SAMPLING EQUIPMENT DECONTAMINATION

CONTENTS

CONTENTS (cont'd)

The policies and procedures established in this document are intended solely for the guidance of OLEM employees of the U.S. Environmental Protection Agency (EPA). They are not intended and cannot be relied upon to create any rights, substantive or procedural, enforceable by any party in litigation with the United States. EPA reserves the right to act at variance with these policies and procedures, and to change them at any time without public notice. EPA strongly encourages all readers to verify the validity of the information contained in this document by consulting the most recent Code of Federal Regulations (CFR) and updated guidance documents.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to describe the methods for preventing or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during environmental investigations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

A Quality Assurance Project Plan (QAPP) in Uniform Federal Policy (UFP) format describing the project objectives must be prepared prior to deploying for a sampling event. The sampler needs to ensure the methods used are adequate to satisfy the data quality objectives (DQOs).

The procedures in this SOP may be varied or changed as required, dependent on site conditions, equipment limitations or other procedural limitations. In all instances, the procedures employed must be documented on a Field Change Form and attached to the QAPP. These changes must be documented in the final deliverable.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the possibility of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances. Some equipment may have specific decontamination procedures that do not follow this SOP. Refer to the user manual for each piece of equipment before utilizing this SOP.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes and high and low pressure water cleaning.

The first step is the physical removal of gross contamination on sampling equipment which may include steam or a high pressure water wash. The second step is a soap and water wash that removes the remainder of visible material and residual oils and grease. The third step involves a potable water rinse to remove any detergent, followed by a distilled/deionized water rinse.

For the removal of metals, an acid rinse with a 10% nitric acid solution is used prior to the final distilled/deionized water rinse. For the removal of organics, pesticide grade acetone, methanol or hexane, depending on the specific contaminant of concern, will be applied prior to the final distilled/deionized rinse. Acetone is typically chosen because it is excellent at removing organics, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern or if Target Compound List analysis (which includes acetone) is to be performed, another solvent such as methanol will need to be substituted.

Hexane should be used when the contaminant of concern is polychlorinated biphenyls (PCBs) or in oily media. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

A generalized decontamination procedure is:

1. Physical removal
2. Non-phosphate detergent wash with potable water
3. Potable water rinse
4. Solvent rinse (acetone, hexane, etc.)
5. Air dry
6. 10% nitric acid solution rinse

7. Distilled/deionized water rinse
8. Air dry

In instances in which sampling equipment is being used to collect samples for biological pathogens, the acid is replaced with a 10% bleach solution. Modifications to the standard procedure are required to be documented in the site-specific QAPP, field log book and subsequent reports. All decontamination water is replaced daily at a minimum. If at any point throughout the day the water becomes too dirty, then it is no longer suitable for cleaning and is required to be replaced. All sampling equipment must be decontaminated before collecting samples on-site and after use of each piece of sampling equipment.

Waste materials generated from the decontamination processes are referred to as Investigation-Derived Waste (IDW). Management of this waste should be in coordination with Environmental Response Team (ERT) SOP, *Investigation-Derived Waste Management.*

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample collected, along with the proper sample container type (i.e. glass, plastic), chemical preservation, and storage requirements are dependent upon the matrix sampled and analysis performed. For further information, refer to ERT SOP, *Sample Storage, Preservation and Handling*.

Sample collection and analysis of decontamination waste generated on-site may be required prior to disposal of decontamination liquids and solids. This should be determined prior to initiation of site activities or as soon as possible thereafter. For more information on handling of IDW, refer to ERT SOP, *Investigation-Derived Waste Management*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

Acetone is an excellent solvent since it is miscible with water; however, if volatile organic compounds (VOCs) are to be analyzed, the use of an alternate solvent (methanol, hexane) should be considered since acetone is a compound on the Target Compound List (TCL).

The use of deionized (distilled if only option) water is required for decontamination of sampling equipment. In addition, that water is required to be lab certified, analyte free (specifically for the contaminants of concern). The deionized water must be secured prior to field activities as it is not commonly found local to the site.

The use of solvents and acids on sensitive sampling equipment may cause damage. It is important to avoid damaging the equipment. If acids or solvents are utilized, follow health and safety, and waste disposal guidelines.

When decontaminating equipment when temperatures are below freezing, water will freeze in pump spray hoses lines, tanks and in buckets/pails, etc. Additionally, equipment will require longer drying times.
Do not store sampling equipment or reagents used for decontamination near gasoline or any exhaust emissions. Improperly cleaned and prepared sampling equipment can lead to misinterpretation of analytical data due to cross contamination.
Make sure that the decontamination station is set up as not to compromise a clean environment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment is selected based on the type of equipment to be cleaned and anticipated contaminants to be removed. For example, soft-bristle scrub brushes or long-handled bottle brushes are used

to remove contaminants. Large galvanized wash tubs, stock tanks, buckets, or children's wading pools hold wash and rinse solutions. Large plastic garbage cans or other similar containers lined with plastic bags help segregate contaminated equipment. Drums are used to store liquid and solid site derived waste.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Tools/Supplies

- Long and short handled brushes
- Bottle brushes, composed of nonmetallic material such as nylon
- Plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers filled with potable water
- Spray bottles
- Aluminum foil
- Pressure washer
- Garden hose
- Electrical cords
- Work lights (if working in the dark)
- Generator (if using a submersible pump or lights)
- Water tank
- Sump pump

5.2 Health and Safety Equipment

The use of personal protective equipment (PPE), (i.e. safety glasses or splash shield, Tyvek® suits, nitrile gloves, aprons or coveralls, steel toe boots, etc.), is required. Refer to the site-specific Health and Safety Plan (HASP) for site-specific requirements.

5.3 Waste Disposal

- Trash bags
- 55-gallon drums (open and closed top types)
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

Table 1 (Appendix A) lists solvents recommended for the elimination of particular chemicals. In general, solvents typically utilized during the decontamination process are:

- 10% Nitric Acid (HNO_3), typically used for inorganic compounds such as metals
- Acetone (pesticide grade)
- Hexane (pesticide grade)
- Methanol (pesticide grade)
- Deionized/Distilled Water that meets ASTM Type II specifications
- Non-Phosphate Detergent
- Potable Water

7.0 PROCEDURES

A decontamination area should be set up prior to sampling. Weather conditions (i.e. hot, cold, rain, snow, etc.) play an important role in the decontamination process. In hot, cold, rainy or snowy conditions, a tent or canopy may be erected around and over the decontamination area. In cold environments, the decontamination may need to occur inside a building or portable heaters may be needed to warm the area under the tent or canopy. In addition, in cold environments the potable and deionized water may freeze. Plan accordingly and consider your working conditions prior to field sampling activities

A decontamination plan needs to be implemented and includes:

- The number, location, and layout of decontamination stations
- Decontamination equipment
- Selection of appropriate decontamination methods
- Methods of disposal of all investigative derived waste (i.e. PPE, solid and liquid waste, etc.)
- Work practices that minimize contact with potential contaminants.
- Protection procedures for monitoring and sampling equipment (i.e. covering with plastic, etc.)
- Considerations related to weather conditions
- The use of disposable and dedicated sampling equipment, when possible

7.1 Decontamination Methods

All samples and equipment removed from site must be decontaminated, removing all contamination that may have adhered to the equipment. Various decontamination methods remove contaminants by washing with water and another physical cleaning action. In addition, solvents and/or acids may be used to decontaminate the equipment.

Physical decontamination methods are grouped into two categories, abrasive and non-abrasive methods, and are listed below:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. It involves the use of metal or nylon brushes. The amount and type of contaminants removed will vary with the brush type, length of time brushed, degree of brush contact, degree of contamination, nature of the contaminant and surface being cleaned.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with water pressure (i.e. sprayer or pressure washer).

Low-Pressure Water

This method consists of a pressure sprayer filled with water. The user pumps air into the sprayer tank to create pressure. The water is then discharged through a slender nozzle and hose, cleaning the equipment. Scrubbing with a brush is typically used in conjunction with this method.

High-Pressure Water

This method consists of the use of a pressure washer. The operator controls the directional nozzle which is attached to a high-pressure hose. Operating pressure usually ranges from 400 – 600 pounds per square inch (PSI). Scrubbing with large brushes can be used to aid in the decontamination process.

Rinsing

Contaminants and any remaining solvents and/or acids are removed by thorough rinsing. The rinsing is done either by the use of a sprayer or a pressure washer depending on the equipment being cleaned.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps attached to a fence, placed on a drum, or equipment protected by plastic or some other material are not likely to become heavily contaminated.

A damp cloth is used to wipe off any contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set. The use of a different cleaning cloth for each piece of equipment is required. Upon completion, dispose of all cloths with the site derived waste.

7.2 Field Sampling Equipment Decontamination Procedures

7.2.1 Decontamination Setup

Set up the decontamination area by laying out a section of plastic sheeting large enough for the type and amount of equipment to be decontaminated and for the equipment drop and equipment air drying areas.

Stage brushes, pressure sprayers, spray bottles (w/appropriate solvents, acids and deionized water), 5-gallon buckets, plastic/galvanized wash tubs, pressure washer (if required) and detergent. Figure 1 (Appendix B) shows the decontamination area overall layout. Section 7.2.2 discusses the decontamination procedures depending on the contaminants of concern for a Site.

Stage the appropriate amount and type of sample bottles and a cooler, for the collection of rinsate samples. For specific rinsate sample information, refer to ERT SOP, *Quality Assurance/Quality Control Samples.*

7.2.2 Decontamination Procedures

There are various stations of the cleaning process in which the equipment move through that are designed to remove all visible contamination. Stations 1 and 2 are designed to remove all visible contamination. Additional stations after 1 and 2 remove materials that require dissolution and a final rinse. Once the equipment has passed through all stations, it is laid out to air dry.

Decontamination Process for Metals

Station 1 - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes or pressure washer. When there is no visible residue remaining, transfer to Station 2.

Station 2 - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

Station 3 - Apply the acid solution and air dry on the plastic sheeting, behind Station 3. Once equipment has fully dried, transfer to Station 4.

Station 4 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area. After drying, the equipment should be wrapped in aluminum foil to prevent contamination of the equipment.

Decontamination Process for Organics

Station 1 - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes. When there is no visible residue remaining, transfer to Station 2

Station 2 - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

Station 3 - Apply the appropriate solvent or solvents and air dry on the plastic sheeting, behind Station 3. Once equipment has fully dried, transfer to Station 4.

Station 4 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area.

Decontamination process for Metals and Organics

Station 1 - Place the sampling equipment into the soapy water solution and thoroughly scrub with brushes. When there is no visible residue remaining, transfer to Station 2.

Station 2 - Rinse the equipment in the bucket/tub with potable water. Then remove from the bucket/tub and rinse with the pressure sprayer. When satisfied with the cleanliness of the sampling equipment, transfer to Station 3.

Station 3 - Apply the acid solution and transfer to Station 4.

Station 4 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to Station 5.

Station 5- Apply the solvent or solvents and air dry on the plastic sheeting behind Station 5. Once equipment has fully dried, transfer to Station 6.

Station 6 - Rinse the equipment with the pressure sprayer filled with deionized water. When satisfied the rinsing process is complete, transfer to the equipment drying area. After drying, the equipment should be wrapped in aluminum foil to prevent contamination of the equipment.

7.2.3 Post Decontamination Procedures

1. Fill out the appropriate labels for the all the various wastes and affix the labels to the drums and/or containers.
2. Clean up the entire work area. Collect solid waste (i.e. nitrile gloves, plastic sheeting, etc.) and store in an appropriate Department of Transportation (DOT) certified drum.
3. Return any remaining unused solvents or acid solutions to their respective labeled containers and properly store.
4. Transfer potable water rinse waste into an appropriate DOT certified drum or container.
5. Transfer the solvent and acid solution rinse water waste into the appropriately labeled DOT certified drums or containers.
6. Using a pressure sprayer, rinse the basins/buckets.
7. Transfer liquid generated from this process into the potable water rinse waste container.
8. Transfer the decontamination brushes into the solid waste container.
9. Empty the pressure sprayer filled with potable water onto the ground.
10. Return all equipment into their carrying cases or shipping containers.
11. Make arrangements for the pickup of all liquid and solid waste.

For further information on waste disposal, refer to ERT SOP, *Investigation-Derived Waste Management*.

7.3 Decontamination of Earth Moving Equipment/Drilling Equipment and Accessories

The decontamination of earth moving and/or drilling equipment and their accessories will require the use of a pressure washer. In addition, an on-site water supply will need to be available. If an on-site water supply is not available, a water tank along with a pump, hoses and a generator will be required. Finally, a designated area on-site needs to be designated as a decontamination area. Some sites already have a concrete pad set-up for this very purpose. If this is not the case, work with the ERT Work Assignment Manager (WAM) to assign a location for these activities to take place on-site.

An area for decontamination can be built with 4x4 lumber or hay bales, heavy-duty plastic sheeting and a sump pump. The area will need to extend at least 4 feet beyond the outer dimensions of the equipment being cleaned. Either slope the decontamination area down to one corner or dig a small

hole about 2 feet by 2 feet square and about 2 feet deep to allow for the collection of the decontamination water. Cover the decontamination area with plastic sheeting, wrapping the sides around and under the 4 x 4 lumber or bales of hay. If equipment being decontaminated includes equipment with tracks that might tear through the plastic sheeting, appropriate surfaces need to be included for the equipment to drive on. Finally, place a sump pump into this area and periodically empty the water as necessary, into the appropriately labeled liquid waste drum.

7.3.1 Decontamination Set-up Procedures

1. Move the equipment into the decontamination area.

2. Stage all the decontamination equipment and supplies (i.e. Pressure Washer, Hoses, PPE, etc.)

3. Connect all hoses and fill the pressure washer with fuel.

4. Dress out in the appropriate PPE (refer to the site-specific HASP).

At a minimum, Tyvek®, safety glasses/goggles, steel toe boots, and nitrile gloves must be worn. If handling any equipment (i.e. drill rods, etc.) work gloves must also be worn to prevent possible injury. For site specific requirements refer to the site-specific HASP.

7.3.2 Decontamination Cleaning Procedures

1. Physically remove as much of the visible material as possible from the heavy equipment after use and prior to steam cleaning. If contaminated material is suspected as determined by visual observations, instrument readings, or other means, collect material in an appropriate waste container.

2. Place the heavy equipment on the decontamination pad in the decontamination area. Verify the decontamination pad has no leaks and the sump pump is functioning properly before beginning the decontamination process.

3. Power on the pressure washer and begin cleaning from the top to the bottom. Thoroughly clean parts of the heavy machinery that come into contact with visible material (such as tires, bucket, augers, drill rods, tracks and the back and underneath of the drill rig). Scrub areas with excessive dirt/debris with large bristle brushes. A flat head shovel can be used to aide in the removal of the dirt/debris. Continue cleaning until all visible contamination has been removed. If required, apply solvents and/or acid solutions, rinse with deionized/distilled water and then let air dry.

The use of solvents and/or acid solutions will depend on site specific conditions. Check with the site-specific HASP for further guidance.

7.3.3 Post Decontamination Procedures

1. Fill out the appropriate labels for the all the various wastes and affix the labels to the drums and/or containers.

2. Transfer potable water rinse waste into an appropriate DOT certified drum or container. Transfer water from the decontamination pad to the liquid waste drums using a sump pump.

3. Collect and transfer solid waste (i.e. nitrile gloves, plastic sheeting, etc.) to a DOT-certified drum or container.

4. Transfer the solvent and acid solution rinse water waste into the appropriately labeled DOT-certified drums or containers.

5. Make arrangements for the pickup of all liquid and solid waste.

For further information on waste disposal, refer to ERT SOP, *Investigation Derived Waste Management*.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

Documentation of the decontamination process including date, time and personnel that conducted the decontamination activities must be recorded in a field logbook. Record manufacturer and lot numbers of the reagents used for the decontamination procedures.

A rinsate blank is a specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field. Rinsate blanks are samples obtained by pouring analyte free deionized water over previously decontaminated sampling equipment, testing for residual contamination. The blank water is then collected in sample containers, processed, shipped and analyzed. The rinsate blank is used to assess possible cross-contamination caused by improper decontamination procedures. The most common frequency of collection is one rinsate blank per day per type of sampling device, to meet definitive data objectives. For further information for each analysis, refer to ERT SOP, *Quality Assurance/Quality Control Samples*.

For information on sample container types and preservation, refer to ERT SOP, *Sample Storage, Preservation and Handling.*

If sampling equipment requires the use of Teflon® or polyethylene tubing, it must be disposed of into the on-site waste container and replaced with clean tubing before additional sampling occurs.

Records must be maintained documenting the training of the operators that use equipment for the collection of environmental information.

10.0 DATA VALIDATION

Data verification (completeness checks) must be conducted to ensure that all data inputs are present for ensuring the availability of sufficient information. These data are essential to providing an accurate and complete final deliverable. Results of quality control samples will be evaluated for possible cross-contamination of improperly or inadequately decontaminated sampling equipment. This data will be utilized to quantify the sample results in accordance with the project's data quality objectives. The ERT contractor’s Task Leader (TL) is responsible for completing the UFP-QAPP verification checklist for each project.

11.0 HEALTH AND SAFETY

Based on Occupational Safety and Health Administration (OSHA) requirements, a site-specific health and safety plan (HASP) must be prepared for response operations under the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard, 29 CFR 1910.120. Field personnel working for EPA's ERT should consult the Emergency Responder Health and Safety Manual currently located at https://response.epa.gov/_HealthSafetyManual/manual-index.htm for the development of the HASP, required PPE and respiratory protection.

The decontamination process can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before their use. Decontamination materials may degrade protective clothing or equipment and some solvents can permeate protective clothing. If decontamination materials pose a health hazard, measures are to be taken to protect personnel. Alternatively, substitutions can be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process. Material generated from decontamination activities requires proper handling, storage, and disposal. PPE may be required for these activities.

Safety data sheets (SDS) are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e. acetone, alcohol, etc.).

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, August 2005.

Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

The Field Branches Quality System and Technical Procedures – Field Equipment Cleaning and Decontamination, USEPA Region IV Science and Ecosystem Support Division, November 2007.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October 1985.

13.0 APPENDICES

A – Tables
B - Figures

APPENDIX A
Tables
SOP: ERT-PROC-2006-20
October 2020

TABLE 1. Soluble Contaminants and Recommended Solvent Rinse

SOLVENT[1]	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Potable water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines) and inorganic compounds.
Dilute Bases	Sodium bicarbonate	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents [2]	Acetone Alcohols Ketones Aromatics Alkanes (e.g., hexane) Common petroleum products (i.e. fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent[2]	Hexane	PCBs

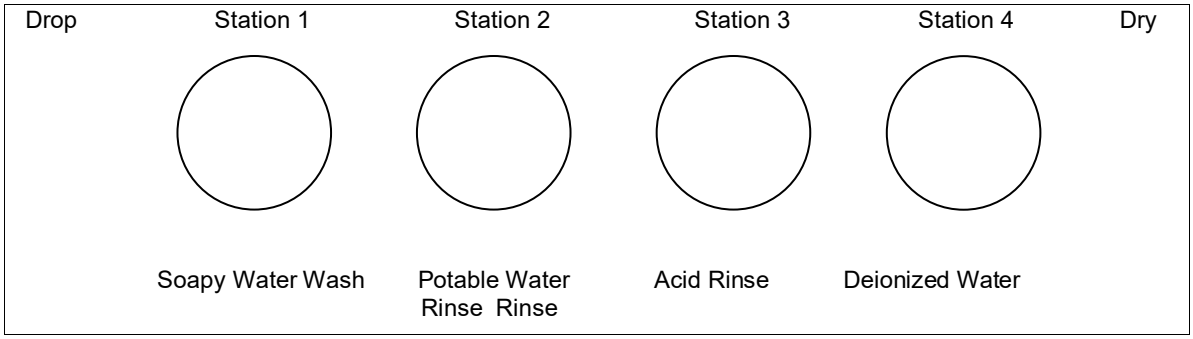
[1] - Safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

[2] - WARNING: Some organic solvents can permeate and/or degrade protective clothing

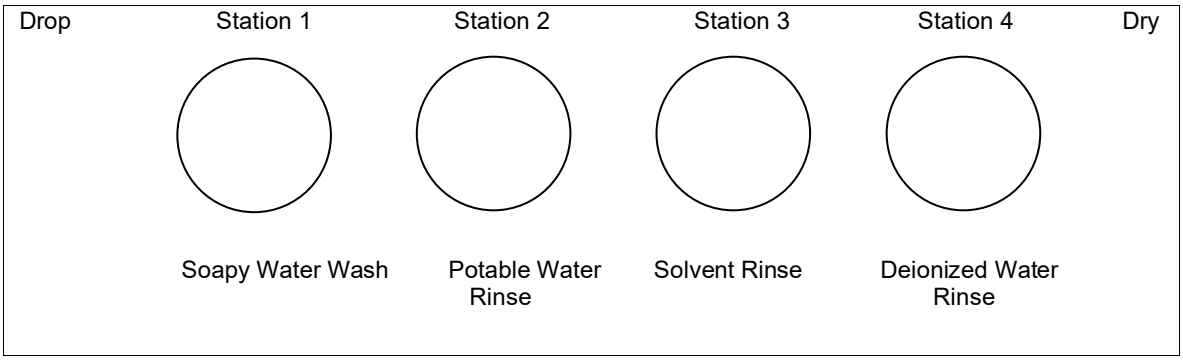
APPENDIX B
Figures
SOP: ERT-PROC-2006-20
October 2020

FIGURE 1. Sampling Equipment Decontamination Area

Configuration for the Removal of Metals



Configuration for the Removal of Organics



Configuration for the Removal of Metals and Organics