

ONTARIO QA/QC INTERPRETATION GUIDE - ENVIRONMENTAL SERVICES



QA/QC Sample Type	Frequency and Purpose	Application and Regulatory Criteria	Recommended Actions														
<b>LABORATORY</b>																	
<b>Method Blank</b> A laboratory control sample that is free of the target parameters and of any substance that may interfere with that analysis. A method blank is processed through the entire analytical method including any extraction, digestion or any other preparation procedure.	1 in 20 samples or 1 in batch.  Monitors laboratory background levels of target analytes and laboratory artifacts	Used for most analytical parameters. Evaluate the impact on data for results >RDL or that that approaches the concentration reported in the sample.	The laboratory will repeat the analysis for all samples in the batch, if unacceptable concentrations of target analytes are identified in the method blank. The laboratory may report elevated RDL values if project/regulatory criteria are not exceeded.														
<b>Blank Spike:</b> A laboratory control sample free of the target analytes or interferences is fortified with a known concentration of all or selected target analytes. The blank spike is processed through the entire analytical method including any extraction, digestion or any other preparation procedure. Results are expressed as a percentage recovery.	1 in 20 samples or 1 in batch.  Monitors analyte recovery and potential loss during the preparation procedures (extraction efficiency). It also serves to validate the calibration of the instrumentation or technique.	Used for most analytical parameters. <table border="1"> <tr><td>Metals</td><td>80% - 120% (water and soil)</td></tr> <tr><td>VOCs</td><td>60% - 130% (water and soil)</td></tr> <tr><td>PHCs</td><td>60%-140% water; 80%-120% soil</td></tr> <tr><td>Volatile Gases and Ketones</td><td>50% - 140% (water and soil)</td></tr> <tr><td>General Chem. (typical)</td><td>80% - 120% (water and soil)</td></tr> <tr><td>ABNs</td><td>50%-140% (water and soil)</td></tr> <tr><td>PAHs</td><td>50%-140% (water and soil)</td></tr> </table>	Metals	80% - 120% (water and soil)	VOCs	60% - 130% (water and soil)	PHCs	60%-140% water; 80%-120% soil	Volatile Gases and Ketones	50% - 140% (water and soil)	General Chem. (typical)	80% - 120% (water and soil)	ABNs	50%-140% (water and soil)	PAHs	50%-140% (water and soil)	Repeat the analysis for all samples in the batch, if >10% blank spike parameter recoveries are outside control limits by 10% absolute. Re-extract/re-analyse all associated samples, if possible. If not, report the data flagged for all failing analytes.
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<b>Matrix Spike</b> A second aliquot from a randomly chosen sample is fortified with a known concentration of target analytes. The sample is processed through the entire analytical method. Results are expressed as a percentage recovery.	1 in 20 samples or 1 in batch.  Evaluates any "matrix effects" that may exist in a sample due to its composition that may affect the recovery of analytes. An example is the presence of peat in soils, which tends to adsorb analytes such as benzene resulting in a poor matrix spike recovery.	Used for most analytical procedures. Matrix spike alert criteria apply when the MS target concentration is $\geq$ the native analyte concentration. <table border="1"> <tr><td>Metals</td><td>70% - 130% (water and soil)</td></tr> <tr><td>VOCs</td><td>50% - 140% (water and soil)</td></tr> <tr><td>PHCs</td><td>60% - 140% (water and soil)</td></tr> <tr><td>General Chem. (typical)</td><td>70% - 120% (water and soil)</td></tr> <tr><td>ABNs</td><td>50% - 140% (water and soil)</td></tr> <tr><td>PAHs</td><td>50% - 140% (water and soil)</td></tr> </table>	Metals	70% - 130% (water and soil)	VOCs	50% - 140% (water and soil)	PHCs	60% - 140% (water and soil)	General Chem. (typical)	70% - 120% (water and soil)	ABNs	50% - 140% (water and soil)	PAHs	50% - 140% (water and soil)	Laboratory will repeat analysis if recovery of analytes is outside of control limits for >10% compounds and if similar outcome is observed, the data is reported with appropriate qualifiers. It should be noted that higher levels of uncertainty in the data are associated with situations when native analyte concentrations are >1/2 MS concentrations.		
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<b>Laboratory Duplicates (RPD)</b> A second aliquot from a randomly chosen sample within an analytical batch processed through the entire analytical method. Laboratory duplicates are expressed as the Relative Percent Difference (RPD) between the two results.	1 in 20 samples or 1 in batch.  Evaluates analytical precision and sample homogeneity.	Applicable for all analytical parameters. RPDs are calculated when the average of the two sample concentrations are greater than 5xRDL. <table border="1"> <tr><td>ABNs, PAHs, OC Pesticides, PCBs, Methyl Mercury</td><td>RPD <math>\leq</math>30% water ; <math>\leq</math>40%soil</td></tr> <tr><td>PHCs</td><td>RPD <math>\leq</math>30% water and soil</td></tr> <tr><td>VOCs</td><td>RPD <math>\leq</math>30% water; <math>\leq</math>50% soil</td></tr> <tr><td>Metals and Inorganics, Mercury</td><td>RPD <math>\leq</math>40% water; <math>\leq</math>30% soil</td></tr> <tr><td>HWSB</td><td>RPD <math>\leq</math>40% water and soil</td></tr> <tr><td>Chromium VI, FOC, Chloride, Cyanide</td><td>RPD <math>\leq</math>20% water; <math>\leq</math>35% soil</td></tr> <tr><td>Electrical Conductivity</td><td>RPD <math>\leq</math>10% water and soil</td></tr> </table>	ABNs, PAHs, OC Pesticides, PCBs, Methyl Mercury	RPD $\leq$ 30% water ; $\leq$ 40%soil	PHCs	RPD $\leq$ 30% water and soil	VOCs	RPD $\leq$ 30% water; $\leq$ 50% soil	Metals and Inorganics, Mercury	RPD $\leq$ 40% water; $\leq$ 30% soil	HWSB	RPD $\leq$ 40% water and soil	Chromium VI, FOC, Chloride, Cyanide	RPD $\leq$ 20% water; $\leq$ 35% soil	Electrical Conductivity	RPD $\leq$ 10% water and soil	The laboratory will inspect sample for homogeneity and qualify data appropriately. The laboratory may repeat affected sample. Since organic parameters in waters are analyzed as whole-bottles, a laboratory duplicate is essentially a field duplicate and these are subject to sampling variability.
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<b>Certified Reference Material (CRM)</b> Purchased samples that have been certified by a recognized agency to contain specified levels of selected constituents, when measured by specified standard procedures. Results are expressed as a percentage of the design value.	During validation; optional otherwise.  Used for validating the performance of a method including precision, extraction or digestion efficiency.	Applicable for all analytical parameters where CRMs are commercially available. Acceptable recovery ranges are provided by the supplier.	Repeat the analysis for all samples in the batch, if CRM % recovery is outside control limits.														
<b>Surrogate Recovery</b> Surrogates are deuterated analogues or compounds not normally found in nature but have chemical and physical behaviour similar to the analytes of interest. Known surrogate concentrations are added to samples prior to analysis and recoveries are calculated and expressed as a percentage.	Every organic analysis, included in every sample and standard.  Monitors the efficiency of organic extractions, instrument performance and provides within-run quality control.	Applicable for all analytical parameters determined by Gas Chromatography or HPLC techniques.  <table border="1"> <tr><td>VOCs, ABNs (SVOCs)</td><td>50% - 140% (water and soil)</td></tr> <tr><td>PHCs</td><td>60% - 140% (water and soil)</td></tr> </table>	VOCs, ABNs (SVOCs)	50% - 140% (water and soil)	PHCs	60% - 140% (water and soil)	Repeat the analysis or qualify data, if interferences are suspected.										
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<b>FIELD</b>																	
<b>Blind Duplicates</b> A second sample is collected at the same time and location in separate containers. Samples are homogenized where possible (ie alternate filling of sample and duplicate for waters and bowl mixing for soils). Samples are submitted to the laboratory without identifying them as duplicates. VOCs in soil should not be homogenized.	1 for every 10 samples collected; must be representative of all parameters.  Evaluates analytical precision, field precision and sample homogeneity. Has limited use for samples that cannot be homogenized (ie VOCs in soil).	As with laboratory duplicates, meaningful RPDs can be calculated when the average of the two sample concentrations are greater than 5xRDL. <table border="1"> <tr><td>ABNs, PAHs, OC Pesticides, PCBs, Methyl Mercury</td><td>RPD <math>\leq</math>30% water ; <math>\leq</math>40%soil</td></tr> <tr><td>PHCs</td><td>RPD <math>\leq</math>30% water and soil</td></tr> <tr><td>VOCs</td><td>RPD <math>\leq</math>30% water; <math>\leq</math>50% soil</td></tr> <tr><td>Metals and Inorganics, Mercury</td><td>RPD <math>\leq</math>40% water; <math>\leq</math>30% soil</td></tr> <tr><td>HWSB</td><td>RPD <math>\leq</math>40% water and soil</td></tr> <tr><td>Chromium VI, FOC, Chloride, Cyanide</td><td>RPD <math>\leq</math>20% water; <math>\leq</math>35% soil</td></tr> <tr><td>Electrical Conductivity</td><td>RPD <math>\leq</math>10% water and soil</td></tr> </table>	ABNs, PAHs, OC Pesticides, PCBs, Methyl Mercury	RPD $\leq$ 30% water ; $\leq$ 40%soil	PHCs	RPD $\leq$ 30% water and soil	VOCs	RPD $\leq$ 30% water; $\leq$ 50% soil	Metals and Inorganics, Mercury	RPD $\leq$ 40% water; $\leq$ 30% soil	HWSB	RPD $\leq$ 40% water and soil	Chromium VI, FOC, Chloride, Cyanide	RPD $\leq$ 20% water; $\leq$ 35% soil	Electrical Conductivity	RPD $\leq$ 10% water and soil	Evaluate laboratory QC, homogenization procedures and field collection technique. Contact the laboratory as soon as possible. Although specific regulatory guidance on field duplicate RPDs is not provided, it is generally acceptable to apply laboratory duplicate criteria, as an initial step. Site-specific considerations should be evaluated by the QP, beyond this (i.e. soil heterogeneity, etc.) to assess the feasibility of wider criteria.
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<b>Trip Blank</b> A sample of analyte free media (supplied by the laboratory) taken to the site and returned to the laboratory unopened. The laboratory prepares the trip blank. A duplicate of the trip blank prepared at the same time is retained at the laboratory in a contaminant free location.	1 per VOC water submission.  Identifies any potential cross-contamination that may occur from other samples, ambient conditions, or other sources that samples may be exposed.	Evaluate the impact on data for results >5x the RDL or that that approaches the concentration reported in the sample.	Contact and engage the laboratory for assistance in qualifying the data. Analyze the laboratory trip blank duplicate retained by the laboratory.														
<b>Trip Spike</b> A sample prepared by the laboratory that is fortified with a known concentration of target analytes. This sample is shipped along with containers and is to be taken into the field, but returned unopened to the laboratory. Analysis is conducted and recoveries are reported expressed as a percentage.	1 per VOC water monitoring program.  Monitors the breakdown or loss of analytes during the sampling process. Holding time, and temperature effects on concentration can be accessed.	Usually volatile organics in water. May be applied to other analyses.  <table border="1"> <tr><td>Majority of VOCs</td><td>60% - 130%</td></tr> <tr><td>Vinyl Chloride, Bomomethane, Chloromethane, Freon-12, Acetone, MIBK &amp; MIBK</td><td>50% - 140%</td></tr> </table>	Majority of VOCs	60% - 130%	Vinyl Chloride, Bomomethane, Chloromethane, Freon-12, Acetone, MIBK & MIBK	50% - 140%	Review storage conditions, temperatures of samples upon receipt.										
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<b>Field Blank</b> Supplied by the laboratory and prepared in the field by filling container with analyte free water.	1 per VOC monitoring program  Determines if the field or transporting environments have contaminated the sample.	Applicable for most parameters.  Evaluate the impact on data for results >5x the RDL or that that approaches the concentration reported in the sample.	Evaluate any hits found in the sample that were also found in the trip blank.														
<b>Blind Known</b> A purchased CRM (see above) or a sample previously analyzed by an accredited laboratory multiple times is submitted to the laboratory blind.	1 per remediation or large project. Evaluates laboratory accuracy and precision.	Ideal for long holding time tests such as metals in soil. Submission of the same blind known multiple times during a large project provides excellent monitoring of the laboratory precision and accuracy. Acceptable recovery ranges are provided by the supplier.	Contact the laboratory.														