Quality Control Sample Processing and Batches

This section illustrates the processing of some of the typical quality control samples and how batches are structured.

Quality control samples may include:

- ➢ Calibration curve standards
- ➢ Initial calibration verification standards (ICV)
- ➢ Continuing calibration verification standards (CCV)
- ➢ Quality control standard samples (QCS) (aka "Blinds")
- ➢ Method blanks (MB)
- ➢ Instrument blanks (IB)
- ➢ Calibration blanks (CB)
- ➢ Laboratory control samples (LCS)
- ➢ Matrix spike samples (MS)
- ➢ Matrix spike duplicates (MSD)
- ➢ Sample replicates (aka "duplicates")

Procedural vs. Non-procedural Calibrations

- ➢ If the calibration curve IS procedural (i.e. digested) then <u>all</u> the QC samples should be processed.
  - Procedural means that the calibration standards are carried through the entire process that the samples go through. Therefore, they are digested or extracted in the same manner as the samples. If the calibration standards are carried through the process then it follows that all the QC samples should as well.
- ➢ If the calibration curve is NOT procedural then the calibration standards are not processed. In this case, the only routine QC samples that <u>must</u> be processed are the laboratory control sample (LCS), the method blank (MB), the matrix spikes (MS/MSD – if applicable) and sample replicate (if applicable).
  - MS/MSD and replicates are mandatory only if required in the method or project plan.
- ➢ LCS, method blank, MS/MSD and replicates always have to go through the same preparation as the samples.

Batches

1. Preparation batch is a set of samples which is processed all in one group using the same equipment, reagents and staff within a 24-hour period.

Although the code does not specify, most methods limit preparation batches to 20 samples.

- ➢ If the lab only analyzes 7 or less samples in a week (on a per test and per matrix basis) then regardless of how many days that week samples were prepared, all samples prepped that week are considered to be part of just one preparation batch for the purposes of following QC sample frequency.

2. An analytical batch is a set of prepared samples (i.e. extracts, digestates or concentrates) or samples requiring no preparatory steps, analyzed together as a group in an uninterrupted sequence, and can consist of samples of various quality system matrices.

- ➢ For method blanks and LCS, the same MB and LCS can be used with different quality system matrices as long as the preparation steps that those different quality system matrices undergo are all the same. In addition the inert matrix used for the LCS and MB needs to closely represent the quality system matrices in the batch.
  - For example, the inert matrix should be reagent water (RW) for aqueous and drinking water matrices and Ottawa sand (or other inert or well-characterized matrix resembling samples) for solids.
- ➢ Only 1 MB and 1 LCS are required per batch regardless of the number of samples prepared as long as all samples are prepared in the same manner with the same inert matrix, within a 24 hour period.
- ➢ MS/MSD and sample replicates (if required by method or project plan) must be performed for each quality system matrix (i.e. effluent wastewater (WW), influent WW, drinking water and so on) being prepped or analyzed (if no prep step).
  - A MS/MSD and replicate are required for each QS matrix. For example, if 4 effluent WW samples, 4 influent WW samples and 2 groundwater samples are analyzed for total phosphorus then three different MS/MSDs and 3 replicates will be needed – one for each QS matrix.

3. Preparation and Analytical Batch Examples

- ➢ Laboratories shall establish procedures for identifying and documenting preparation batches.
  - Each preparation batch needs to be documented and associated with the appropriate QC samples.
  - Samples that do not undergo a preparation step (i.e. digestion or extraction) will be documented in the records for the analytical batch.

Batch examples for total phosphorus:

When Curve is Procedural (Is Digested):

Curve Day Preparation and Analytical Batch
(both preparation and analytical batches are the same; calibration standards are digested)

Digest and Analyze:
- Instrument Blank = RW no color reagent (CR) used for zero
- Calibration Blank = RW w/CR
- Standard 1
- Standard 2
- Standard 3
- Standard 4[1]
- Standard 5[1]
- ICV[2] (2nd source standard, if not doing QCS)
- MB
- 1 - 20 samples
- CCV[3]
- 21-40 samples
- CCV[3]

[1] Minimum of 3 standards required for phosphorus
[2] The ICV covers the LCS requirement when it is digested. ICV not required if running QCS.
[3] If run less than 20 samples will not need these CCVs

Non-Curve Day Preparation and Analytical Batch
(both prep and analytical batches are the same; calibration standards are digested)

Digest and Analyze:
- Instrument blank = RW no CR used for zero
- CCV[1]
- MB
- 1 - 20 samples
- CCV[2]
- 21-40 samples
- CCV[2]

[1] The CCV covers the LCS requirement when it is digested.
[2] If run less than 20 samples will only need first CCV

When Curve is Not Procedural (Not Digested):

Curve Day Preparation Batch (calibration standards are not digested)

Digest:
- MB

➢ LCS
➢ 1 - 20 samples
➢ 21-40 samples

Curve Day Analytical Batch (calibration standards are not digested)

Analyze:
➢ Instrument Blank = RW no CR
➢ Calibration Blank = RW w/CR
➢ Standard 1
➢ Standard 2
➢ Standard 3
➢ Standard 4[1]
➢ Standard 5[1]
➢ ICV[2] (2nd source standard, if not doing QCS)
➢ LCS (digested)
➢ MB (digested)
➢ 1 - 20 samples (digested)
➢ CCV[3]
➢ 21-40 samples (digested)
➢ CCV[3]

[1] Minimum of 3 standards required for phosphorus
[2] ICV not required if running QCS.
[3] If run less than 20 samples will not need these CCVs

Non-Curve Day Preparation Batch (calibration standards are not digested)

Digest:
➢ MB
➢ LCS
➢ 1 - 20 samples
➢ 21-40 samples

Non-Curve Day Analytical Batch (curve is not digested)
Analyze:
➢ Instrument blank
➢ CCV
➢ MB (digested)
➢ LCS (digested)
➢ 1 - 20 samples (digested)

➢ CCV[2]
➢ 21-40 samples (digested)
➢ CCV[2]
[2] If run less than 20 samples will not need these CCVs