# LOD/LOQ

Unraveling the details around spike concentration, frequency, data points, and handling failures.

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# Spike Concentrations

Initial…. Ongoing…. DL…. LOQ….

- What things should you consider?
  - Estimated initial MDL
  - Must be at or below the LOQ
  - Result must be qualitatively identifiable and quantitative *routinely*
  - Results must be greater than the MDL *routinely*

# Spike Concentrations

What things should you consider?

## ❖Estimated initial MDL

**(a)** The mean determined concentration plus three times the standard deviation of a set of method blanks.

**(b)** The concentration value that corresponds to an instrument signal-to-noise ratio in the range of 3 to 5.

**(c)** The concentration equivalent to three times the standard deviation of replicate instrumental measurements of spiked blanks.

**(d)** That region of the calibration where there is a significant change in sensitivity, ***i.e.,*** a break in the slope of the calibration.

**(e)** Instrumental limitations.

**(f)** Previously determined MDL.

# Spike Concentrations

What things should you consider?

- Must be at or below the LOQ
  - What RL is needed?
- Results must be qualitatively identifiable and quantitative routinely
  - What makes the result qualitatively identifiable?
  - What is the calibration range of the instrument?
- Results must be greater than the MDL routinely
  - What is the prep efficiency?

# Frequency

Requirement:  At least two spikes per quarter per instrument in separate batches

- Can you run spikes more often?
- Why would you want to run spikes more often?
  - Tracking
  - To ensure they get done
  - Gather more data points

# Data Points

- How many data points must you use?
  - Initial: *At least* 7
  - Ongoing:  All quarterly spikes from the last two years plus the initial
- The more the merrier?
- How do you manage them?
  - Spreadsheets
  - LIMS
  - Scoreboards

# Failures

## What is a failure?

Initial: Not above zero or does not meet the qualitative identification criteria

Ongoing: Does not meet the qualitative identification criteria, Not above the *calculated DL* or does not meet laboratory established acceptance criteria

- Laboratory established acceptance criteria
  - What does that mean?
  - What is acceptable?

# Failures

How do you handle a failure?

# SIRS

"This question relates to failures of the ongoing verification of the DL and LOQ:

For the DL, the standard states: ""In the event that verification fails, the laboratory shall perform a new DL study within thirty (30) calendar days"". Is the laboratory allowed to perform analyses and report data according to the old DL and without qualification during this 30 calendar day period or must it cease analysis until the new DL study is performed?

Similarly for the LOQ one of the options for a failed verification is: ""...raising the spiking level (and the quantitation limit if the spiking level is above it) and repeating the initial verification study within thirty (30) calendar days of the initial failure."" Is the laboratory allowed to perform analyses and report data according to the old LOQ and without qualification during this 30 day calendar period or must it cease analysis until the LOQ study is performed?"

# SIRS

40 CFR 136 Appendix B (3) (a) “During any quarter in which samples are being analyzed, prepare and analyze a minimum of two spiked samples on each instrument, in separate batches, using the same spiking concentration used in Section 2.” If the variation in the spiking concentration is used to calculate the MDL (MDLS = $t(n-1, 1-\alpha = 0.99)Ss$), and the lab uses the MDL to calculate a LOQ (maintaining that the LOQ ≥ the lowest calibration concentration), this may not be “a spike at or below the LOQ” as prescribed in TNI V1M4-2016 §1.5.2.1.2 because the concentration value does not play a role in calculating the MDL (DL). It seems the TNI ongoing verification definition differs from 40 CFR. If the lab were to use a concentration at or below the LOQ, this would not always satisfy 40 CFR 136 Appendix B (4) (b) “Include data generated within the last twenty four months, but only data with the same spiking level.” The lab seeks clarification on when to verify at or below the LOQ and when to use the same spiking concentration as in the original study. Thank you.

# SIRS

**II. Procedure**

**(1)** Estimate the initial MDL using one or more of the following:

**(a)** The mean determined concentration plus three times the standard deviation of a set of method blanks.

**(b)** The concentration value that corresponds to an instrument signal-to-noise ratio in the range of 3 to 5.

**(c)** The concentration equivalent to three times the standard deviation of replicate instrumental measurements of spiked blanks.

**(d)** That region of the calibration where there is a significant change in sensitivity, ***i.e.,*** a break in the slope of the calibration.

**(e)** Instrumental limitations.

**(f)** Previously determined MDL.

# Question?

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