New Mexico Environment Department (NMED) Surface Water Quality Bureau (SWQB)

Standard Operating Procedure (SOP) for

Chemical Sampling – Equipment Cleaning Procedures

Approval Signatures

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1.0 Purpose and Scope

The purpose of this procedure is to describe the equipment, supplies, and procedures needed to clean typical water chemical sampling equipment used by the SWQB.

2.0 Responsibilities

The Program Manager will provide input on the scope and intent of the SOP as it pertains to the program's goals and objectives. The Program Manager will review SOP every two (2) years after revision by SME and/or Quality Assurance Officer.

The Quality Assurance Officer (QAO) is involved in the development and revision of this SOP to ensure the SOP meets the requirements of the SWQB's Quality Assurance Project Plan. The QAO, along with the Subject Matter Expert and Program manager will determine if any revisions to this SOP are needed at a minimum of every two (2) years in accordance with SOP 1.1 for the Creation and Maintenance of SOPs (NMED/SWQB 2020). Pending the review and approval of the document, the QAO will ensure the SOP is accessible through the SWQB's website.

The SME reviews SOP every two (2) years and updates the SOP as the procedure or equipment changes in coordination with the QAO and Program Manager.

Personnel who conduct environmental sampling or who supervise those who do are responsible for implementing this procedure. Personnel will perform cleaning of equipment for water chemical sampling in accordance with this SOP.

3.0 Background and Precautions

3.1 Background

The goal of equipment cleaning is to minimize the chance that equipment is a source of foreign substances that could affect the ambient concentrations or chemistry of target analytes in samples. Equipment for chemical water samples should be as clean as practicable before contacting the sample.

3.2 Procedural Precautions

Equipment for chemical water samples should be as clean as practicable before contacting the sample media. Wear safety gloves, glasses, and apron when working with corrosive and oxidizing solutions. Work in a well-ventilated area. Always add acid to water, never add water to acid

3.3 Safety Precautions

Review Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) before working with chemicals. Store and dispose of chemicals according to MSDS or SDS. Refer to SWQB's Job Hazard Analysis (JHA) for further safety precautions.

4.0 Definitions

Program Manager – An individual within the SWQB that manages a program such as the Monitoring, Assessment and Standards Section (MASS), Watershed Protection Section (WPS) or Point Source Regulation Section (PSRS). The Program Manager may be the same individual as the Subject Matter Expert.

Project Manager – An individual responsible for a specific project. This individual, in most cases, holds a different title within the organization. The Program Manager and Project Manager are not necessarily synonymous. The Project Manager may be the same individual as the Subject Matter Expert.

Quality Assurance (QA) – An integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the SWQB.

Quality Control (QC) – The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the SWQB; operational techniques and activities that are used to fulfill requirements for quality.

Quality Assurance Officer (QAO) – An individual within the MASS that is responsible for overseeing the development and implementation of all quality assurance procedures and processes within the SWQB including those projects that receive support or funding from the SWQB.

Quality Assurance Project Plan (QAPP) – A formal planning document for environmental data collection activities that describes the data collection procedures and the quality assurance and quality control activities that must be implemented to ensure that the results are sufficient and adequate to satisfy the stated performance criteria.

Standard Operating Procedure (SOP) – A document that lists the steps that should be completed when performing a task.

Subject Matter Expert (SME) – A person who is familiar with the purpose and procedure for accomplishing a task. The SME may hold another title within the organization.

5.0 Equipment and Tools

Table 1. Cleaning equipment supplies

Item	Description and Comments
Acid solution	Hydrochloric Acid (HCl): ACS trace-element grade (10 % by volume)
Bags, plastic or fluorocarbon polymer	Sealable bags with uncolored closure strips, various sizes. Recyclable trash bags are recommended for large equipment storage.
Brushes and sponges	Uncolored; plastic components needed for inorganic work
Distilled water/deionized water (DIW)	Maximum specific electrical conductance, 1 mS/cm

Laboratory-produced organic-grade DIW	Usable only as a cleaning solution and only as specified in the text. Must not be used to substitute for pesticide grade blank water (PBW) or volatiles organic grade blank water (VBW).
Detergent	Nonphosphate laboratory soap (for example, Liquinox®).
Gloves, disposable	Powderless, noncolored vinyl, latex, or nitrile (latex or nitrile for use with methanol), assorted sizes.
Safety equipment and guidelines	For example, MSDS and SDS, safety glasses, chemical spill kit, apron, emergency phone numbers.
Tap water	If quality is questionable, substitute DIW. Tap water is more effective for initial and rapid removal of detergent residue and dirt.
Wash bottles	Labeled to indicate contents (for example, ACID, DIW, TAP).
Disinfectant	Bleach

6.0 Step-by-step Cleaning Process Description

Clean sample collection and sample processing equipment before use to remove manufacturing residues from new equipment, dust and other foreign substances from equipment that has been in storage, and substances adhering to equipment from previous sampling events. Sampling equipment requiring cleaning consists primarily of sample tubing, equal-width-increment sampling equipment, processing equipment, such as churn splitters and automated sampling devices (e.g., ISCO® Automatic sampler). Disposable sample collection containers, if pre-cleaned and certified, do not require cleaning or rinsing prior to use.

6.1 Preparation at the Laboratory

The majority of equipment cleaning is performed in the laboratory prior to any sampling events. Space is dedicated in the laboratory for equipment cleaning and for storage of cleaning supplies.

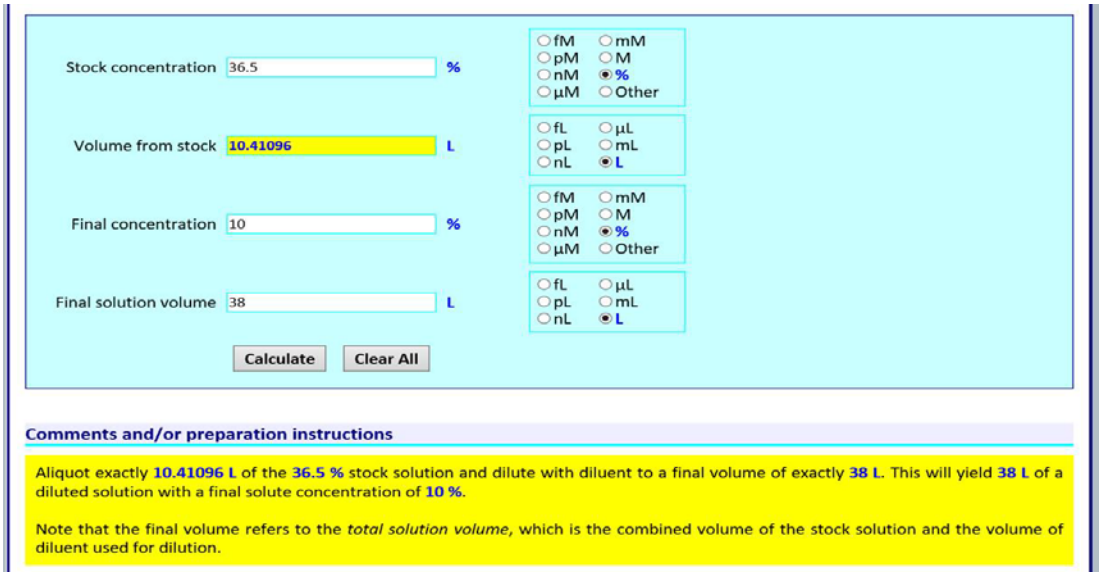
6.1.1 Preparations in the laboratory

- Prepare an area for cleaning and drying cleaning supplies, sample-collection, and sample-processing equipment.
- Gather cleaning supplies, equipment to be cleaned, and plastic bags or other material with which to wrap cleaned equipment. See Table 1 for cleaning supplies needed
- Place clean paper over the work surface.
- Put on disposable, powderless gloves.
- For most situations prepare a 0.1-0.2% solution of Liquinox. Use a higher concentration for dirtier equipment.

Preparation of dilute 10% “Trace Metal” grade HCl solution: Prepare a 10% v/v dilution of American Chemical Society (ACS) stock solution trace-element-grade hydrochloric acid (HCl) in de-ionized water (DIW) following Figure 1 instructions. Proper PPE is crucial while preparing acid bath! Acid will give off

strong, harmful fumes so ensure area is well ventilated. Prepare bath either outdoors or make smaller batches in fume hood and then pour into bath container. Be sure to always add acid to water, never add water to acid. Every two years make new acid bath in a non-reactive container (polyethylene or Teflon©), preferably prior to beginning of start of field season. Dispose of old acid bath by first neutralizing with baking soda to a safe pH and then disposing down the drain. It will take A LOT of baking soda so be sure to plan ahead. Continually check pH until it reaches 7 using pH test strips.

Figure 1. Acid bath dilution



Source: https://www.physiologyweb.com/calculators/dilution_calculator_molarity_percent.html

Dilution Formula: $C_1V_1 = C_2V_2$

- C_1 is the concentration of the stock solution. This calculation example uses a concentration of 36.5% but this percentage may vary based on stock HCl purchased
- V_1 is the volume to be removed (i.e., aliquoted) from the concentrated stock solution. This is the value to be solved. Round to nearest milliliter.
- C_2 is the final concentration of the diluted solution. Our target concentration is 10%
- V_2 is the final volume of the diluted solution. The acid bath container holds 40L so we want a final volume of 38L to leave room for submerging tubing.
- To solve for Formula:

36.5%* V_1=10%*38L

V_1=(10%*38L)/36.5%

V_1=38L/3.65

V_1=10.411L

- This formula may be used to create a cleaning solution for volumes other than 38L.

For final acid bath concentration aliquot 10.41L of HCl stock solution into 27.59L of DIW to create 38L of 10% HCL

6.1.2 Clean the Items Used to Clean the Equipment

- Fill wash basins and add approximately one cap full of Liquinox solution. Put wash bottles, scrub brushes, and other small items used for cleaning into a wash basin. Soak for 30 minutes.
- Scrub interior and exterior sides of basins/tubs and standpipes with soft scrub brushes. Fill wash bottles with a soapy solution and shake vigorously.
- Rinse all items thoroughly with tap water to remove detergent residue. No detergent bubbles should appear when fresh tap water is agitated in the basin, standpipe, or wash bottle.

6.2 Detergent Wash and Tap Water Rinse

6.2.1 Detergent Wash and Tap Water Rinse

- Disassemble dirty sampling equipment as necessary to aid in cleaning.
- Place small equipment parts into wash basin labeled for detergent and fill with Liquinox solution. Soak equipment for 30 minutes.
- Scrub exterior and interior of equipment surfaces to the extent possible using a firm sponge or soft brush to remove any adhering material such as oil and grease, sediment, algae, or chemical deposits. Pay particular attention to grooves and crevices, O-rings, nozzles, and other spaces where inorganic or organic materials might be trapped
- Rinse equipment thoroughly with warm tap water.
- Nonmetal equipment or equipment with removable metal parts: remove any metal parts and go to Acid Soak/Rinse section if required.
- Metal equipment components: go to Deionized Water Rinse section.

6.3 Acid Soak/Rinse

6.3.1 Acid Soak and Rinse for Filtration Tubing

- For new tubing, remove from the factory packaging, cut to an appropriate length and place in an acid bath filled with a dilute 10% “Trace Metal” grade HCl solution for not less than 1 hr and not more than 2 hrs*.
- For tubing that was used in the field, soak the used tubing first in a hot water/Liquinox solution for a minimum of 15 minutes then rinse with hot, flowing tap water and then DI before placing the tubing in an acid bath filled with a dilute 10% “Trace Metal” grade HCl solution for not less than 1 hr and not more than 2 hrs*.
- At the end of the acid bath period, remove the tubing from the acid bath, rinse with DIW inside and out, coil and place the tubing in an unused Ziploc® type, approx. 1 gal. capacity plastic bag.

  **The tubing is not acid resistant and exposure to HCl for extended periods will cause it to depolymerize and fail.*

6.3.2 Acid Soak and Rinse for Non-Tubing

For equipment that contact sample media and are constructed primarily of glass, fluorocarbon polymer, or other plastic, soak in a dilute 10% “Trace Metal” grade HCl solution, or, using a wash bottle, rinse surfaces that contact sample water with dilute 10% “Trace Metal” grade HCl solution.

- Place nonmetal equipment into the wash basin labeled “acid solution.”
- In a basin filled with dilute 10% “Trace Metal” grade HCl solution, soak equipment for 30 minutes and no longer than an hour.
- Carefully remove items from the acid bath and properly store or dispose of the solution.
- Place equipment into the cleaned wash basin.
- Rinse exterior and interior of each piece of equipment thoroughly with DIW. For pieces of equipment too large to submerse in the wash basin, rinse surfaces that contact sample. Place on a clean surface to dry.
- Place dry, clean equipment inside plastic bags. For small equipment or parts, use sealable plastic bags.

6.4 Cleaning of Equipment in the Field

Equipment cleaning also occurs in the field as it is necessary to thoroughly rinse equipment as soon as possible after use. Equipment that contact sample media, such as water grab samplers, Kemmerers, water carboys, re-used Cubitainers®, etc., must be thoroughly rinsed with source water before collecting a sample to prevent contamination from a previously sampled water body. Tap water or river/lake water may be used to wash or clean waders and equipment before going to the next station. It may be necessary to power wash the boat and allow to dry before going to a lake in a different watershed. Soap and/or a 10% bleach solution should be used if working in two disconnected watersheds while on one field trip.

6.5 Miscellaneous sampling equipment

After the sampling run is completed, sampling equipment (e.g., boats, buckets, cups, nets, flow equipment, etc.) that came in contact with surface waters should be washed off and dried out before going to another watershed. Immerse all porous material (e.g., nets, waders) in a 10% bleach solution for 10 minutes. Rinse thoroughly with tap water. Dry and put coolers away.

6.6 Cleaning boat

To prevent the spread of aquatic invasive species boats must be cleaned and properly stored, especially prior to deploying the boat in a different watershed. After removing the boat from water and while still on boat ramp, remove any aquatic plants that are attached to boat, motor, and trailer. Lower motor completely down to drain water. Remove boat plug and standpipe in live well and allow all water to drain. After returning to office clean boat and trailer with power washer and allow to dry before storing. Allow anchor ropes and any other equipment that came into contact with lake water to completely dry. If equipment needs to be used in a different water body before it can dry, spray equipment with 10% bleach solution.

6.7 Fungal Decontamination Procedure

Sampling sites where there is a concern of spreading harmful fungus or pathogens requires on site field equipment decontamination prior to entering site. This decontamination procedure is to prevent the introduction of diseases, pathogens, and parasites that may or have been impacting native populations, such as the Chiricahua Leopard Frog. Before mobilizing, make sure you have packed sufficient water to perform this procedure. It is recommended to use boots without laces for this procedure, as they are much easier to clean. It is also preferable to only have one technician enter stream to limit amount of cleaning required

- Mix 2oz of Mediclean® Germicidal Concentrate per gallon of water in bucket or wash basin
- Using brush, scrub all sampling equipment including boots and waders that will come in contact with stream thoroughly with solution ensuring all debris is removed
- Pay special attention to wading boots as debris can be easily missed around laces and other crevices
- Be sure to fully immerse equipment in germicidal solution for 60 seconds
- Rinse equipment with clean water and allow to dry prior to use

7.0 Data and Records Management

All documentation associated with this process is stored on the SWQB server (file depot) along with approved field forms. The original approved SOP is kept by QAO and stored in accordance with 1.21.2 NMAC, Retention and Disposition of Public Records.

8.0 Quality Assurance and Quality Control (QAQC)

The SWQB controls the quality of chemical sampling equipment by using standardized methods that are documented in this SOP. All personnel who conduct cleaning of chemical sampling equipment must be familiar with these protocols, sign the acknowledgment form associated with this specific SOP and perform cleaning procedures in accordance with this SOP. In addition to standardized methods, proper training of personnel represents a critical aspect of meeting the data quality objectives in order to fulfill the goals of the SWQB's QAPP (NMED/SWQB. 2018b).

QAQC is implemented through adherence to the process outlined in this SOP for Chemical Sampling - Equipment Cleaning. Conducting QAQC activities reduces the variability and uncertainty in the decision-making process. Additionally, following procedures outlined in this SOP may identify areas where variability can be reduced or eliminated in the future, thereby improving the overall quality of the project being implemented. If, at any time, the QAO determines this process is not being adhered to, the QAO has the authority to cease activities specific to this SOP with prior support and approval by the SWQB Bureau Chief or Program Manager, until such a time that the issue can be resolved.

9.0 Related Forms

MSDS or SDS forms

10.0 Revision History

- Original (March 21, 2011).
  Jodey Kougioulis QAO; Douglas Eib, SME; James Hogan, Program Manage

- Revision 1. June 25, 2020. Added sections 6.6 Cleaning Boat and 6.7 Fungal Decontamination Procedure; added volumetric calculation and procedure for preparation of cleaning solution. Grammatical mistakes and typographical errors addressed from original SOP.
  Miguel Montoya, QAO; Jonathan Celmer, SME; Kristopher Barrios, Program Manager-MASS

11.0 References

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