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State of Washington

School Supplies 2023: Addendum 1

Quality Assurance Project Plan: Lead and Cadmium in School Supplies, 2021

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Contact Information

Publications Coordinator
Environmental Assessment Program
Washington State Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-407-6764

Washington State Department of Ecology – ecology.wa.gov

Headquarters, Olympia	360-407-6000
Northwest Regional Office, Shoreline	206-594-0000
Southwest Regional Office, Olympia	360-407-6300
Central Regional Office, Union Gap	509-575-2490
Eastern Regional Office, Spokane	509-329-3400

School Supplies 2023: Addendum 1

Quality Assurance Project Plan: Lead and Cadmium in School Supplies, 2021

By Lyndsey Smith

September 2023

Approved by:

Signature:	Date:
Junine So, Client, Assistant Attorney General, Attorney General's Office Signature:	Date:
Lyndsey Smith, Author / Project Manager, EAP Signature:	Date:
Sara Sekerak, Author's Unit Supervisor, EAP Signature:	Date:
Jessica Archer, Author's Section Manager, EAP Signature:	Date:
Dean Momohara, Acting Director, Manchester Environmental Lab, EAP Signature:	Date:
Arati Kaza, Ecology Quality Assurance Officer	

Signatures are not available on the Internet version.
EAP: Environmental Assessment Program

1.0 Table of Contents

Note: The numbered headings in this document correspond to the headings in the original QAPP. Only relevant sections are included here; therefore, some numbered headings may be missing.

List of Tables

2.0 Abstract

In partnership with the Washington State Attorney General's Office, the Washington State Department of Ecology will investigate lead and cadmium in school supplies. School supplies include pencil pouches, backpacks, and other supplies marketed and sold as school supplies for school-aged children 12 years or younger. Products available online to Washington state residents in the summer of 2023, coinciding with the beginning of the next school year, will be purchased for this study.

3.0 Background

3.1 Introduction and problem statement

Children are at greater risk from exposure to toxic chemicals than adults. Children eat, drink, and breathe more than adults in relation to their body size. Also, exposure can occur through common child development behaviors, such as biting, chewing, or sucking on toys and other products. Everyday use of products may increase a child's contact with toxic chemicals.

The Product Testing Unit (PTU) at the Washington State Department of Ecology (Ecology) regularly conducts studies to analyze children's products for the presence of restricted toxic chemicals. Ecology conducted an initial study in 2015, then partnered with the Washington State Attorney General's Office (AGO) to conduct additional studies in 2017, 2018, 2019, and 2021 to continue assessing lead and cadmium levels in school supply products. This quality assurance project plan (QAPP) addendum describes the procedures for conducting this 2023 product testing study for lead and cadmium in school supplies.

3.2 Study area and surroundings

Ecology will assess online products available to Washington state residents to include in this study. Purchasing products online reflects merchandise that is available to residents across Washington state.

3.2.1 History of study area

Ecology will limit the products purchased and collected during this study to products available online at the time of purchase.

4.0 Project Description

This study will assess lead and cadmium levels in school supplies purchased online. The AGO will be given data from this School Supplies 2023 study.

Ecology will focus on purchasing pencil pouches and backpacks available for sale online. If available, items previously tested in the 2019 (Trumbull 2019) and/or 2021 (Trumbull 2021) school supplies studies may be prioritized for purchase. The 2023 study may also include investigations on other supplies marketed and sold as school supplies for school-aged children 12 years or younger.

4.1 Project goals

The School Supplies 2023 study is being conducted with the following goals:

- Assess lead and cadmium concentrations in pencil pouches/cases and backpacks that are the same or similar to previously tested school supplies in an Ecology product testing study.
- Assess lead and cadmium concentrations in three product multiples of school supplies that are the same or similar to previously tested school supplies in an Ecology product testing study.
- Provide lab testing data and one fully-intact product multiple to the AGO.

4.2 Project objectives

The following objectives will be carried out to meet the 2023 study goals:

- Purchase up to 80 total school supplies (20 unique products in multiples of four) marketed and sold for school-aged children in Washington state.
- Analyze lead and cadmium in 60 product component samples from school supply products.
- Transfer the fourth multiple of each product to the AGO.

4.3 Information needed and sources

This study will require a review of Ecology's previous studies of lead and cadmium in school supplies (Trumbull 2019; Trumbull 2021). Previous Ecology study data of school supply products will be assessed to select products for this study. Products will be prioritized based on their appearance and design similarity to previously tested products with lead levels at or above 90 ppm or cadmium levels at or above 75 ppm.

4.4 Tasks required

The study will include the following tasks:

- Conduct an online search for the availability of school supply products.
- Purchase up to 20 school supply products (in multiples of four) available for online

purchase to residents in Washington state.

- Record purchase, product information, and product photos in Ecology's Product Testing Database (PTDB).
- Deconstruct product components from school supply products and prepare for X-ray fluorescence (XRF) screening.
- Screen product components for estimated levels of lead and cadmium using the XRF analyzer.
- Review XRF screening levels of lead and cadmium to identify and prioritize product component samples for lab analysis.
- Process product components from school supply products into samples for lab analysis.
- Submit up to 60 product component samples to Ecology's Manchester Environmental Laboratory (MEL) for analysis of lead and cadmium.
- Transfer one of the product multiples to the AGO.
- Submit lead and cadmium laboratory data packages to MEL's Quality Assurance (QA) Coordinator for data validation.
- Enter final lead and cadmium laboratory data in the PTDB.
- Conduct a QA review of the analytical data and PTDB data entries.
- Transfer initial findings to the AGO.
- Analyze study data and write a report to accompany the final data set. This final report will document methods, data quality assessment, and results.
- At the direction of the AGO, Ecology will report data to the Consumer Product Safety Commission (CPSC).

5.0 Organization and Schedule

5.1 Key Individuals and their responsibilities

Table 1. Organization of project staff and responsibilities.

Staff[1]	Title	Responsibilities
Junine So Assistant Attorney General Washington State Attorney General's Office Phone: 206-389-2426	Client	Clarifies scope of the project. Provides internal review of the QAPP and approves the final QAPP.
Lyndsey Smith Product Testing Unit SCS, EAP Phone: 564-669-4335	Project Manager	Writes the QAPP. Coordinates with client and laboratory, Oversees purchase of products, data entry. Conducts QA review of these entries. Oversees online sampling and submission of samples to the lab. Conducts QA review of data, analyzes and interprets data, and enters data into PTDB. Writes a report to include a data quality assessment and laboratory test results.
Amy Salamone Product Testing Unit SCS, EAP Phone: 564-669-1760	Assistant Project Manager	Reviews the QAPP. Assists with analysis and interpretation of data and entry into PTDB. Reviews the report.
Jenna Rushing Product Testing Unit SCS, EAP Phone: 360-407-6492	Sample Prep Lead	Leads purchasing, entering purchases and products into PTDB, chain of custody, transport of samples to/from laboratory, and assists with conducting QA review of data entry.
Sara Sekerak Product Testing Unit SCS, EAP Phone: 360-480-9501	Unit Supervisor for Project Manager	Reviews the project scope and budget. Provides internal review of the QAPP, tracks progress, approves the budget, and approves the final QAPP
Jessica Archer SCS, EAP Phone: 360-890-2721	Section Manager for Project Manager	Reviews the project scope and budget, approves peer reviewer of draft QAPP, and approves the final QAPP
Christina Frans MEL Phone: 360-995-2473	MEL QA Coordinator	Reviews QAPP and completes data validation.
Dean Momohara MEL Phone: 360-871-8801	Acting Director	Reviews and approves the final QAPP.
Arati Kaza Phone: 360-407-6964	QA Officer, Ecology	Reviews and approves the draft QAPP and the final QAPP.

EAP: Environmental Assessment Program
HWTR: Hazardous Waste and Toxics Reduction Program
MEL: Manchester Environmental Laboratory
PTDB: Product Testing Database
QAPP: Quality Assurance Project Plan
SCS: Statewide Coordination section

5.4 Proposed project schedule

Table 2. Schedule for completing product collection, data entry, and screening.

Task	Due date	Lead staff
Product purchase complete	July 21, 2023	Lyndsey Smith
Product receiving complete	Aug 18, 2023	Lyndsey Smith
Product data entry complete	Aug 22, 2023	Lyndsey Smith
Product data entry QA	Aug 31, 2023	Jenna Rushing
Component screening complete	Sept 22, 2023	Jenna Rushing

Table 3. Schedule for sending samples to the lab and lab analysis.

Task	Due date	Lead staff
Samples sent to MEL complete	Sept 29, 2023	Jenna Rushing
Transfer of product multiples to AGO	Oct 31, 2023	Jenna Rushing
All lab analyses complete	Dec 29, 2023	MEL

Table 4. Schedule for data and study reviews.

Task	Due date	Lead staff
Lab data validation	Mar 18, 2024	Christina Frans
Lab data QA reviewed	Mar 28, 2024	Lyndsey Smith
Lab data loaded into internal PTDB	Apr 1, 2024	Lyndsey Smith
PTDB Study QA review complete	Apr 8, 2024	Jenna Rushing
Lab data QA review with AGO	Apr 16, 2024	Lyndsey Smith

QA: Quality Assurance
PTDB: Product testing Database

Table 5. Schedule for report and final data transfer to the client.

Task	Due date	Lead staff
Draft due to supervisor/peer reviewer	May 31, 2024	Lyndsey Smith
Final draft and data transfer to AGO	June 28, 2024	Lyndsey Smith
Final report published on web	TBD	Publications Team

5.5 Budget and funding

The estimated study budget is displayed in Tables 6 and 7. The AGO provides funding for this study.

Table 6. 2023 Study budget for purchasing products.

Activity	Number of Products	Estimated Cost per Product	Subtotal Cost
Purchase school supply products	80	$20.00	**$1600.00**

Table 7. 2023 Study budget for laboratory analysis.

Analyte	Number of Lab Samples	Lab QC Samples*	Estimated Cost Per Sample	Subtotal Cost
Metals: Lead, Cadmium	60	12	$105.00	$7560.00
Data Validation	60	-	-	$2000.00

Note. Study Total = $11,160.00 (Estimate based on up to 80 purchased products, 60 product samples, and 12 QC samples, and data validation at a Stage 3). Not to exceed $12,000.
*Quality Control (QC) samples in this table are those not provided free of charge (matrix spike, matrix spike duplicate, and sample duplicate).

6.0 Quality Objectives

6.2 Measurement quality objectives

Table 8. 2023 Measurement quality objectives.

Analyte	LCS (% recovery)	Matrix Spikes (% recovery)	Sample and LCS Duplicates (RPD)	Matrix Spike Duplicates (RPD)	Lowest Concentration of interest (ppm)
Metals: Lead, Cadmium	85-115%	75-125%	≤ 20%	≤ 20%	1.0

LCS: Laboratory control standard
RPD: Relative percent difference
ppm: parts per million

7.0 Study Design

7.1 Study boundaries

School supply products available to Washington state residents online will be considered for selection in the 2023 study (section 3.2). Product selection of school supplies marketed and sold for use by children 12 years or younger will follow the strategy used in Ecology's previous product testing school supply studies (Trumbull et al. 2017; Sekerak 2017; Sekerak 2019; Trumbull 2019; Trumbull 2021). To collect four product multiples that are the most similar, purchasing will be limited to those items that are available and shipped from the same seller in the same purchase event. Purchase events for school supplies online will begin in the weeks following the July 4th holiday when retailers increase types of merchandise geared toward the upcoming school year.

Products purchased for this study will be documented in the PTDB, then one of the four product multiples will be sealed and stored for later transfer to the AGO. One product multiple will be processed into components for XRF screening. XRF screening levels for lead and cadmium will be used to prioritize specific component samples (for example, a metal zipper or fabric case material) to select for lab testing. Once a component has been selected for lab testing, the same component from the remaining two product multiples will also be processed for lab testing. Multiple component samples from one product may be composited to meet sample weight testing requirements.

7.4 Assumptions underlying study design

Products collected for this study will reflect products available online to Washington residents at the time of purchase. Manufacturing formulations are subject to change, and similar or the same products may generate different analytical lab results depending on how and when the product was manufactured.

Items will be purchased in multiples of four for this study. Product multiples purchased and shipped from the same location are assumed to be manufactured with the same materials.

All purchases for this study will be made online. It is assumed that orders will be fulfilled with the same products advertised on the website.

8.0 Field Procedures

8.3 Containers, preservation methods, holding times

Sample containers, minimum quantity, storage and preservation, and holding times for sample matrices are shown in Table 9. Hand-reduced lab samples will be stored in certified clean wide-mouth glass jars with Teflon-lined lids.

Table 9. Sample containers, preservation, and holding times‡.

Analyte	Matrix	Minimum Quantity^	Container	Sample Storage and Preservative*	Estimated Holding Time*
Metals: Lead, Cadmium	Metal, plastic, fabric	0.25 to 1 gram	4 to 8 oz. glass jar	Ambient to reduced temperature	1 year

‡Table conveys information from the original QAPP.
^A greater minimum quantity may be needed for samples with lab sample duplicates and matrix spike/matrix spike duplicate samples.
*No demonstrated maximum holding times or preservation methods have been established for product matrices.

9.0 Laboratory Procedures

9.1 Lab procedures table

Ecology's Manchester Environmental Laboratory (MEL) will conduct the metal analysis. The procedures described below are consistent with those used in previous Ecology school supply studies.

Table 10. Measurement methods (laboratory).

Analyte	Sample Matrix	2023 Study Sample Number	Expected Range of Results^	Detection or Reporting Limit+	Preparation Method	Analytical Method
Metals: Lead, Cadmium	Metals, Plastics, Fabrics	60 samples	1 ppm to 8,560 ppm	1 ppm	EPA 3052*	EPA 6020B

^Based on data from previous Ecology product testing school supply studies.
+Individual reporting limits may vary based on specific analyte and matrix types.
*Preparation method modified to omit hydrofluoric acid (HF).
ppm: parts per million.

9.2 Sample preparation method(s)

The preparation of product components into samples for XRF screening and processing of product components into lab samples for lead and cadmium analysis is detailed in the original QAPP. For this study, only components from one of the four product multiples will be screened by XRF.

10.0 Quality Control Procedures

10.1 Table of field and laboratory quality control

The lab QC samples have associated MQOs (section 6.2) that will be used to evaluate the quality and usability of the sample results.

Table 11. Quality control samples, types, and frequency‡.

Analyte	Laboratory Method Blanks	Laboratory Sample Duplicates	Laboratory Control Standards/ Laboratory Control Standard Duplicates	Laboratory Matrix Spikes/Matrix Spike Duplicates
Metals: lead, cadmium	1/batch	1/batch	1 set/batch	1 set/batch

Lab batch: 18 product components or fewer and typically matrix matched[1]
‡Table conveys information from the original QAPP

[1] Batch sizes will be a maximum of 18 product component samples to adjust for microwave prep method size limitations.

12.0 Audits and Reports

12.4 Responsibility for reports

The project manager, with assistance from the project assistant, will write a final report detailing the findings of the study.

13.0 Data Verification

13.2 Laboratory data verification

Lab data verification evaluates a specific data set's completeness, correctness, and conformance/compliance against the method, procedural, or contractual requirements. The project manager will review data packages and data validation reports and conduct a QA review of the data to assess suitability. The project manager, with guidance from Ecology's QA Officer, will be responsible for the final acceptance of lab data. Based on these verification assessments, the data will be either accepted, accepted with qualifications, rejected with re-analysis considered, or rejected without re-analysis considered.

13.3 Validation requirements, if necessary

Lab data validation is an analyte- and sample-specific process that extends the evaluation of data beyond data verification to determine the analytical quality of a specific data set. A Stage 3 validation of data for analyses by EPA 6020B will be performed by the MEL QA Coordinator. The Stage 3 validation follows this QAPP, EPA National Functional Guidelines for Inorganic Data Review (EPA 2020), and EPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (EPA 2009).

The Stage 3 data validation report is to address the following assessments:

- Sample receipt and holding conditions.
- Project reporting limits stated in Table 10.
- Project MQOs stated in Table 8, including objectives for method blanks, laboratory control sample recoveries, duplicate analyses, and matrix spike and matrix spike duplicate recoveries.
- Checks and recalculations for initial calibration standards and blanks and continuing calibration verification standards and blanks.

The project manager will review the data validation reports and, with guidance from Ecology's QA Officer, will determine the final acceptance of lab data. Based on these validation and verification assessments, the data will be either accepted, accepted with qualifications, rejected with re-analysis considered, or rejected without re-analysis considered.

15.0 References

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16.0 Appendix. Glossaries, Acronyms, and Abbreviations

Glossary of General Term

Ambient: Background or away from point sources of contamination. Surrounding environmental condition.

Acronyms and Abbreviations

AGO Washington State Attorney General's Office
CAS Chemical Abstracts Service
CPSC U.S. Consumer Product Safety Commission
CPSIA U.S. Consumer Product Safety Improvement Act
CSPA Washington State Children's Safe Products Act
e.g. For example
EAP Ecology's Environmental Assessment Program
Ecology Washington State Department of Ecology
EPA U.S. Environmental Protection Agency
et al. And others
i.e. In other words
MEL Manchester Environmental Laboratory
MQO Measurement quality objective
PPE Personal Protective Equipment
ppm parts per million
PTDB Ecology's Product Testing Database
QA Quality assurance
QAPP Quality assurance project plan
QC Quality control
RCW Revised Code of Washington
RPD Relative percent difference
SDS Safety Data Sheet
SOP Standard operating procedure
WAC Washington Administrative Code
XRF X-ray fluorescence

Units of Measurement

mm millimeter
mg/kg milligrams per kilogram (parts per million)

Quality Assurance Glossary

Accreditation: A certification process for laboratories, designed to evaluate and document a lab's ability to perform analytical methods and produce acceptable data. For Ecology, it is "Formal recognition by (Ecology)…that an environmental laboratory is capable of producing accurate analytical data." [WAC 173-50-040] (Kammin 2010).

Accuracy: The degree to which a measured value agrees with the true value of the measured property. USEPA recommends that this term not be used, and that the terms *precision* and *bias* be used to convey the information associated with the term *accuracy* (USGS 1998).

Analyte: An element, ion, compound, or chemical moiety (pH, alkalinity) which is to be determined. The definition can be expanded to include organisms, e.g., fecal coliform, Klebsiella (Kammin 2010).

Bias: The difference between the sample mean and the true value. Bias usually describes a systematic difference reproducible over time and is characteristic of both the measurement system and the analyte(s) being measured. Bias is a commonly used data quality indicator (DQI) (Kammin 2010; Ecology 2004).

Blank: A synthetic sample, free of the analyte(s) of interest. For example, in water analysis, pure water is used for the blank. In chemical analysis, a blank is used to estimate the analytical response to all factors other than the analyte in the sample. In general, blanks are used to assess possible contamination or inadvertent introduction of analyte during various stages of the sampling and analytical process (USGS 1998).

Calibration: The process of establishing the relationship between the response of a measurement system and the concentration of the parameter being measured (Ecology 2004).

Check standard: A substance or reference material obtained from a source independent from the source of the calibration standard; used to assess bias for an analytical method. This is an obsolete term, and its use is highly discouraged. See Calibration Verification Standards, Lab Control Samples (LCS), Certified Reference Materials (CRM), and/or spiked blanks. These are all check standards but should be referred to by their actual designator, e.g., CRM, LCS (Kammin 2010; Ecology 2004).

Comparability: The degree to which different methods, data sets and/or decisions agree or can be represented as similar; a data quality indicator (USEPA 1997).

Completeness: The amount of valid data obtained from a project compared to the planned amount. Usually expressed as a percentage. A data quality indicator (USEPA 1997).

Continuing Calibration Verification Standard (CCV): A quality control (QC) sample analyzed with samples to check for acceptable bias in the measurement system. The CCV is usually a

midpoint calibration standard that is re-run at an established frequency during the course of an analytical run (Kammin 2010).

Control chart: A graphical representation of quality control results demonstrating the performance of an aspect of a measurement system (Kammin 2010; Ecology 2004).

Control limits: Statistical warning and action limits calculated based on control charts. Warning limits are generally set at +/- 2 standard deviations from the mean, action limits at +/- 3 standard deviations from the mean (Kammin 2010).

Data integrity: A qualitative DQI that evaluates the extent to which a data set contains data that is misrepresented, falsified, or deliberately misleading (Kammin 2010).

Data quality indicators (DQI): Commonly used measures of acceptability for environmental data. The principal DQIs are precision, bias, representativeness, comparability, completeness, sensitivity, and integrity (USEPA 2006).

Data quality objectives (DQO): Qualitative and quantitative statements derived from systematic planning processes that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (USEPA 2006).

Data set: A grouping of samples organized by date, time, analyte, etc. (Kammin 2010).

Data validation: An analyte-specific and sample-specific process that extends the evaluation of data beyond data verification to determine the usability of a specific data set. It involves a detailed examination of the data package, using both professional judgment and objective criteria, to determine whether the MQOs for precision, bias, and sensitivity have been met. It may also include an assessment of completeness, representativeness, comparability, and integrity, as these criteria relate to the usability of the data set. Ecology considers four key criteria to determine if data validation has actually occurred. These are:

- Use of raw or instrument data for evaluation.
- Use of third-party assessors.
- Data set is complex.
- Use of EPA Functional Guidelines or equivalent for review.

Examples of data types commonly validated are:

- Gas Chromatography (GC).
- Gas Chromatography-Mass Spectrometry (GC-MS).
- Inductively Coupled Plasma (ICP).

The end result of a formal validation process is a determination of usability that assigns qualifiers to indicate usability status for every measurement result. These qualifiers include:

- No qualifier – data are usable for intended purposes.
- J (or a J variant) – data are estimated, may be usable, may be biased high or low.
- REJ – data are rejected, cannot be used for intended purposes.
  (Kammin 2010; Ecology 2004).

Data verification: Examination of a data set for errors or omissions, and assessment of the Data Quality Indicators related to that data set for compliance with acceptance criteria (MQOs). Verification is a detailed quality review of a data set (Ecology 2004).

Detection limit (limit of detection)**:** The concentration or amount of an analyte which can be determined to a specified level of certainty to be greater than zero (Ecology 2004).

Duplicate samples: Two samples taken from and representative of the same population, and carried through and steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variability of all method activities including sampling and analysis (USEPA 1997).

Field blank: A blank used to obtain information on contamination introduced during sample collection, storage, and transport (Ecology 2004).

Initial Calibration Verification Standard (ICV): A QC sample prepared independently of calibration standards and analyzed along with the samples to check for acceptable bias in the measurement system. The ICV is analyzed prior to the analysis of any samples (Kammin 2010).

Laboratory Control Sample (LCS): A sample of known composition prepared using contaminant-free water or an inert solid that is spiked with analytes of interest at the midpoint of the calibration curve or at the level of concern. It is prepared and analyzed in the same batch of regular samples using the same sample preparation method, reagents, and analytical methods employed for regular samples (USEPA 1997).

Matrix spike: A QC sample prepared by adding a known amount of the target analyte(s) to an aliquot of a sample to check for bias due to interference or matrix effects (Ecology 2004).

Measurement Quality Objectives (MQOs)**:** Performance or acceptance criteria for individual data quality indicators, usually including precision, bias, sensitivity, completeness, comparability, and representativeness (USEPA 2006).

Measurement result: A value obtained by performing the procedure described in a method (Ecology 2004).

Method: A formalized group of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, data analysis), systematically presented in the order in which they are to be executed (EPA 1997).

Method blank: A blank prepared to represent the sample matrix, prepared and analyzed with a batch of samples. A method blank will contain all reagents used in the preparation of a sample, and the same preparation process is used for the method blank and samples (Ecology 2004; Kammin 2010).

Method Detection Limit (MDL): This definition for detection was first formally advanced in 40CFR 136, October 26, 1984 edition. MDL is defined there as the minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, and reported to be greater than zero (Federal Register October 26, 1984).

Percent Relative Standard Deviation (%RSD): A statistic used to evaluate precision in environmental analysis. It is determined in the following manner:

%RSD = (100 * s)/x

where s is the sample standard deviation and x is the mean of results from more than two replicate samples (Kammin 2010).

Parameter: A specified characteristic of a population or sample. Also, an analyte or grouping of analytes. Benzene and nitrate + nitrite are all parameters (Kammin 2010; Ecology 2004).

Population: The hypothetical set of all possible observations of the type being investigated (Ecology 2004).

Precision: The extent of random variability among replicate measurements of the same property; a data quality indicator (USGS 1998).

Quality assurance (QA): A set of activities designed to establish and document the reliability and usability of measurement data (Kammin 2010).

Quality Assurance Project Plan (QAPP): A document that describes the objectives of a project, and the processes and activities necessary to develop data that will support those objectives (Kammin 2010; Ecology 2004).

Quality control (QC): The routine application of measurement and statistical procedures to assess the accuracy of measurement data (Ecology 2004).

Relative Percent Difference (RPD): RPD is commonly used to evaluate precision. The following formula is used:

[Abs(a-b)/((a + b)/2)] * 100

where “Abs()” is absolute value and a and b are results for the two replicate samples. RPD can be used only with 2 values. Percent Relative Standard Deviation is (%RSD) is used if there are results for more than 2 replicate samples (Ecology 2004).

Replicate samples: Two or more samples taken from the environment at the same time and place, using the same protocols. Replicates are used to estimate the random variability of the material sampled (USGS 1998).

Representativeness: The degree to which a sample reflects the population from which it is taken; a data quality indicator (USGS 1998).

Sample (field): A portion of a population (environmental entity) that is measured and assumed to represent the entire population (USGS 1998).

Sample (statistical): A finite part or subset of a statistical population (USEPA 1997).

Sensitivity: In general, denotes the rate at which the analytical response (e.g., absorbance, volume, meter reading) varies with the concentration of the parameter being determined. In a specialized sense, it has the same meaning as the detection limit (Ecology 2004).

Spiked blank: A specified amount of reagent blank fortified with a known mass of the target analyte(s); usually used to assess the recovery efficiency of the method (USEPA 1997).

Spiked sample: A sample prepared by adding a known mass of target analyte(s) to a specified amount of matrix sample for which an independent estimate of target analyte(s) concentration is available. Spiked samples can be used to determine the effect of the matrix on a method’s recovery efficiency (USEPA 1997).

Split sample: A discrete sample subdivided into portions, usually duplicates (Kammin 2010).

Standard Operating Procedure (SOP): A document which describes in detail a reproducible and repeatable organized activity (Kammin 2010).

Surrogate: For environmental chemistry, a surrogate is a substance with properties similar to those of the target analyte(s). Surrogates are unlikely to be native to environmental samples. They are added to environmental samples for quality control purposes, to track extraction efficiency and/or measure analyte recovery. Deuterated organic compounds are examples of surrogates commonly used in organic compound analysis (Kammin 2010).

Systematic planning: A step-wise process which develops a clear description of the goals and objectives of a project, and produces decisions on the type, quantity, and quality of data that will be needed to meet those goals and objectives. The DQO process is a specialized type of systematic planning (USEPA 2006).

References for QA Glossary

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