LCS Control Limits
A Modest Proposal

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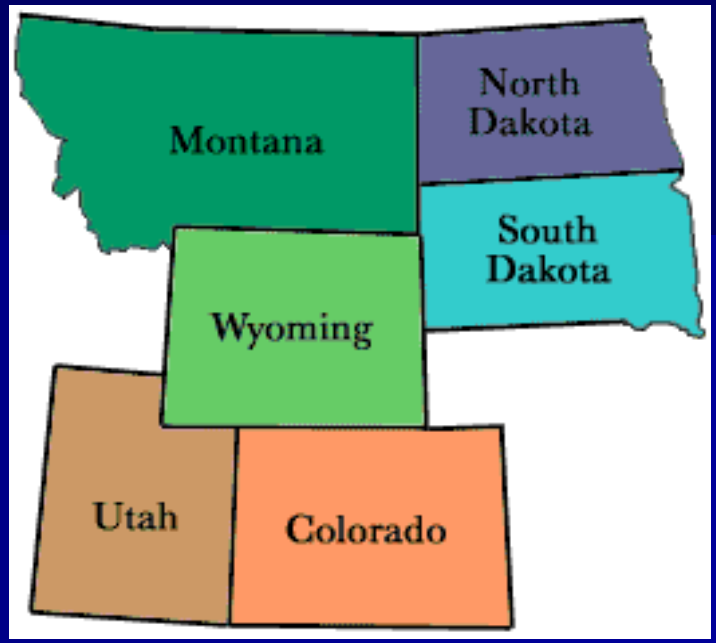
Proposal

- Use the TNI / NELAC Fields of Proficiency Testing (FoPT) regression equations to establish laboratory control sample (LCS) control limits

EPA Region 8

- 6 states
- 27 Tribal Nations
- 15 National Parks



Region 8 Laboratory

- Full service laboratory
- NELAP accredited
  - Drinking water
  - Non-potable water
- Field sampling support
- Certifying Officers for drinking water
- PSL for Wyoming

Analytical Areas

- Metals
  - ICP-OES
  - ICP-MS
- Wet chemistry
  - Anions
  - Alkalinity
- GC
  - GRO / BTEX
  - DRO
  - EDB / DBCP
- GC/MS
  - VOCs
  - SVOCs
- HPLC
  - Pesticides
  - PPCPs
- Microbiology

LCS Control Limits - Sources

- DoD LCS Study
- Method requirements
- TNI / NELAC FoPT regression equations?

DoD LCS Study

- Published 2004
- Focused on nine SW 846 methods
- Based on empirical data
  - Performed in cooperation with ACIL
  - Over 20 participating laboratories
    - Doing work for DoD
    - Considered to be “good performing”
- Used to establish benchmarks for DoD
  - PT regression equations considered a “benchmark”
    - PT limits generally less stringent than LCS Study limits

PT Regression Equations

- Three matrices
  - Drinking water
  - Non-potable water
  - Solid and chemical materials
- Based on empirical data
- Acceptance criteria
  - Mean recovery: $a * conc + b$
  - Standard deviation: $c * conc + d$
- Reviewed and updated periodically
  - TNI SOP 4-101

Comparison to LCS Study as Benchmark

LCS Study

- Nine methods
  - Water
  - Solids
- Unique analyses
  - Explosives
  - 2 Aroclors
- No concentration dependence

PT Equations

- Twelve^{+} methods
  - Water
  - Solids – limited
  - Drinking water - limited
- Unique analyses
  - GRO
  - DRO
  - Anions
  - 7 Aroclors, including PCBs in oil
  - Miscellaneous analytes
- Concentration dependant

Ground Rules for Comparing acceptance criteria with LCS Study

- Use non-potable water equations
- Use a mid-range concentration
- Focus on overall properties of analytical groups

Comparison to LCS Study as Benchmark – Metals in Water

LCS Study

- Mean recovery
  - 24 analytes (including Hg)
  - 98.7%
- Standard deviation
  - 4.2%

PT Equations

- Mean recovery
  - 28 analytes (including Hg)
  - 99.7%
    - a(ave): 0.998
- Standard deviation
  - 5.1%
    - c(ave): 0.050

Method 200.7: ± 15%
Method 200.8: ± 15%

Comparison to LCS Study as Benchmark – Volatiles in Water

LCS Study

- Mean recovery
  - 69 analytes (including surr)
  - 98.5%
- Standard deviation
  - 10.9%

PT Equations

- Mean recovery
  - 33 analytes
  - 98.4%
    - a(ave): 0.982
- Standard deviation
  - 12.0%
    - c(ave): 0.113

Comparison to LCS Study as Benchmark – Semivolatiles in Water

LCS Study

- Mean recovery
  - 69 analytes (including surr)
  - 77.7%
- Standard deviation
  - 12.1%

PT Equations

- Mean recovery
  - 62 analytes
  - 77.3%
    - a(ave): 0.759
- Standard deviation
  - 17.9%
    - c(ave): 0.168

Extension to Other Analyses Anions

- 7 analytes
- Mean recovery: 99.8%
  - a(ave): 0.998
- Standard deviation: 5.9%
  - c(ave): 0.048
- Method 300.0: ± 10%
- R8L:
  - Mean recovery: 97.6%
  - Standard deviation: 4.6%

Extension to Other Analyses Gas Range Organics

- Analyte: GRO
- Mean recovery: 106.1%
  - a: 1.068
- Standard deviation: 25.1%
  - c: 0.216
- R8L (MS detection):
  - Mean recovery: 95.5%
  - Standard deviation: 7.0%
  - Use ± 30% for BTEX compounds

Extension to Other Analyses Diesel Range Organics

- Analyte: DRO
- Mean recovery: 73.1%
  - a: 0.779
- Standard deviation: 19.3%
  - c: 0.136
- R8L LCS:
  - Mean recovery: 86.6%
  - Standard deviation: 12.3%

Extension to Other Analyses PCBs in Water

- 7 Aroclors
- Mean recovery: 88.6%
  - a(ave): 0.878
- Standard deviation: 18.0%
  - c(ave): 0.192

Conclusions

- LCS Study and PT regression equations lead to similar results
  - Especially true for mean recoveries
  - Use ± 2 SD for in-house limits?
- When the analytical process includes extraction, the mean recoveries will be less than 100%
- The a term is most important in determining the %R
- Both the c and d terms are important in determining the standard deviation
  - Increasingly true as concentration decreases

Advantages of Using PT Regression Equations

- Provide a benchmark for analyses not in the LCS Study
  - Examples: DRO analysis, PCBs in oil
  - Use in absence of in-house statistical limits
- Control limits are concentration dependant
  - Slight
- Have regular review with periodic updates
  - Get DoD out of the business of maintaining


Questions?