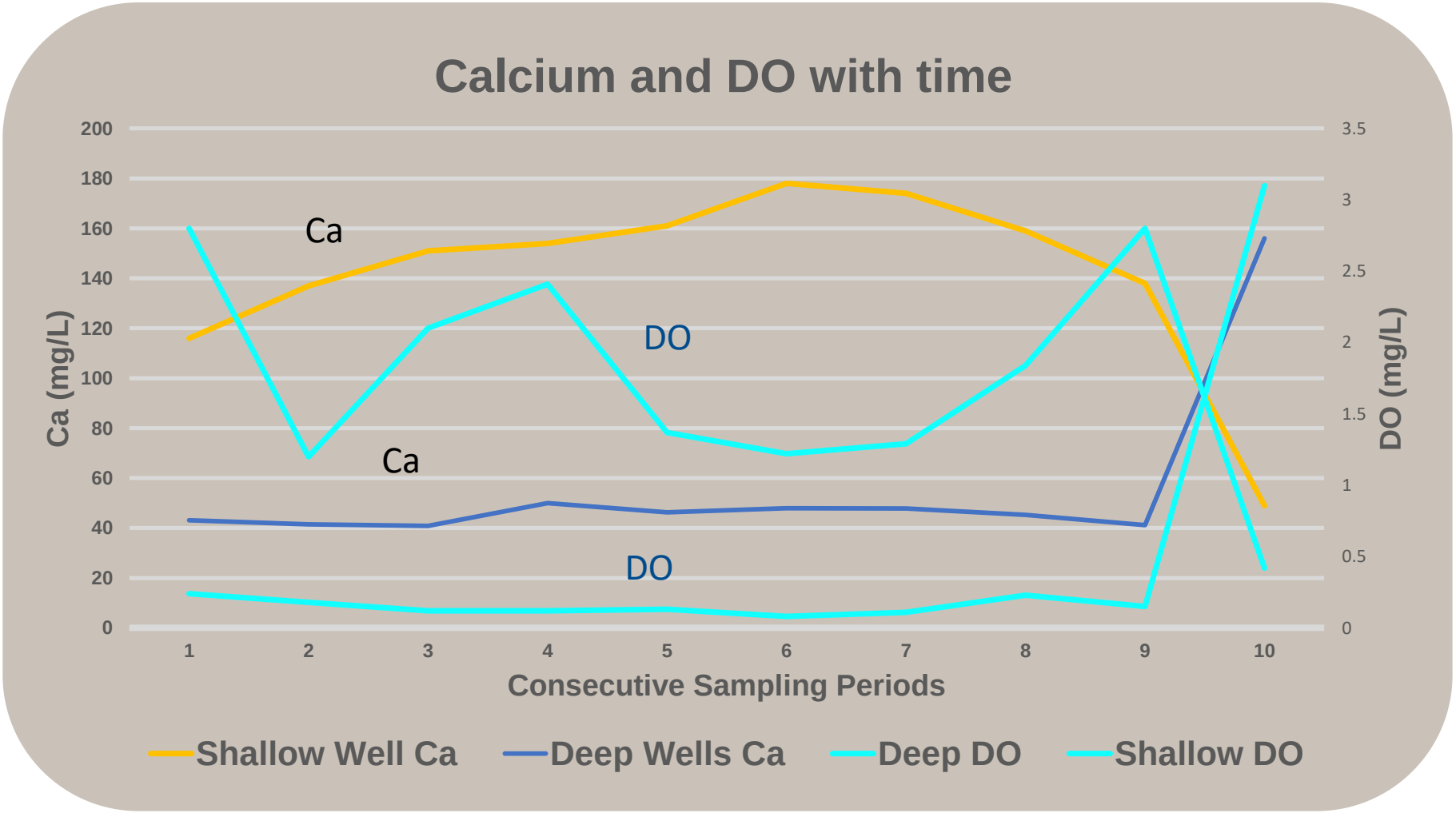
Sudden Anomalous Data



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SOP Instruction

- Unknown to the Sampler, the wellhead caps were switched.
- Well results were completely anomalous to all prior events.
- If the Field Team had checked the total depth of the well in the field (per SOP instruction) they would have identified mislabeled wellhead caps.
- Deconvoluting the data was expensive, and inefficient for the client.

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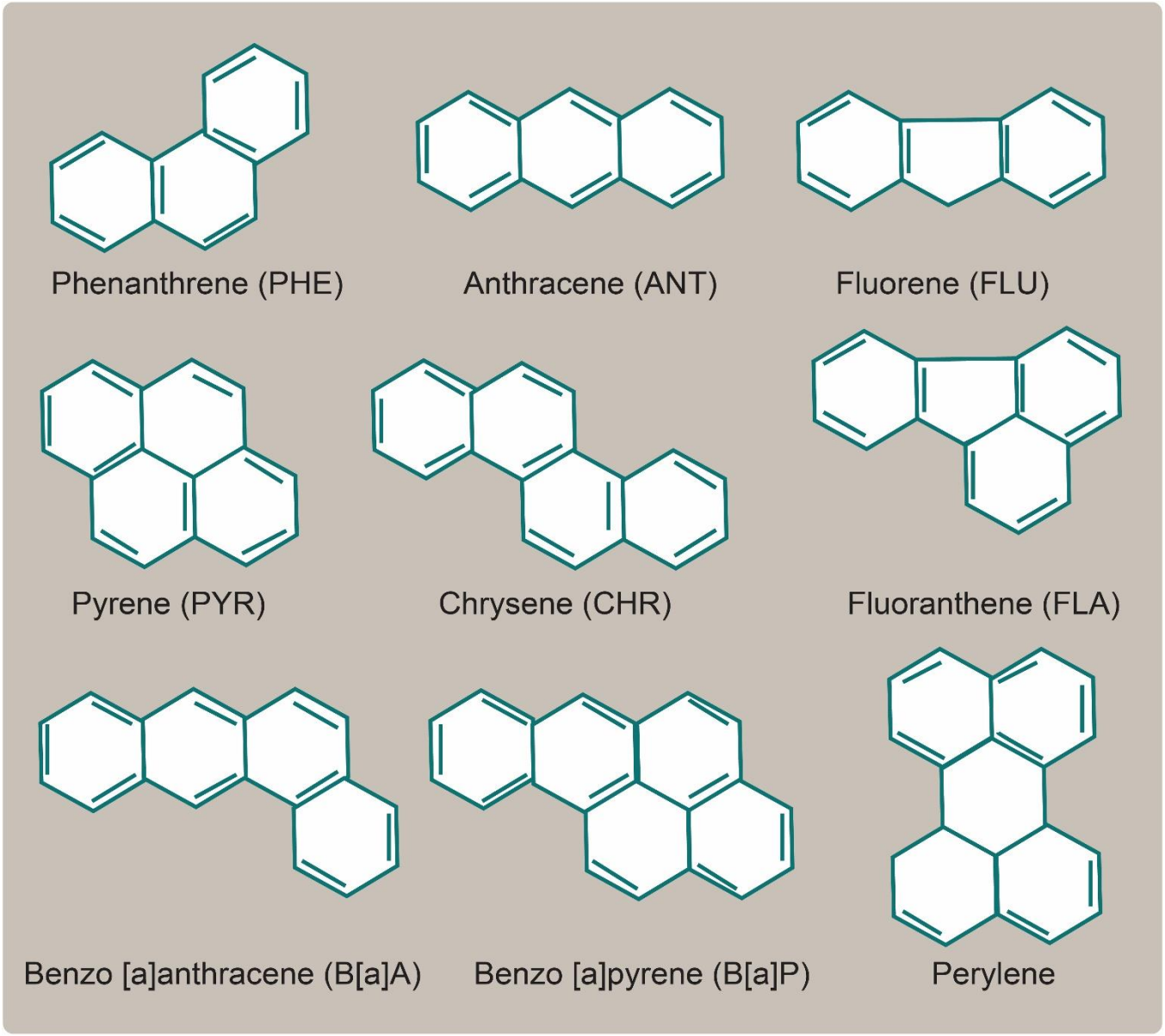
SAP Instructions

- A Field Technician had collected drinking water samples from a home with well water.
- Concern was VOC plume appeared to surround location.
- VOC results were all < RL ???
- Home system included treatment system, UV light, granular activated carbon filter, chlorination, 50-micron particulate filter and pressure tank.

PAHs

(think PFAS too)

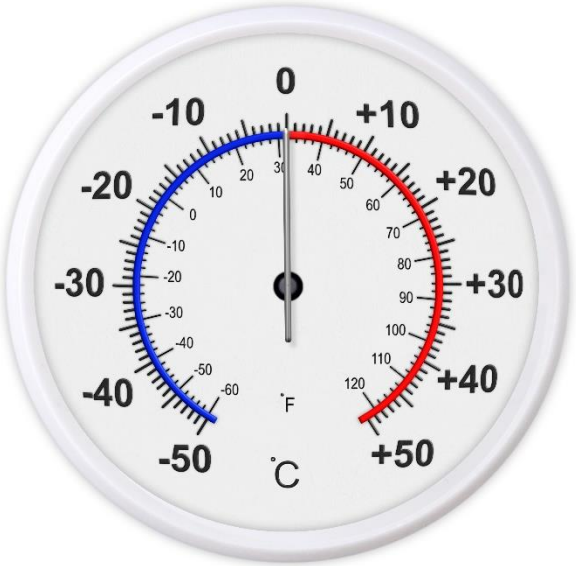


Loss of Spiked Analytes

Double-blind performance evaluation (PE) samples were sent to laboratories as part of the PAH investigation.

- The PE vendors prepared the PAH samples (in methanol) using full bottles with DI water injected into the neck of ambers.
- Seventy-six monitoring wells (MWs) and four PEs later when data reported, the 4- and 5-ring PAHs were in the single-digit percent recoveries for all four of the PEs.
  - The client was very concerned the state would reject all the PAH data.
- Inquiry revealed that the 4/5-ring PAHs most likely stuck to the amber neck, AND the laboratory extraction personnel were not adequately solvent rinsing the empties.
- Proper solvent rinsing demonstrated acceptable recovery for all PAHs.

More Stories



- Handling VOA water samples - laboratories very diligently documented receipt at 6°C, BUT often put them on a cart and left them hours at room temperature before getting around to putting them in cold storage.
- Laboratory was digesting metals samples uncovered in a block digester, EXCEPT one sample in the hot block was noted capped. When asked why only that sample is capped, the Analyst replied that it was the method blank, and it is capped "because we need that to pass."
- "Method-defined parameters"

Traceability

- “The ability to chronologically interrelate uniquely identifiable entities in a way that is verifiable.”
- Trace something back to its roots.
- Must be able to track back to the manufacturer's certification of authenticity or purity.

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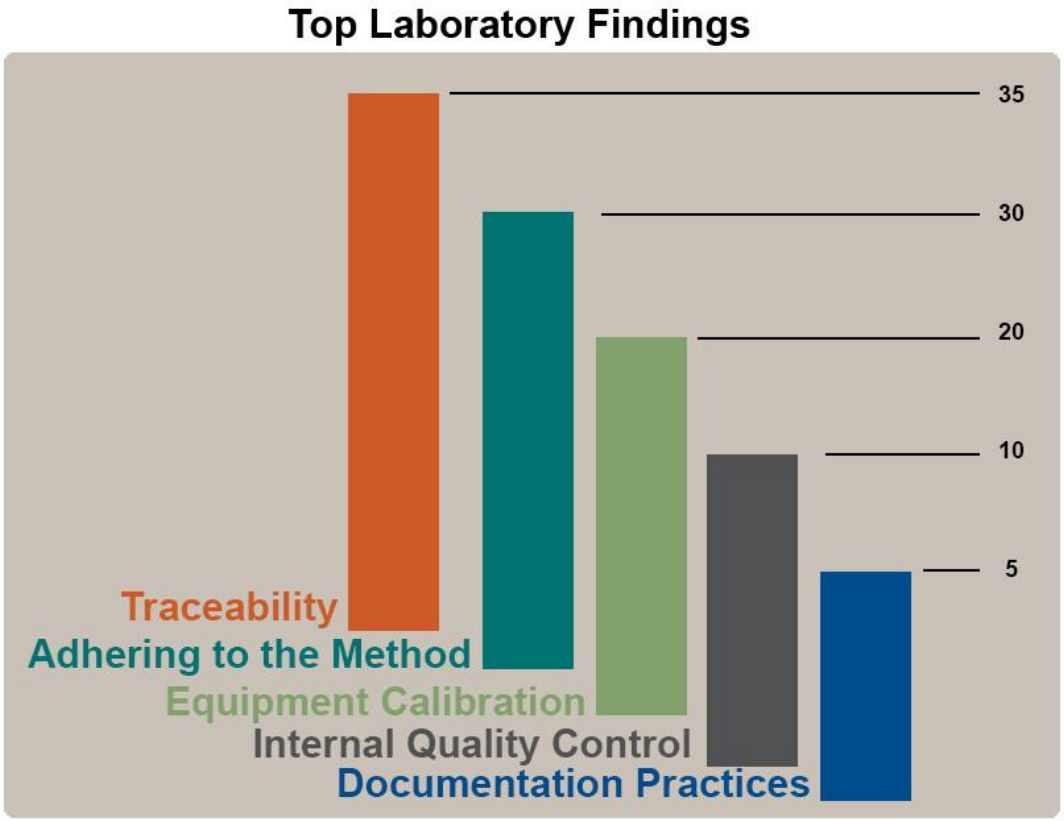
Traceability (Cont.)

- “The ability to trace the history, application, or location of an entity by means of recorded identifications.”
- “In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.”
- “In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials.”

Traceability (Cont.)

- Paper/electronic trail
- Field:
  - pH, EC standards, depth, volumes
  - Calculations
- Laboratory
  - All reagents, standards, balance weights, temperatures, volumes
  - Certificate of cleanliness – bottleware
  - Calculations



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Traceability (Cont.)

- Auditing a federal laboratory using top-loading balance for heavy containers used to collect large samples in heating process.
- NIST-traceable weight was too expensive, used a large rock for bounding the upper weight calibration check.

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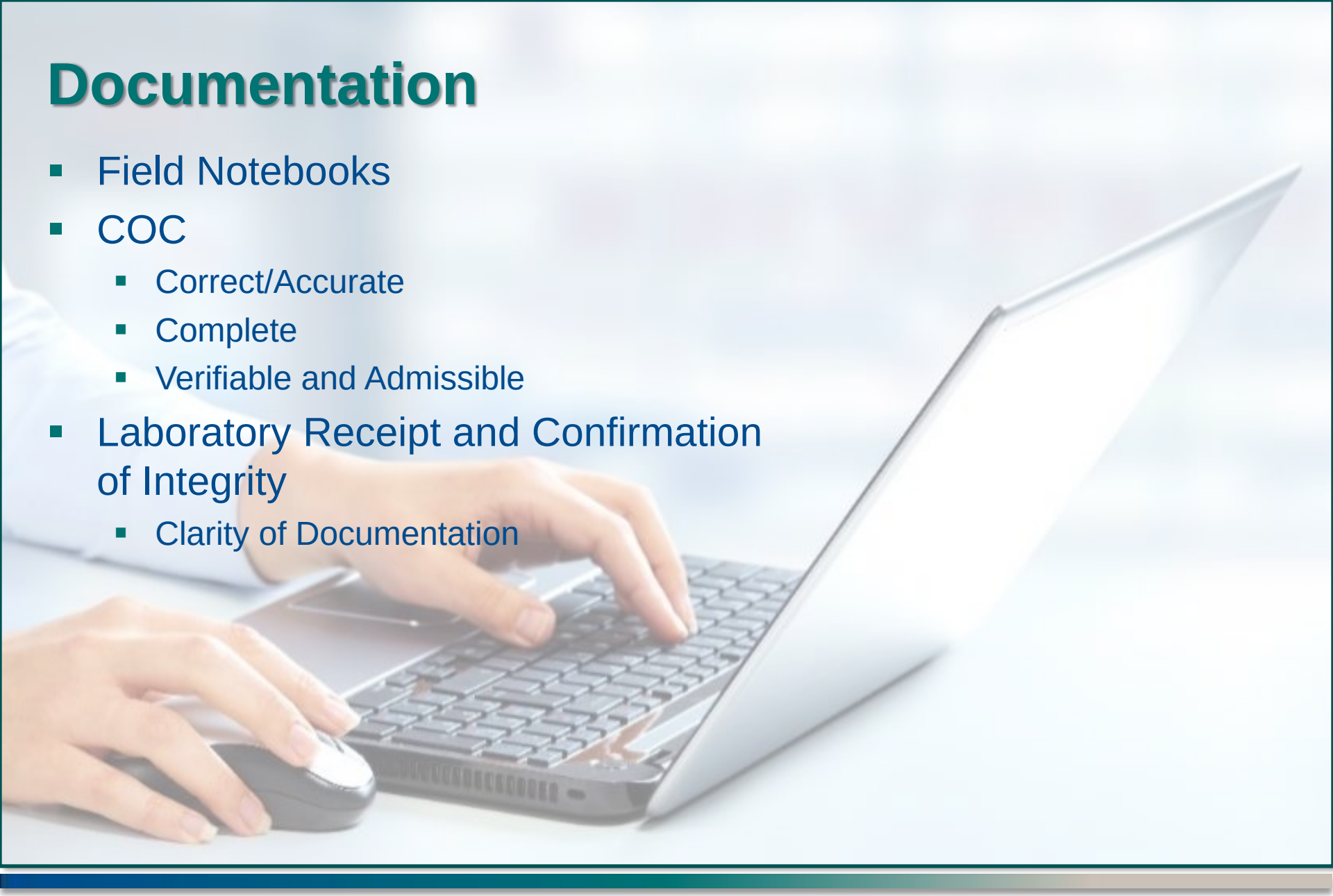
Documentation

- Field Notebooks
- COC
  - Correct/Accurate
  - Complete
  - Verifiable and Admissible
- Laboratory Receipt and Confirmation of Integrity
  - Clarity of Documentation



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No Field Notebook

- A Field Technical documented a recovery system's measurements (total water recovered, pressures, *etc.*) on his hands with ballpoint pen ink. Then he washed his hands before lunch and again before he wrote the information down in his field book …
  He completely smeared the numbers he was writing to the point they were illegible; so he made some up – and wasn't even close.

Equipment

- In a remote part of Alaska, there are small laboratories …
- Multiple major industrial clients were 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.
- Logbooks/data appeared in order until an on-site audit discovered that laboratory TDS oven was tagged out of service …
  - Instead, a Toastmaster® kitchen broiler and a 5-degree increment thermometer was being used for this 104^{o}C +/- 2^{o}C compliance parameter.
- Guess what? The clients bought the laboratory a proper oven/thermometer.

Support Equipment Calibration

Failure to adequately calibrate ancillary monitoring and measuring devices used in the process, field or laboratory.

e.g., Balances, thermometers, pipettes

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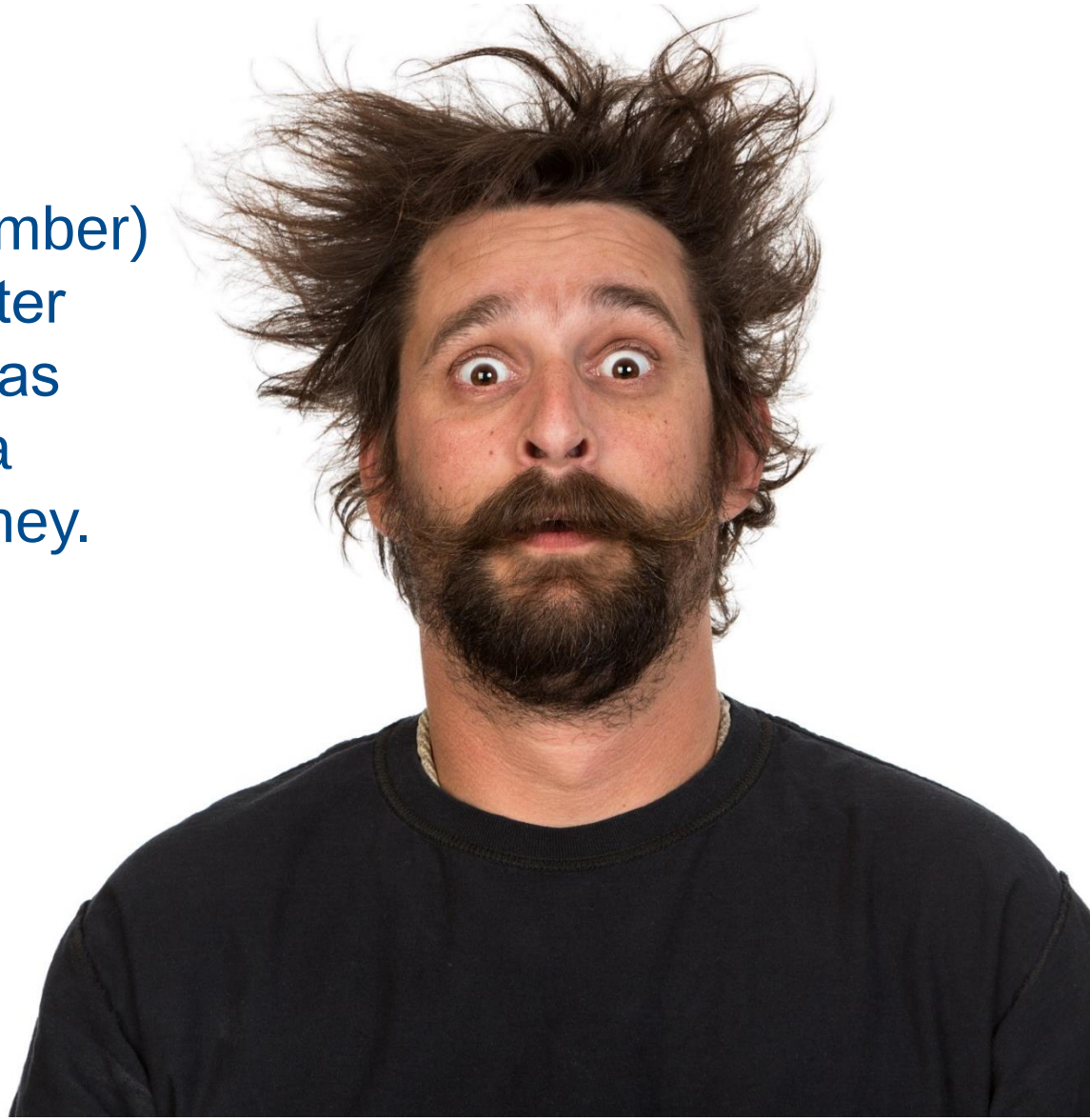
#11

- Writing down a 1-900 number (sex number) in the field book for “later use” … The number was identified later during a deposition by an Attorney.



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Supply Chain Management

Commodity?

Sample Collection

Laboratory Analysis

Data Verification & Validation

Humans make mistakes. How many hands touch this process?

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Build in Controls

- Begin with the end in mind.
  - Critically review the sampling procedures beforehand.
  - Critically review analytical requirements beforehand.
- Audit Field Teams and laboratories beforehand.
  - Just because it is written in the SAP …
- Verify and validate data.
- Identify quality consultants and laboratories, develop long-term relationships based on quality and service *versus* cost.

Thank You

QUESTIONS?

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