MWH LABORATORY QC REPORT

To ensure that MWH Laboratories provide you with data of known and documented quality, MWH generates a QC report with the sample data report.

The QC report summarizes the QC samples or QC checks that are processed, analyzed and batched together with your samples to demonstrate the data integrity, authenticity and reliability. Positive controls are included to monitor precision and accuracy and to demonstrate that during the analysis of your samples, the analytical system was in control.

The type and frequency of QC checks batched, processed and analyzed simultaneously with your samples are conducted as per method specifications. A "Laboratory QC summary" is included that lists the group of samples batched together with the QC checks and the QC batch reference number.

Abbreviations & Definitions

Accuracy — A measure of the closeness of an individual measurement or the average of a number of measurements to the true value.

AASPKSMP — **Spiked Sample:**
Information identifying selected specific sample for MS/ MS1/ MS2/ MS_2nd and MSD.

Batch — Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents, within a specified time period.

CCCL — **Continuing Calibration Check Low-level or Continuing Calibration Verification Low-level:**
The analysis of a low standard prior to the analysis of samples to assure that the instrument is retaining and verifying its initial calibration.

CCCH — **Continuing Calibration Check High-level or Continuing Calibration Verification High-level:**
The analysis of a high standard during the analysis of samples to assure that the instrument is retaining and verifying its initial calibration.

DUP/DUP2 — **Laboratory Duplicate:**
Two sample aliquots of the same sample taken in the analytical laboratory and analyzed separately with identical procedures. Analyses of the sample and duplicate give a measure of the precision associated with laboratory procedures, but not with sample collection, preservation, or storage procedures. Precision is expressed as RPD (%) – Relative Percent Difference:

RPD (%) = Absolute Value of:

$$\left[\frac{(x_1 - x_2)}{\left(\frac{x_1 + x_2}{2} \right)} \right] \times 100$$

Where:
x_1 = Concentration Observed in Original Sample (see "Spiked" column)
x_2 = Concentration Observed in Duplicate Sample (see "Recovered" column)

FLCS1/FLCS2 — **Florisil-treated Laboratory Control Sample:**
Florisil-cleanup done on LCS associated with Florisil-treated dirty samples.

FMBLK — **Florisil-treated method blank:**
Florisil-cleanup done on method blank associated with Florisil-treated dirty samples.

FMS/FMSD — **Florisil-treated matrix spike/ Florisil-treated matrix spike duplicate:**
Florisil cleanup done on matrix spikes associated with Florisil-treated dirty samples

IS

Internal Standard (IS):
A pure analyte(s) added to a sample, extract, or standard solution in known amount(s) and used to measure the relative responses of other method analytes and surrogates that are components of the same solution. The internal standard must be an analyte that is not a sample component.

Limits (%)

Acceptance Limits/ Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents.

LCS1/LCS2/LCS3

Laboratory Control Sample (however named, such as laboratory fortified blank (LFB), spiked blank, or QC check sample (QCS)):
An aliquot of reagent water or other blank matrix to which known quantities of the method analytes and all the preservation compounds are added in the laboratory. The LCS/ LFB/ Spiked Blank/ QCS is analyzed exactly like a sample to determine whether the **batch is in control**, and whether the laboratory is capable of making accurate and precise measurements. LCS1/LCS2/LCS3 may represent either the same or different spike levels. If LCS 1 and LCS2 are of the same spike level, LCS2 serves as LCS Duplicate and %RPD is calculated to determine method precision.

Measure of Accuracy:

$$\text{Yield (\%)} = \frac{\text{“Recovered”}}{\text{“Spiked”}} \times 100$$

Measure of Precision:

RPD (%) = Relative Percent Difference:
= Absolute Value of:

$$\left[\frac{(x_1 - x_2)}{\left(\frac{x_1 + x_2}{2}\right)}\right] \times 100$$

Where:
x_1 = Concentration Observed in LCS Sample (see LCS “Recovered” column)
x_2 = Concentration Observed in LCS Duplicate Sample (see LCS Duplicate “Recovered” column)
Or

RPD_LCS (using LCS recovery data):
x_1 = Recovery Observed in LCS Sample (see “Spiked” column)
x_2 = Recovery Observed in LCS Duplicate Sample (see “Recovered” column)

MBLK

Method blank:
An aliquot of reagent water or other blank matrix that is treated exactly as a sample and processed simultaneously with other samples in the analysis batch through all steps of the analytical procedure. MBLK is used to determine if method analytes or other interferences are present in the lab environment, reagents, or apparatus.

MRL

Minimum Reporting Limit:
The lowest concentration normally reported by MWH. It represents a conservative, nominal reporting limit designed to be representative of the minimum quantifiable concentration level for a particular analyte in a real environmental matrix as opposed to the statistically derived calculated MDL (method detection limit) as per 40 CFR 136 Appendix B procedure. This MRL defined by the laboratory must be greater than the statistically derived MDL and is typically the lowest calibration level used by the lab.

MS/MS1/MS2/MS_2nd

Matrix Spike (however named, such as Spiked sample or Laboratory fortified sample matrix (LFSM) or Laboratory fortified matrix (LFM)):
An aliquot of a preserved field sample to which known quantities of the method analytes are added in the laboratory. MS/LFSM/LFM is processed and analyzed exactly like a sample, and its purpose is to determine the impact of the sample matrix on the accuracy of the sample results. The background concentrations of the analytes in the sample matrix must be determined in a separate aliquot and the measured values in the MS/LFSM/LFM corrected for

background concentrations. MS results are sample/matrix specific and would not normally be used to determine the validity of the entire batch.

Measure of Accuracy:

MS Yield (%) = "Recovered" X 100
"Spiked"

Where:
Recovered = Amount Found in Spiked Sample – Background Amount
Spiked = True value of Spike

MSD

Matrix Spike Duplicate (however named, Spiked sample duplicate or Laboratory fortified sample matrix duplicate (LFSMD) or Laboratory fortified matrix duplicate (LFMD)):
A second aliquot of the field sample used to prepare the MS/LFSM/LFM, fortified, processed, and analyzed identically to the MS/LFSM/LFM. MSD/LFSMD/LFMD is used instead of the Field duplicate to access method precision on a specific matrix when the occurrence of target analytes are low. MSD results are sample/matrix specific and would not normally be used to determine the validity of the entire batch.

Measure of Accuracy:

MSD Yield (%) = "Recovered" X 100
"Spiked"

Where:
Recovered = Amount Found in Spiked Sample – Background Amount
Spiked = True value of Spike

Measure of Precision:

RPD (%) = Relative Percent Difference:
= Absolute value of:

$$\left[\frac{(x_1 - x_2)}{\left(\frac{x_1 + x_2}{2}\right)}\right] \times 100$$

Where:
x_1 = Conc Observed in Spiked Sample – Background (see MS "Recovered" Column)
x_2 = Conc Observed in Duplicate Spiked Sample - Background (see MSD "Recovered" Column)

OR

RPD_MS (using MS recovery data)
Where:
x_1 = Recovery Observed in MS Sample (see "Spiked" column)
x_2 = Recovery Observed in MS Duplicate Sample (see "Recovered" column)

NA

Not Analyzed

ND

Not Detected

NELAC

National Environmental Laboratory Accreditation Conference:
A voluntary organization of State, Federal and other groups to establish mutually acceptable National standards for accrediting environmental laboratories.

Precision

The measure of mutual agreement among individual measurements obtained under similar conditions: precision is usually expressed as % RPD (relative percent difference).

QC

Quality Control:
The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

QC Ref #

QC Batch Reference no.: *See Batch*

RPD_DUP **Relative Percent Difference between Laboratory duplicate:**
A measure of the precision associated with the laboratory procedures but not with sample collection, preservation or storage procedures. See Dup-Laboratory duplicate for %RPD calculation.

RPD_LCS **Relative Percent Difference between the Laboratory control sample and the Laboratory control sample duplicate:**
A Measure of precision associated with laboratory procedures but not with sample collection, preservation, or storage procedures. See LCS1/LCS2/LCS3 for RPD_LCS %RPD calculation using LCS recovery data.

RPD_MS **Relative Percent difference between the Matrix spike (MS) and the Matrix spike duplicate (MSD):**
A measure of method precision on a specific matrix. See RPD_MS for %RPD calculation using MS recovery data.

Surr **Surrogate:**
A pure analyte which chemically resembles target analytes and is extremely unlikely to be found in any sample. This analyte is added to a sample aliquot in known amount(s) before filtration or other processing and is measured with the same procedures used to measure other sample components. The purpose of the surrogate is to monitor method performance with each sample.

Measure of Accuracy:
$$\text{Surr \%Yield or \% Recovery} = \frac{\text{Recovered}}{\text{Spiked}} \times 100$$

Units:

ACU	Apparent Color Unit
cm^{-1}	Per Centimeter
CFU/mL	Colony Forming Unit per milliliter
MFL	Million Fibers Per Liter
mg/L	Milligrams per liter
ml/L	Milliliter per liter
MPNM	Most Probable Number per 100 milliliter
ng/L	Nanogram per liter
NTU	Nephelometric Turbidity Units
PA	P=Presence, A= Absence
pCi/L	PicoCurie per liter
PTUB	Positive Tube
TON	Threshold Odor Number
ug/L	Micrograms per liter
umho/cm	Micromhos per centimeter

Technology:

ASBTEM	Asbestos by Transmission Electron Microscope
GC/MS	Gas Chromatography/ Mass Spectroscopy
GC	Gas chromatography
GF	Graphite Furnace
FIA	Flow Injection Analysis
IC	Ion Chromatography
ICAP or ICP	Inductively-Coupled Argon Plasma
ICAP/MS	Inductively-Coupled Argon Plasma Mass Spectrometry
RFA	Rapid Flow Analyzer