DEPARTMENT OF ECOLOGY
State of Washington

Quality Assurance Project Plan

Assessment of Lead and Cadmium in Children's Jewelry

May 2025

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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: 564-669-3028

Washington State Department of Ecology – https://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

[1] https://apps.ecology.wa.gov/consumerproducts/

Quality Assurance Project Plan

Lead and Cadmium in Children's Jewelry 2025

By Lyndsey Smith

May 2025

Approved by:

Signature: Date:

Kimberly Grieves, Policy Partner, Unit Supervisor, HWTR Program, HQ Office

Signature: Date:

Richelle Perez, Policy Partner's Section Manager, HWTR Program, HQ Office

Signature: Date:

Lyndsey Smith, Author / Project Manager, EAP

Signature: Date:

Jenna Rushing, Sample Prep Lead, EAP

Signature: Date:

Sara Sekerak, Author's Unit Supervisor, EAP

Signature: Date:

Jess Archer, Author's Section Manager, EAP

Signature: Date:

Rob Waldrop, Director, Manchester Environmental Lab, EAP

Signature: Date:

Christina Frans, Ecology Quality Assurance Officer, EAP

EAP: Environmental Assessment Program
P2RA: Pollution Prevention & Regulatory Assistance
HWTR: Hazardous Waste and Toxics Reduction Program

Signatures are not available on the Internet version.

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2.0 Abstract

The Washington State Department of Ecology (Ecology) will conduct a study in 2025 to evaluate the presence of lead and cadmium in children's jewelry. This study will be used to assess manufacturer compliance with the Children's Safe Products Act (CSPA). Ecology will purchase approximately 50 inexpensive children's jewelry products, including necklaces, bracelets, and hair accessories marketed or sold for use by children 12 years of age or younger. Up to 60 product component samples will be tested for lead and cadmium. Products will be purchased from local area retail stores that sell products to people in the state of Washington.

Study data will be provided to the CSPA Compliance Lead to evaluate manufacturer compliance. A final report summarizing the findings will be published in 2025. All lab data will be made available in Ecology's Consumer Products Database.

3.0 Background

3.1 Introduction and problem statement

Children can be exposed to lead or cadmium in jewelry by frequent hand-to-mouth contact after handling jewelry, putting jewelry in their mouth, biting or sucking on jewelry, and swallowing jewelry (Minnesota 2023). Children are more vulnerable than adults when exposed to toxic chemicals. Their bodies are actively growing and developing and are exposed more in relation to their smaller body weight.

Washington's Legislature passed the CSPA in 2008. The law (Chapter 70A.430 RCW) applies to children's products sold in Washington state. It sets limits on the presence of toxic chemicals, including lead, cadmium, phthalates, and flame retardants in children's products. In 2011, the Children's Safe Product Rule (Chapter 173-334 WAC) further established a requirement for manufacturers to report chemicals of high concern to children (CHCC) present in their products.

Ecology regularly conducts studies to support Washington's CSPA. Ecology's researchers design product testing studies to find, purchase, and test products for the presence of restricted chemicals. Ecology's CSPA enforcement lead uses the results of the studies to evaluate manufacturer compliance. Ecology has conducted multiple studies to assess children's jewelry for lead, cadmium, and other CHCC metals.

This Quality Assurance Project Plan (QAPP) describes the methods of conducting a product testing study to assess lead and cadmium levels in children's jewelry currently available for purchase in Washington.

3.2 Study area and surroundings

This study will focus on inexpensive children's jewelry designed to be worn by children 12 years and younger. Children's jewelry is defined by RCW 70A.430.010[2] as jewelry that is made for,

[2] https://app.leg.wa.gov/RCW/default.aspx?cite=70A.430.010&pdf=true

marketed for use by, or marketed to children under the age of 12. Jewelry is defined in the ASTM F2923-20[3] as a product principally designed and intended as an ornament worn by a person.

For this study, jewelry that meets any of the following conditions shall be considered children's jewelry:

- Represented by packaging, display, or advertising as appropriate for use by children under the age of 12.
- Sold in conjunction with, attached to, or packaged with other products that are packaged, displayed, or advertised as appropriate for use by children.
- Sized for children and not intended for use by adults; or
- Sold in any of the following:
    1. Retail store where products are packaged, displayed, or advertised as appropriate for use by children; or
    2. A discrete portion of a retail store where products are packaged, displayed, or advertised as appropriate for use by children.

For this study, inexpensive jewelry is defined as individual jewelry pieces costing $5 or less and multipacks with multiple jewelry pieces costing $15 or less. Inexpensive jewelry might be fashioned entirely of metal or plastic, or contain components of both these materials. The type and quality of metals can vary widely, and the jewelry can be adorned with inexpensive gems and stones, plastic beading, or be painted to add decorative attributes (Sekerak 2015).

Products available to Washington state residents that meet the conditions for inexpensive children's jewelry, as defined above, may be included in this study. In-store purchases will be from retail stores located in the Puget Sound area. Retail stores with locations that are also accessible to most Washington residents will be prioritized.

3.2.1 History of study area

Lead and cadmium are toxic metals that may be found in children's jewelry. Although there is limited information on toxicity from skin contact with lead or cadmium, there are serious and potentially fatal risks from ingesting lead or cadmium.

In many cases, lead and cadmium are likely present in jewelry as unintended contaminants.

Historically, manufacturers used lead and cadmium to make jewelry because of the metals' distinct qualities. Where regulations are not as tight, lead and cadmium may still be used to manufacture inexpensive or costume jewelry.

Lead exposure in children can lead to brain and nervous system damage, resulting in slowed growth and development, learning and behavior problems, as well as hearing and speech problems (CDC 2020b). For children less than six years old, the health effects of lead exposure

[3] https://store.astm.org/f2923-20.html

can be more harmful because they are still developing and growing rapidly (CDC 2020a). Lead has a sweet taste that may encourage children to repeatedly chew or suck on lead-containing jewelry (Canada 2021b). It has been demonstrated that if swallowed, jewelry containing lead may become lodged in the stomach or gastrointestinal tract and result in the release of large amounts of lead over time. Several cases of lead poisoning in children have been linked to children's jewelry. In 2006, a child in Minnesota died of lead poisoning after swallowing a children's charm with a high lead content.

Cadmium and its compounds are known carcinogens. Long-term exposure to low levels of cadmium in air, food, or water can lead to kidney damage, lung damage, and fragile bones. Ingested cadmium has been associated with harmful effects on the kidneys, liver, cardiovascular system, and immune system. Reproductive, developmental, and neurological impacts have also been associated with cadmium ingestion (ATSDR 2012).

In 2008, the United States Congress passed the Consumer Product Safety Improvement Act (CPSIA) of 2008, restricting total lead content in children's products to 100 ppm in accessible parts and 90 ppm in surface paints. This law also enabled testing children's jewelry for other heavy metals such as cadmium. Cadmium was limited to 75 ppm extractable or soluble cadmium from metal or plastic components of children's jewelry.

3.2.2 Summary of previous studies and existing data

Ecology Studies

In 2015, Ecology conducted a study to evaluate the presence of cadmium, lead, and five other toxic metals (antimony, arsenic, cobalt, mercury, molybdenum) in children's jewelry. Findings from the 2015 study showed that necklaces sold with children's dresses contained high percentage levels of cadmium, ranging from 39.7% to 98.4%. Lead was also detected in 97% of the samples. The highest concentration of lead, at 5%, was also found in a necklace component sold with a child's dress (Sekerak 2016).

In 2018, Ecology conducted a follow-up study to assess compliance for specific jewelry identified in the 2015 study. A total of 38 samples from 33 products were tested. A total of 11 samples contained cadmium above the 40 ppm restriction limit, and seven samples contained lead above the 90 ppm restriction limit (Nelson 2023).

Literature review of studies in the U.S and other countries

Below is a list of studies that report on the presence of lead and cadmium in jewelry in the U.S. and other parts of the world:

- Adie et. al tested bangles, earrings, bracelets, necklaces, pendants, and rings purchased from retail shops in Nigeria. High levels of cadmium were found across all types of jewelry tested (Adie et al. 2020).
- Kern et al. used X-ray Fluorescence to screen jewelry purchased at discount jewelry stores. They identified cadmium in 40% of the screened items. They conducted leaching studies on nine jewelry items with high cadmium readings and found seven of nine had cadmium leachate above the U.S. recommended maximum of 18 micrograms (Kern et al. 2021).

- Negev et al. conducted a survey of 35 items of children's jewelry in Israel and found 17% of the samples exceeded the ASTM standard for lead (Negev et al. 2022).
- Murphy et al. conducted a study of 89 jewelry products in Cambodia and found that jewelry clasps of necklaces contained the highest levels of lead. Lead was also found in other jewelry pieces such as hairclips, earrings, necklaces, bracelets, rings, and anklets (Murphy et al. 2016).
- Guney and Zagury conducted a study on children's jewelry and toys and found the highest levels of total lead and cadmium in metallic components of children's jewelry. A metal rose from a jewelry piece had the highest lead concentration, and a metal jewelry pendant had the highest concentration of cadmium (Guney and Zagury 2013).
- Weidenhamer and Clement conducted a study testing a total of 139 jewelry items, where 42.6% of the items were found to be heavily leaded (Weidenhamer and Clement 2007a, 2007b).

Organizational studies and investigations

Health Canada inspectors completed a compliance verification project in 2020-2021, testing 36 different jewelry products for lead and cadmium compliance. This resulted in six products (charms, pendants, necklaces, and earrings) being voluntarily recalled (Canada 2021a).

Coordinated Activities on Product Safety (CASP) Europe completed a study testing 179 samples of both adult and children's jewelry, purchased online from multiple countries in Europe. Thirteen of 51 children's products tested did not meet Europe's regulation criteria for lead, cadmium, and nickel. Most of the children's products that did not meet the criteria were necklaces, pendants, and earrings (EC 2021).

The Department of Toxic Substances Control (DTSC) in California found jewelry for adults and children with high levels of lead in 2017. Most of the children's jewelry products were hair accessories (clips, hair ties and bands, tiaras), bracelets with charms, necklaces with metallic charms or pendants (pearl, fabric), and earrings (DTSC 2023).

The Canadian Broadcasting Corporation (CBC) marketplace investigated the testing of more than 50 necklaces, bracelets, and earrings purchased from various retailers in 2016. They found seven items with high levels of cadmium. A metal pendant from a necklace was found to be nearly 100% cadmium (CBC 2016).

The Center for Environmental Health (CEH) has published reports from 2008 and 2010 showing that higher levels of lead and cadmium were found in metallic necklaces and pendants (CEH 2008, 2010).

3.2.3 Parameters of interest and potential sources

The selected metals listed in Table 1 will be analyzed in this study.

Table 1. Laboratory analytes to be assessed.

Metals	Abbreviation	CAS	Regulation
Lead	Pb	7439-92-1	Restricted to ≤ 90 ppm[1]
Cadmium	Cd	7440-43-9	Restricted to ≤ 40 ppm[2]

CAS = Chemical Abstracts Service
ppm = parts per million
[1]As required by Children's Safe Product Act 70A.430.020 RCW.
[2]As required by Children's Safe Product Act 70A.430.060 RCW.

Cadmium is used to make the coating of children's jewelry shiny and to add weight and mass to each piece (DTSC 2024). Lead is used in making inexpensive jewelry because it is cheap, accessible, and can be easily molded. It has also been identified as a component of recycled metal used to make inexpensive jewelry (Weidenhamer and Clement 2007a/b). Cadmium and lead can also serve as chemical stabilizers or softening additives in plastics.

Jewelry components made with metals or plastics will be tested in the study. Glass components in jewelry will not be tested.

3.2.4 Regulatory criteria or standards

At the federal level, the Consumer Product Safety Commission (CPSC) administers and enforces the Consumer Product Safety Improvement Act (CPSIA). Under CPSIA, children's products must not contain more than 100 parts per million (ppm) total lead content in accessible parts or lead content greater than 90 ppm in paint or similar surface coatings. Accessible parts in toys, including glass, metal, and ceramic parts, are limited to 75 ppm of soluble cadmium content, or 50 ppm for modeling clays that are part of toys.

In Washington state, CSPA limits children's products to a total lead content of 90 ppm and total cadmium content of 40 ppm. The CSPA also requires manufacturers to file an annual report of their children's products that contain chemicals of high concern to children (CHCC) and are offered for sale in Washington State (Chapter 173-334 WAC). Manufacturers are required to submit annual reports to the High Priority Chemicals Data System (HPCDS), which is maintained by the Interstate Chemicals Clearinghouse.[4]

[4] Manufacture data reported into the HPCDS was not reviewed as a part of this study plan.

Links to information on rules and regulations pertaining to lead or cadmium in jewelry in other states are listed below:

California: Health and Safety Code § 25214.1-25214.4.2 (Metal-Containing Jewelry Law)[5]

Connecticut: General Statutes of Connecticut §21a-12d 'Children's Jewelry Containing Cadmium: Prohibition; Enforcement', (Public Act 10-113)[6]

Illinois: Public Act 096-1379 (Cadmium Safe Kids Act)[7]

Minnesota: Sec. 24. [325E.3892] Lead and Cadmium in Consumer Products; Prohibition[8]

Maryland: Environment, §6-1401 through §6-1404 'Cadmium in Children's Jewelry'[9]

3.3 Water quality impairment studies

Not applicable to this study.

3.4 Effectiveness monitoring studies

Not applicable to this study.

[5] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200SB647
[6] https://www.cga.ct.gov/current/pub/chap_416.htm#sec_21a-12d
[7] https://www.ilga.gov/legislation/publicacts/fulltext.asp?Name=096-1379
[8] https://www.revisor.mn.gov/laws/2023/0/Session+Law/Chapter/60/
[9] https://mgaleg.maryland.gov/2011rs/chapters_noln/Ch_578_hb0145E.pdf

4.0 Project Description

This study will assess levels of lead and cadmium in jewelry marketed and sold for use by children 12 years of age or younger. Products are limited to those available to Washington state residents in retail stores. Samples will be submitted to Ecology's Manchester Environmental Laboratory (MEL) for metals analysis by EPA Method 6020B by inductively coupled plasma mass spectrometry (ICP-MS). Laboratory data will be reviewed for quality assurance and made publicly available in the Consumer Products Database (CPD). A report documenting study findings and a data narrative will be provided to the CSPA compliance lead.

4.1 Project goals

This study is designed to meet the following goals:

- Assess the levels of lead and cadmium in children's jewelry available for sale in Washington.
- Provide data to Ecology's CSPA compliance lead to assess limit violations.

4.2 Project objectives

Study goals will be met through the following objectives:

- Purchase up to 50 articles of inexpensive children's jewelry available for sale in Washington.
- Select up to 60 samples for laboratory analysis of total lead and cadmium.

4.3 Information needed and sources

A literature review of existing studies, previous Ecology studies, and recall data on children's jewelry will be completed prior to purchasing events to assist in selecting product categories most likely to contain lead and cadmium. Information such as product UPCs, product brands, and design patterns from products with past violations will also be reviewed to identify similar products available in the current market.

4.4 Tasks required

The following tasks will be performed for this study:

- Review previous Ecology studies, research literature, and available recall data of children's jewelry to prioritize categories of jewelry for purchase.
- Conduct in-store and online searches for the availability of children's jewelry and prioritize jewelry products for purchase.
- Purchase up to 50 inexpensive children's jewelry products.
- Document purchasing information, product details, and product component descriptions in the database.

- Screen product components using X-ray Fluorescence (XRF) to prioritize samples for lab analysis.
- Submit up to 60 component samples for analysis of lead and cadmium at MEL.
- Perform appropriate data verification and review data validation report(s).
- Document validated and qualified lab analysis data in the database.
- Perform a QA review of product and lab analysis data.
- Analyze study data and write a report for publication by Ecology.
- Publish laboratory data and product information in Ecology's Consumer Product Database.

4.5 Systematic planning process

This QAPP addresses comprehensive systematic planning for this study.

5.0 Organization and Schedule

5.1 Key individuals and their responsibilities

Table 2 shows the responsibilities of those who will be involved in this project.

Table 2. Organization of project staff and responsibilities.

Staff[1]	Title	Responsibilities
Kimberly Grieves Consumer Product Regulatory Unit, HWTR Program Phone: 360-584-3456	Unit Supervisor of Consumer Product Regulatory Unit	Clarifies scope and informational needs of the project. Reviews draft QAPP and approves final QAPP. Reviews draft report. Oversees staff for CSPA compliance assessment and enforcement actions.
Lyndsey Smith Product Studies Unit SC Section, EAP Phone: 564-669-4335	Project Manager/Principal Investigator	Clarifies scope and design of project. Writes the QAPP. Oversees product sampling, processing, screening, and submission of samples to the laboratory. Leads QA review of product and lab data, analyzes and interprets data, and enters data into the database. Writes the draft and final report.
Jenna Rushing Product Studies Unit SC Section, EAP Phone: 360-407-6492	Sample Prep Lead	Reviews draft QAPP and approves final QAPP. Leads product collection, data entry, sample processing and screening. Enters product, component, and screening data into database. Assists in QA review of project data in the database. Reviews draft report.
Sara Sekarak Product Studies Unit SC Section, EAP Phone: 360-480-9501	Unit Supervisor for Project Manager	Reviews project scope and budget. Reviews draft QAPP and approves final QAPP. Oversees project progress and reviews draft and approves final report.
Jessica Archer SC Section, EAP Phone: 360-407-6698	Section Manager for Project Manager	Reviews project scope and budget. Approves final QAPP
Richelle Perez P2RA, HWTR Program Phone: 360-407-6724	Section Manager for HWTR	Reviews and approves the final QAPP.
Rob Waldrop Manchester Environmental Laboratory Phone: 360-871-8801	Acting Director	Reviews and approves the final QAPP.
Christina Frans Program Manager Unit, EAP Phone: 360-995-2473	Ecology Quality Assurance Officer	Reviews and approves the draft QAPP and the final QAPP.

[1] All staff are from the Washington State Department of Ecology.
EAP = Environmental Assessment Program
HWTR = Hazardous Waste and Toxics Reduction
P2RA = Pollution Prevention and Regulatory Assistance Section;
SC = Statewide Coordination;
QAPP = Quality Assurance Project Plan.

5.2 Special training and certifications

Staff making purchases with an Ecology credit card will complete online training programs and have a signed credit card authorization on file.

All staff will follow appropriate SOPs detailed in Chapters 8 and 9.

5.3 Organization chart

Not Applicable - See Table 2.

5.4 Proposed project schedule

Tables 3 – 6 list key activities, due dates, and lead staff for this project.

Table 3. Schedule for completing product collection and data entry.

Task	Due Date	Lead Staff
Product Purchasing	March 6 – March 20, 2025	Lyndsey Smith/Jenna Rushing
Product data entry complete	March 25, 2025	Jenna Rushing
Product data entry QA	March 28, 2025	Lyndsey Smith

Table 4. Schedule for screening and sending samples to the laboratory.

Task	Due Date	Lead Staff
Screening and sample prep complete	April 7, 2025	Jenna Rushing/Lyndsey Smith
Samples sent to the lab	April 7, 2025	Jenna Rushing/Lyndsey Smith
Lab analysis complete	June 20, 2025	Heidi Chuhran
Lab testing data validation complete	September 20, 2025	John Weakland

Table 5. Schedule for data and study reviews.

Task	Due date	Lead staff
Study data analysis complete	October 16, 2025	PM
Lab testing data entry complete	October 16, 2025	PM
Database QA complete	Prior to report publication	PM

Table 6. Schedule for final report.

Task	Due date	Lead staff
Draft to supervisor	September 20, 2025	PM
Draft to peer reviewer	October 31, 2025	PM
Draft to external reviewers	December 22, 2025	PM
Final draft to publications team	January 13, 2026	PM
Final report due on web	February 24, 2026	EAP Pubs

5.5 Budget and funding

Total estimated costs for this study are presented in Tables 7 and 8. Estimations include costs for product purchasing, laboratory testing, and data validation. Quality control (QC) samples (duplicates, matrix spikes, and matrix spike duplicates) are included in the cost of analysis. This project is funded through the Environmental Assessment Program's product testing budget.

Table 7. Project budget and funding.

Item	Cost ($)
Product Purchasing (up to 50 products)	750
Laboratory analysis	7,920
Budget Total	8,670

Table 8. Laboratory budget details.

Lab analysis	Number of Samples	Lab QC samples*	Total samples	Cost Per Sample ($)	Lab Subtotal ($)
Metals: Lead and Cadmium	60	12	72	110	7,920

*QC for a maximum of four batches (three per batch) is estimated.

6.0 Quality Objectives

6.1 Data quality objectives

The overall data quality objective (DQO) is to provide analytical data that meets all documented precision and bias standards to support CSPA compliance actions. Ecology's product studies follow established Guidelines for Data Verification and Validation of Chemical Data from Ecology's QA Coordinator (Ecology 2024). Lab data used to evaluate compliance will undergo verification and validation as detailed in Chapter 13.

Analytical laboratory testing for the metals listed in Table 1 will follow standard methods that meet measurement quality objectives (MQO) outlined below.

6.2 Measurement quality objectives

6.2.1 Targets for precision, bias, and sensitivity

The MQOs expressed as precision, bias, and sensitivity of metals data are presented in Table 9.

Table 9. Measurement quality objectives for laboratory analyses.

Analyte	LCS (% recovery)	Matrix Spike (% recovery)	Sample, Matrix Spike, and LCS Duplicates (RPD)	Method Blank	Target Reporting Limit[1]
Lead, Cadmium	85–115%	75–125%	≤ 20%	< RL	1 ppm

LCS = laboratory control sample
RL = reporting limit
RPD = relative percent difference
ppm = parts per million
[1] Individual lab reporting limits may vary based on specific matrix type.

6.2.1.1 Precision

Precision is a measure of variability among replicate measurements due to random error. Laboratory precision will be assessed through analysis of one sample duplicate, matrix spike duplicate (MSD), and laboratory control duplicate (LCSD) per analytical batch.

Precision assessments through the collection of product replicates may be conducted when manufacturing lot/batch information is available. This may be used to determine manufacturing consistency at the point of purchase/collection.

Sample splits (replicates) collected during product deconstruction would be measured as the relative percent difference between the two results.

The MQOs are presented in Table 9.

6.2.1.2 Bias

Bias is the difference between the sample mean and the true value. Lab analysis bias will be assessed through lab control samples (LCS) and matrix spike (MS) samples. MQOs for LCS and MS are shown in Table 9.

6.2.1.3 Sensitivity

Sensitivity is a measure of the capability of a method to detect a substance. It is commonly described as a detection or reporting limit. Target reporting limits for all the analytes are shown in Table 9.

6.2.2 Targets for comparability, representativeness, and completeness

6.2.2.1 Comparability

Comparability will be ensured by implementing standardized procedures for sampling and analysis. Data from this study can be compared to publicly available data of similar product types and analyzed using substantially the same analytical methods, if available.

6.2.2.2 Representativeness

Products purchased through retail stores for this study will be representative of children's jewelry available to residents of Washington.

6.2.2.3 Completeness

The project manager will consider purchasing for this study to be complete if 90% of the identified products are collected within the study collection timeframe. The project manager will consider the study to be complete if 95% of the lab samples meet the MQOs in Table 9.

6.3 Acceptance criteria for quality of existing data

Not applicable to this study.

6.4 Model quality objectives

Not applicable to this study.

7.0 Study Design

7.1 Study boundaries

The study will focus on purchasing children's jewelry products from the following categories based on findings from previous studies, HPCDS reporting, and recall information:

- Chains or Necklaces with or without pendants or decorative elements
- Bracelets with or without pendants or decorative elements
- Hair accessories[10] including tiaras or crowns

The table below illustrates the targeted procurement plan:

Table 10. Anticipated purchasing categories of children's jewelry.

Jewelry Category	Number of products
Chains/Necklaces	20
Bracelets	10
Hair accessories	20

Any jewelry items sold with or attached to clothing or shoes can be included as long as 1) the jewelry item can be worn independently by a child, and 2) fits one of the categories above.

Efforts will be made to purchase the number of items within each of the jewelry categories listed in Table 10. Lack of availability may impact the number of products purchased from each category.

7.2 Field data collection

7.2.1 Sampling locations and frequency

Products will be purchased from retail stores in the Puget Sound area of Washington.

Stores will be prioritized for purchasing if they have multiple locations across Washington state, to ensure representation of products available to residents of Washington.

7.2.2 Field parameters and laboratory analytes to be measured

Table 1 lists the laboratory analytes to be measured, and methodology details are in Section 9. There are no field parameters to be measured for this study.

[10] Bobby pins, barrettes, headbands, etc. without a significant decorative element are not hair accessories but are grooming aids. Combs, brushes, and similar items not intended to be worn as an item of personal ornamentation are not hair accessories. Novelty products such as deely boppers are not hair accessories

7.3 Modeling and analysis design

Not applicable to this study.

7.4 Assumptions underlying design

Children's products purchased for this study are assumed to reflect those currently available and on the market for sale to residents of Washington. It is assumed that large retail stores sell similar products at locations throughout Washington.

7.5 Possible challenges and contingencies

The possible logistical challenges, constraints, and schedule limitations for this study are described below.

7.5.1 Logistical problems

Jewelry components are lightweight and may require multiple of the same products to be purchased to ensure a large enough sample for laboratory testing. Purchase options may be restricted due to the need for multiples.

7.5.2 Practical constraints

Researching purchase options and establishing a purchasing schedule will help guide sampling. However, since product availability and shortages are unpredictable, the plan must remain flexible and will include alternatives.

To ensure a large enough sample size for laboratory testing, some products will be purchased in multiples, and similar jewelry components will be combined.

7.5.3 Schedule limitations

Complex matrices may require an extended period of time for laboratory analysis. Additional cleaning or purging tasks can be common when analyzing consumer product samples. Complex data sets may require extended data QA procedures or data validation. Immediate communication about MEL staff or resource shortages and instrument issues will help inform management of schedule and deadline changes.

8.0 Field Procedures

8.1 Invasive species evaluation

Not applicable to this study.

8.2 Measurement and sampling procedures

Product purchasing and processing will follow SOP PTP001 v.2.2 (Ecology 2023). Data entry and data quality assurance will follow SOP PTP002 v.3.0 (Ecology 2025).

If lot or batch information is available, one product replicate will be collected and analyzed. Products collected for this study will be brought to Ecology's Product Studies Preparation Room, where they will be stored and processed under secure holding conditions.

8.2.1 Product selection

Staff will record information about the products and take photos of them within the store. This will include details such as the type of advertisement used to sell the product and the area in the store where the product was found. This will demonstrate that the product is marketed for children. After staff collect all products, they will return to Ecology headquarters and assign a unique product identification number. Additional photos and descriptive notes will be recorded and stored.

Inexpensive children's jewelry products will be purchased from retail stores with multiple locations across Washington.

8.2.2 Product screening and component sample selection

Screening of product component samples will be performed following SOP PTP004 (Ecology 2022b).

Samples will be prioritized for laboratory submission based on XRF screening results.

An effort will be made to maximize the number of products tested. If screening data of multiple components from one product indicate high levels of lead or cadmium, the component with the highest levels will be prioritized. If there are not enough components from different products, multiple components from the same product may be sent to the lab.

If XRF screening does not identify sufficient components with high levels of lead or cadmium, additional components will be selected at random. In this case, the PM may choose a component (metal or plastic) from the product that will minimize the number of batches[11] necessary for analysis.

[11] Different matrices are analyzed in different batches. Each batch may contain up to 20 component samples.

8.3 Containers, preservation methods, holding times

Sample containers, minimum quantity, storage and preservation, and holding times for sample matrices are shown in Table 12.

Table 11. Sample containers, preservation, and holding times.

Parameter	Matrix	Minimum Quantity Required	Container	Preservative	Holding Time
Metals: Lead, Cadmium	Metal, Plastic	2.5 g	4 to 8 oz. glass jars	Ambient temperature	1 year

8.4 Equipment decontamination

Decontamination procedures will follow protocols in SOP PTP001. Product testing staff will clean stainless steel surfaces with 1% Liquinox solution, followed by a 24% ethanol wipe prior to use, and between processing each product. Product testing staff will change into new gloves between processing products. A clean tool will be used in the deconstruction and componentization of each new product.

8.5 Sample ID

Upon entry into the database, individual product component identification codes are automatically assigned as outlined in SOP PTP002. Product IDs convey information about the store of purchase, the purchase event, product number, and component number. For example, "WM-1-3-1" means Walmart store, purchase event 1, product number 3, component number 1 of the product tested.

A Pre-Sampling Notification form will be submitted to MEL prior to the planned submission of samples. MEL will generate a seven-digit work order number (e.g., 1601027) for each sample set for a study. During sample processing at Ecology Headquarters (Lacey, WA), the addition of a two-digit suffix to the work order number will result in a laboratory sample ID number (e.g., 1601027-01, 1601027-02) for each sample (Sekerak 2016).

8.6 Chain of custody

Appropriate chain of custody procedures will be followed according to SOP PTP001. Products gathered for this study will be kept in locked cabinets in Ecology's Product Studies Preparation Room for the duration of the study. Product component samples will be stored in glass sample jars in locked cabinets prior to shipment to MEL for laboratory analysis (Sekerak 2016). A detailed chain of custody form will accompany all samples during shipment to the lab.

8.7 Field log requirements

Product advertisements, photos of in-store marketing, and receipts for purchases will be collected during purchasing events and scanned and saved in the database. Purchasing event information will be entered into the database as outlined in SOP PTP002.

At a minimum, the store name, street address, website address, purchase date, purchase price, brand name, manufacturer name, manufacture date, and distributor name will be recorded in the database for all products in this study. Photographs of in-store marketing, such as store displays and product locations in the store, may be used to show that the products were marketed for children.

8.8 Other activities

Not applicable to this study.

9.0 Laboratory Procedures

9.1 Lab procedures table

The assessment of metals will be performed at MEL following the methods listed in Table 12.

Table 12. Measurement methods (laboratory).

Analyte	Sample Matrix	Expected Range of Results	Target Reporting Limit	Sample Prep Method	Analytical (Instrumental) Method
Metals: Lead, Cadmium	Metals, Plastic	Unknown	1 ppm	EPA 3052*	EPA 6020B

ppm = parts per million
*Preparation method modified to omit use of hydrofluoric acid

9.2 Sample preparation method(s)

Product component sample preparation will follow SOP PTP001. Laboratory sample preparation and digestion will follow EPA Method 3052, without the use of hydrofluoric acid. The omission of hydrofluoric acid is due to the lack of need for silica glass solubilization.

9.3 Special method requirements

Not applicable to this study.

9.4 Laboratories accredited for methods

Ecology's MEL is currently accredited for analysis of lead and cadmium by EPA Method 6020B.

10.0 Quality Control Procedures

10.1 Table of field and laboratory quality control

Table 13 presents the lab QC samples for this study. Lab QC tests will consist of lab control samples, lab control sample duplicates, sample duplicates, method blanks, matrix spikes, and matrix spike duplicates.

Table 13. Quality control samples, types, and frequency.

Analyte	Sample duplicate	LCS/LCSD	Method blanks	MS/MSD
Metals: Lead, Cadmium	1/batch	1/batch	1/batch	1/batch

LCS = lab control sample
LCSD = lab control sample duplicate
MS = matrix spike
MSD = matrix spike duplicate
Batch = 20 samples or fewer

10.2 Corrective action processes

Ecology staff will adhere to the appropriate SOPs and study-specific processing and preparation protocols in this QAPP. MEL staff will document whether the project data meet method QC criteria. The lab will notify the project manager if substantial departures from method techniques will be required. Any departures from stated analytical methods will be documented by the laboratory and described in the case narrative. When MQO or QC criteria are not met, or if the integrity of the processing and preparation processes is in question, the project manager will determine if samples should be re-collected, re-analyzed, rejected, or used with appropriate qualification.

11.0 Data Management Procedures

11.1 Data recording and reporting requirements

Product data logging will follow SOP PTP002 (Ecology 2025). Study data will be stored in Ecology's Consumer Product Database. Study data records will include purchase receipts, product descriptions, product component descriptions, product photos, and laboratory testing data. Purchase and product metadata of store name, street address, website address, purchase date, purchase price, brand name, manufacturer name, and distributor name will be recorded in the database.

XRF data are strictly utilized for internal preliminary screening purposes and are not intended for external use. These methods have not been validated or verified at the matrix-specific level, making them unsuitable for formal analysis or reporting. Additionally, interpreting XRF results requires specialized training, as misinterpretation by untrained users is a significant risk. Consequently, XRF data are not included as part of official project deliverables.

Laboratory data will be received as an analytical report in PDF format and an electronic data deliverable (EDD) or comparable package. The lab data packages will also be sent to MEL's data validator for data validation. The project manager will perform a final QA review of all data before they are uploaded into the Consumer Product Database. All raw data, lab case narratives, and validation reports are managed under appropriate retention criteria.

11.2 Laboratory data package requirements

MEL will provide a Level IV data package to the data validator. The lab data will contain all required specific content, along with sample and QC data. The data package must include all sample raw data, QC sample raw data, and chain of custody forms needed to perform an independent verification of the results and sample handling procedures.

Case narratives will be included to discuss any problems encountered with the analyses, corrective action taken, changes to the requested analytical method, and a glossary for data flags.

11.3 Electronic transfer requirements

Laboratory analytical reports with case narratives will be in PDF format, and EDDs will be in a CSV spreadsheet format that meets Ecology's product testing formatting requirements unless an alternative format is approved in advance by the project manager.

11.4 Data upload procedures

The data for this project will be stored in Ecology's Consumer Products Database according to SOP PTP002 Data Entry and Data Entry Quality Assurance (Ecology 2025).

11.5 Model information management

Not applicable to this study.

12.0 Audits and Reports

12.1 Field, laboratory, and other audits

Analytical labs must participate in performance and system audits of their routine procedures. The product testing process conducted at Ecology will be audited at a minimum of one audit a year.

12.2 Responsible personnel

Ecology's QA Officer or their designee will conduct the product studies process audit. The processes can include product acquisition, product documentation and data entry in the database, sample screening, sample processing, chain of custody, and adherence to product testing QAPPs and SOPs.

12.3 Frequency and distribution of reports

A final published report summarizing the data and findings will be written when the study is completed. The final report will include at a minimum:

- An overview of the study.
- Goals and objectives of the study.
- Discussion of the results.
- Discussion of methods, any corrective actions, and the significance of any problems encountered.
- Summary statistics of the laboratory results from products purchased.
- Summary tables and graphs of laboratory data.

The final report will be available online[12].

12.4 Responsibility for reports

The project manager is responsible for writing the final report as stated in Table 2.

[12]https://apps.ecology.wa.gov/publications/UIPages/PublicationList.aspx?IndexTypeName=Topic&NameValue=Product+Testing&DocumentTypeName=Publication

13.0 Data Verification

13.1 Field data verification, requirements, and responsibilities

The project manager, or assigned designee, will conduct a final review of product purchases, product components, component screening, and additional product metadata in the database. All data will be reviewed by the project manager at several stages during the study according to SOP PTP002.

13.2 Laboratory data verification

Lab data verification is the process of evaluating the completeness, correctness, and conformance/compliance of a specific data set against the method, procedural, or contractual requirements. Lab data used to evaluate compliance will undergo verification by the project manager according to SOP PTP002. 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 is responsible for the final acceptance of lab data and will document all decisions in a case narrative. 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. Data validation requirements for consumer product studies follow established Ecology Guidelines for Data Verification and Validation of Chemical Data (Ecology 2024). A Stage 3 data validation of analyses by EPA 6020B will be performed by MEL's Data Validation Chemist following 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), and MELs validation SOPs.

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

13.4 Model quality assessment

Not applicable to this study.

14.0 Data Quality (Usability) Assessment

14.1 Process for determining project objectives were met

The project manager will examine data from all field and lab procedures to ensure that the data were collected using proper procedures, fall into the expected range of results, and meet quality objectives as described in Sections 6, 8, and 9. The project manager will assess the quality of the data based on case narratives, data packages, and the data validation report. Laboratory QC tests will be examined to determine if the lab met MQOs for method blanks, LCSs, duplicates, matrix spike samples, and surrogates when applicable. Reporting limits will be examined to ensure that the contract-defined reporting limit was met (Sekerak 2016).

If all MQOs and QC criteria are met, the quality of the data will be considered suitable for meeting study objectives. The study will be considered complete and objectives met if 95% of the samples meet MQOs and QC criteria. If a sample does not meet MQOs or any QC criteria, the project manager may apply a "REJ" qualification to the data. The final report for this study will discuss the data quality findings and whether the project objectives were met. If limitations in the data are identified, they will be noted. Analytical data qualifiers that will be used in the Consumer Product Database are described in Table 14.

Table 14. Analytical data qualifiers.

Qualifier Symbol in Consumer Product Database	Qualifier Description
U	Analyte was not detected above the reporting limit.
UJ	Analyte was not detected above the reporting limit. However, the reporting limit is an estimated value.
J	Analyte was positively identified. The reported result is an estimate.
NJ	The analyte was tentatively identified in the sample, but the result value reported is an estimate.
REJ	The sample result was rejected due to serious deficiencies in the ability to analyze the sample, meet quality control criteria, or other technical reasons. The presence or absence of the analyte cannot be verified.

14.2 Treatment of non-detects

Laboratory data will be reported down to the reporting limit, with an associated "U" or "UJ" qualifier for samples below the reporting limit. All samples will be evaluated against the associated method blank for each analytical batch. Sample results less than or equal to 5x of the method blank concentration will be qualified as non-detect due to lab background.

14.3 Data analysis and presentation methods

The final report will include a summary of the results of this study. Simple summary statistics and data will be presented in tables and graphs. Example summary statistics may include minimum, maximum, median, and frequencies of detection.

The report will include a link to the study data available on the Consumer Products Database[13].

14.4 Sampling design evaluation

The samples collected and tested were designed to determine regulatory compliance with CSPA. This study design does not support estimating prevalence in a population, identifying wider areas of contamination, making wider comparisons, or estimating a market parameter. The results of this study may be used to plan future study events with a larger sample size and a wider variety of consumer products, or to establish a follow-up on products tested within this study.

Further use of these data to draw conclusions beyond those reported requires consultation with the principal investigator for this study and QA personnel to assess the need for a QAPP for existing data.

14.5 Documentation of assessment

Documentation of the assessment will be included in the final report.

[13] https://apps.ecology.wa.gov/consumerproducts/

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16.0 Appendices

16.1 Appendix A: Acronyms, Abbreviations, and Quality Assurance Glossary

Acronyms and Abbreviations

CHCC	Chemicals of high concern to children
CPD	Consumer Products Database
CSPA	Washington's Children's Safe Products Act
CSV	Comma separated values
EDD	Electronic data deliverable
e.g.	For example
EAP	Environmental Assessment Program
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
et al.	And others
GC/MS	Gas chromatography mass spectrometry
HPCDS	High Priority Chemicals Data System
HWTR	Hazardous Waste and Toxics Reduction
i.e.	In other words
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
MEL	Manchester Environmental Laboratory
MQO	Measurement quality objective
RL	Reporting Limit
MS	Matrix spike sample
MSD	Matrix Spike duplicate sample
PDF	Portable document format
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RCW	Revised Code of Washington
RPD	Relative percent difference
RSD	Relative standard deviation
SC	Statewide Coordination
SOP	Standard operating procedure
UPC	Universal product code
WAC	Washington Administrative Code
XRF	X-ray Fluorescence

Units of Measurement

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 would be:

- 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 2025).

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 stepwise 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).

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