The Use of Single and Double Blind Performance Test Samples in Evaluating Laboratory Performance

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Corporate Environmental Data Needs

Environmental Data Must Be;

1. Accurate
2. Defensible
3. Timely
4. Cost Effective

To be able to demonstrate compliance with environmental regulations.
Purpose of the Ford PT Program

• To improve compliance against the Ford specifications – MEETING CLIENT NEEDS

• To improve laboratory work quality for all of their clients – IMPROVING PERFORMANCE
Single vs. Double Blind PTs

**Single Blind PTs** $$
-$$ Required for certification
- Know that it is a PT
- No bottle request
- Clean Matrix
- Non-standard report

**Double Blind PTs** $$$
- Not typically used
- Don’t know it is a PT
- Evaluates bottle order
- Real World Matrix
- Standard client report
PT Provider – Results & Statistics

- All results managed by individual PT Providers
- All PT Providers calculate study statistics
- Most PT Providers have a variety of data analysis/reporting tools
- All PT Providers will provide results in EDD format
- No PT Provider has data from other providers
Single Blind Performance Test (PT) Database

• **Previously** - Data summarized into tables manually after review of PT provider report

• **Now** - Data submitted by PT provider using Ford EDD and downloaded into an Access Database
### Single Blind PT Summary

<table>
<thead>
<tr>
<th>PT Type</th>
<th>Provider</th>
<th>Date</th>
<th>No.</th>
<th>Warning</th>
<th>Control</th>
<th>Outlier</th>
<th>% Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>HW013</td>
<td>Phenova</td>
<td>2/1/14</td>
<td>284</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>3.17</td>
</tr>
<tr>
<td>WP414</td>
<td>ERA</td>
<td>5/6/14</td>
<td>299</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
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<tr>
<td>WS012</td>
<td>NYDOH</td>
<td>6/3/14</td>
<td>267</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1.87</td>
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<tr>
<td>SOIL17</td>
<td>RTC</td>
<td>8/7/17</td>
<td>260</td>
<td>20</td>
<td>8</td>
<td>0</td>
<td>6.92</td>
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<tr>
<td>UST03</td>
<td>ERA</td>
<td>9/5/14</td>
<td>45</td>
<td>2</td>
<td>1</td>
<td>0</td>
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<tr>
<td>TOTAL</td>
<td></td>
<td>2014</td>
<td>1,155</td>
<td>30</td>
<td>13</td>
<td>1</td>
<td>2.51</td>
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</tbody>
</table>

\[
%\text{Error} = \left(\frac{C+W+O}{N}\right) \times 100
\]

- **N** = Total number of parameters
- **C** = Number of parameters outside of control limit
- **W** = 0.5 \times number of parameters between the warning and control limit
- **O** = Number of parameters more than an order of magnitude from the true or expected value
## Single Blind PT Summary

<table>
<thead>
<tr>
<th>PT Type</th>
<th>Comments</th>
</tr>
</thead>
</table>
| HW013   | OUTLIER: Hexachlorobenzene  
NO ACCEPTABLE: PCBs, Benzene, Carbon Tetrachloride, Heptachlor, Heptachlor Epoxide, DDT |
| WP414   |          |
| WS012   | NOT ACCEPTABLE: Hexachlorobenzene, Carbon Tetrachloride, Arsenic, Ammonia |
| SOIL17  | NOT ACCEPTABLE: Lead, PCBs, TPH, O-Cresol, 2,4-Dinitrotoluene, O-Cresol, Pentachlorophenol, DDT |
| UST03   | NOT ACCEPTABLE: Toluene, DRO, TPH |
WP204 Study Data (5 labs)
DW PTs all Parameters by Lab

1 stdev, 2 stdev, 3 stdev from Mean
ARSENIC in Soil vs. True Value by all labs

Query Ran: Arsenic Results in Soil for various studies shown by lab as Ratio to True Value of Study
Method 300 in WW

Ave Z-Score, Ave Ratio to True Value

![Diagram showing average Z-Score and ratio to true value for various chemicals like Chloride, Fluoride, Nitrate-N, Nitrite-N, Ortho-PO4, and Sulfate. The diagram highlights perfect ratio and perfect Z score.]
Ford Doubled Blind PT Program Characteristics

- Whole volume samples in provided containers
- Real world matrix, realistic analytes/concentrations
- Submitted following normal procedures (Blind)
- Evaluates every aspect of the process;
  - Bottle order and project management
  - Sampling preservation and handling
  - Analytical and preparation steps
  - Result accuracy in sample matrix
  - Batch QC performance
  - Report content, completeness and accuracy
- Intentional errors introduced to evaluate process
Ford Doubled Blind PT Program

- Low & High level VOCs
- Low level PCBs and Metals
- PCBs
- TPH & O&G
- TCLP VOCs & SVOCs
- VOCs, Metals, PCBs, FP & pH
Ford Doubled Blind PT Program

- TS, TDS, TSS, Metals, PCBs
- Phenols, Wet Chem, BOD, PCBs
- PCBs & Metals
- TCLP & Total VOCs
- pH, FP, Metals, VOCs & SVOCs
PT Report Contents

• Executive summary
• Sample matrix description
• Sample preparation procedure
• Client requirements
• Performance objectives
• Scores and ranking
• Lessons learned
PT Report Contents

• **Performance Objectives**
  - Laboratory / Client Communications
  - Bottle order, Preservation, Shipping & Handling
  - Batch QC Performance
  - Deliverables *(Certificate of Analysis & EDD)*
  - Analytical Performance
  - Program Compliance including TAT
  - Cost Compliance
Overall DB PT Scoring Example

<table>
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<tr>
<th>LABORATORY ID</th>
<th>F</th>
<th>B</th>
<th>G</th>
<th>A</th>
<th>D</th>
<th>I</th>
<th>E</th>
<th>C</th>
<th>L</th>
<th>K</th>
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<th>J</th>
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<td>100</td>
<td>86</td>
<td>86</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
iDashboard Demonstration

• Live demonstration of interactive presentation of test results and study statistics

• https://eval.ideshboards.com/idashboardsbulb
DB Lessons Learned

PROJECT COMMUNICATIONS

• Data being sent to client prior to Cadena verification
• Client notification procedure not always followed
• Volume correction for low level VOCs in soils
• Bottle order content requirements
• pH was being determined when <20% water
• Ignitability being determined on solid samples
• TCLP procedural errors on multi-phase samples
• OWEP (Method 1330) for metals misapplied
• Correct preservation for Hex Cr not always followed
DB Lessons Learned

MATRIX SPECIFIC FINDINGS

• Sample density correction not always applied
• Certain sample handling procedures caused ZHE losses
• High variability and bias in TS & TSS for samples with particulates >50µm (ASTM D3977 corrects problem)
• ICP/AES yields bias results for As and Se in Anti-Freeze
• MMCs not being reported consistently for OWEP
• CLL Extraction improved acid fraction SVOC recovery
• Heated soxhlet extraction after size reduction improves PCB recovery from concrete
• Salting-out improves PCB recovery from WW
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