NEON PREVENTIVE MAINTENANCE PROCEDURE:

WET DEPOSITION COLLECTOR

PREPARED BY	ORGANIZATION	DATE
Rommel C. Zulueta	FIU	06/28/2017
Natchaya Pingintha-Durden	FIU	09/28/2016
Robert Lee	FIU	05/10/2017
Madeline Cavileer	ENG	06/28/2017

APPROVALS	ORGANIZATION	APPROVAL DATE
Scott Jones	QA	07/20/2017
Laura Leyba-Newton	ENG	08/03/2017
Mike Stewart	SYS	07/19/2017

RELEASED BY	ORGANIZATION	RELEASE DATE
Judy Salazar	CM	08/04/2017

See configuration management system for approval history.

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Change Record

REVISION	DATE	ECO #	DESCRIPTION OF CHANGE
A	12/08/2016	ECO-04273	Initial Release
B	08/04/2017	ECO-04906	Multiple changes and updates

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DESCRIPTION

1.1 Purpose

The National Ecological Observatory Network (NEON) employ terrestrial and aquatic sensors to collect measurements from air, wind, soil, and sun. Regular maintenance of these sensors and their infrastructure is necessary for the continued operation of the observatory, and to preemptively identify problems before they escalate.

This document establishes mandatory procedures and recommend practices for preventive maintenance of the **Wet Deposition Collector (N-CON TM 00-127-07)**.

1.2 Scope

The procedures in this document are strictly preventive. Any corrective maintenance issues uncovered while performing preventive maintenance should be addressed using the corrective maintenance procedure associated with this subsystem.

2 RELATED DOCUMENTS AND ACRONYMS

2.1 Applicable Documents

Applicable documents contain information that shall be applied in the current document. Examples are higher level requirements documents, standards, rules and regulations. Visit the NEON Document Warehouse for electronic copies of these documents.

AD [01]	NEON.DOC.004300	Environmental, Health, Safety And Security (EHSS) Policy, Program And Management Plan
AD [02]	NEON.DOC.004301	EHSS Environmental Protection Manual
AD [03]	NEON.DOC.004316	Operations Field Safety and Security Plan
AD [04]	NEON.DOC.050005	Field Operations Job Instruction Training Plan
AD [05]	NEON.DOC.001436	TIS Comm Interconnect Mapping
AD [06]	NEON.DOC.004257	NEON Standard Operating Procedure (SOP): Decontamination of Sensors, Field Equipment and Field Vehicles
AD [07]	NEON.DOC.002768	TIS Subsystem Architecture, Site Configuration and Subsystem Demand by Site - SCMB Baseline
AD [08]	NEON.DOC.001421	NEON Sensor Command, Control and Configuration – Wet Deposition Collector Assembly
AD [09]	NEON.DOC.003968	Instruction, Assembly/Configuration/Test of Wet Deposition Collector
AD [10]	NEON.DOC.001693	Site Acceptance Test Procedures: Wet Deposition Collector (NADP and Isotope)

2.2 Reference Documents

Reference documents contain information complementing, explaining, detailing, or otherwise supporting the information included in the current document. Visit the NEON Document Warehouse for electronic copies of these documents.

RD [01]	NEON.DOC.000008	NEON Acronym List
RD [02]	NEON.DOC.000243	NEON Glossary of Terms
RD [03]	NEON.DOC.000705	NEON Bolt Torque Specification
RD [04]	NEON.DOC.000501	Pre-Tower Climb JSA
RD [05]	CD06920000	Subsystem, Wet Deposition Collector, Tower

2.3 External References

External references contain information pertinent to this document, but are not NEON configuration-controlled. Examples include manuals, brochures, technical notes, and external websites.

ER [01]	N-CON Systems Company, Inc. *Precipitation Sampler MDN 00-125 & TM 00-127 Installation & Operations Manual*, TM-MDN Manual v12-31-2013.pdf SHA1 Checksum: afbf0fdcfc401007b9c619bdc8e9a94ca76f0629

ER [02]	N-CON Systems Company, Inc. (Main Website – Precipitation Samplers) URL: http://www.n-con.com/
ER [03]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for Bucket and Bottle Preparation*, SOP Number PR-0009.16, Revision 16.0, effective June 2, 2016
ER [04]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for Sample Inspection and Contamination Coding for NTN and AIRMoN*, SOP Number PR-0056.5, Revision 5.0, effective May 5, 2010
ER [05]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for the Determination of pH*, SOP Number AN-0023.14, Revision 14.0, effective May 19, 2014
ER [06]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for the Determination of Conductivity*, SOP Number AN-0019.12, Revision 12.0, effective May 19, 2014
ER [07]	National Atmospheric Deposition Program – National Trends Network – Central Analytical Laboratory *Standard Operating Procedure for the Determination of Calcium, Magnesium, Sodium, Potassium by Inductively Coupled Plasma-Optical Emission Spectroscopy – Agilent 5100 SVDV*, SOP Number AN-0082.0, Revision 0.0, effective May 8, 2015
ER [08]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for the Determination of Cl^-, Br^-, NO_3^-, and SO_4^{2-} using Thermo Scientific ICS-2000 and ICS-5000 Ion Chromatographs and Chromeleon Software*, SOP Number AN-0018.7, Revision 7.0, effective June 2, 2015
ER [09]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for the Determination of Ammonia (Phenolate) by Flow Injection Analysis*, SOP Number AN-0014.12, Revision 12.0, effective October 8, 2015
ER [10]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for the Determination of Orthophosphate by Flow Injection Analysis*, SOP Number AN-0021.12, Revision 12.0, effective October 8, 2015
ER [11]	National Atmospheric Deposition Program – National Trends Network – Central Analytical Laboratory *Standard Operating Procedure for IPD/CPD Calculations for NTN, AIRMoN and Related Atmospheric Deposition Samples*, SOP Number DA-0067.1, Revision 1.0, effective February 28, 2012
ER [12]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for Specific Conductance Standard Preparation*, SOP Number PR-0062.7, Revision 7.0, effective June 8, 2015
ER [13]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for 4.9 Quality Control Check Sample Preparation*, SOP Number PR-0002.10, Revision 10.0, effective June 8, 2015
ER [14]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for Preparation of QA/QC Samples*, SOP Number PR-0045.6, Revision 6.0, effective May 1, 2014

ER [15]	National Atmospheric Deposition Program – Central Analytical Laboratory *Standard Operating Procedure for Preparation of Blanks*, SOP Number QA-0041.13, Revision 13.0, effective August 22, 2016
ER [16]	National Atmospheric Deposition Program – National Trends Network – Central Analytical Laboratory *Standard Operating Procedure for the Determination of the Method Detection Limit*, SOP Number QA-0020.7, Revision 7.0, effective May 5, 2014
ER [17]	National Atmospheric Deposition Program – National Trends Network – Central Analytical Laboratory *Standard Operating Procedure for Reanalysis Procedures for NTN and AIRMoN*, SOP Number QA-0049.7, Revision 7.0, effective July 22, 2009
ER [18]	Gartman, N., *Quality Assurance Plan*, Central Analytical Laboratory, National Atmospheric Deposition Program, Illinois State Water Survey, Champaign, IL, May 2014, http://nadp.isws.illinois.edu/lib/qaplans/qapCal2014.pdf, accessed June 2, 2017
ER [19]	Gartman, N., *Quality Assurance Report*, National Atmospheric Deposition Program: 2015, Illinois State Water Survey, http://nadp.isws.illinois.edu/lib/qa/cal_qar_2015.pdf, accessed June 2, 2017

2.4 Acronyms

A/R	As Required
AIRMoN	Atmospheric Integrated Research Monitoring Network
CVAL	Calibration, Validation and Audit Laboratory
EPROM	Electrically Erasable Programmable Read-Only Memory
ESD	Electrostatic Discharge
GAW	Global Atmospheric Watch
GNIP	Global Network in Precipitation
HQ	Headquarters
IAEA	International Atomic Energy Agency
IRMS	Isotope-Ratio Mass Spectrometry
LC	Location Controller
LOGWAR	Logistics Warehouse
NADP	National Atmospheric Deposition Program
NTN	National Trends Network
PoE	Power Over Ethernet
PRT	Platinum Resistance Thermometer
PVC	Polyvinyl Chloride
WMO	World Meteorological Organization

2.5 Symbols

$\delta^{2}H$	delta 2 H(ydrogen); aka δD or delta deuterium
$\delta^{18}O$	delta 18 O(xygen)

2.6 Terminology

The use of common names for NEON instrumentation and subsystems vary across departments and domains. This section aims to clarify and associate the common names with the technical names herein.

SYNONYMOUS AND COMMON NAME(S)	NEON TECHNICAL REFERENCE NAME
NADP	Wet Deposition Collector

3 SAFETY AND TRAINING

Personnel working at a NEON site must be compliant with safe field work practices as outlined in the Operations Field Safety and Security Plan (AD [03]) and EHSS Safety Policy and Program Manual (AD [01]).

The Field Operations Manager and the Lead Field Technician have primary authority to stop work activities based on unsafe field conditions; however, all employees have the responsibility and right to stop their work in unsafe conditions.

All technicians must complete required safety training and protocol-specific training for safety and implementation of this protocol as required in Field Operations Job Instruction Training Plan (AD [04]).

4 SENSOR OVERVIEW

4.1 Associated Equipment

4.1.1 External Components

- Environmental Enclosure with Chimneys (see Figure 1, and Figure 3)
- Moving Cover (see Figure 1, Figure 2, and Figure 3)
- Splash Shield (see Figure 2, and Figure 3)
- Precipitation Sensor (see Figure 1, and Figure 4)
- Thermo-electric Chiller Unit (see Figure 1, Figure 2, and Figure 3)
- Thermo-electric Chiller Power Supply (see Figure 1, Figure 2, and Figure 3)
- Catawba GRAPE 24V (see Figure 3)

4.1.2 Internal Components

- Temperature Controller – heater set point (see Figure 5a and Figure 8)
- Temperature Controller – chiller set point (see Figure 9)
- Power Box (see Figure 5d)
- Glass Sample Trains (see Figure 5e)
- Circulating Fan (see Figure 5f)
- Glass Sample Bottle for Isotope Analysis (see Figure 5g)
- Glass Sample Bottle for Chemical Analysis (see Figure 5h)
- Platinum Resistance Thermometers (PRT) (see Figure 5i)
- Thermo-electric Chiller/Heater (see Figure 5j)
- Sample bottle tray holder (see Figure 5k)
- Overflow catch basins (if installed) (see Figure 6)
- Funnel strip heater (see Figure 7)

4.2 Description

4.2.1 Wet Deposition Overview

The Wet Deposition Collector (N-CON TM 00-127-07) collects wet atmospheric deposition samples. Atmospheric deposition is defined as a process where solid and liquid airborne particles and gases are deposited on the earth's surface by two general mechanisms: dry deposition and wet deposition. Dry deposition is a mechanism where airborne particles settle to the earth's surface either via impaction, molecular diffusion, interception, turbulence, or gravity. Wet deposition occurs when raindrops, snow, or ice drag these airborne particles with them as they fall to the surface.

NEON is employing best practices from existing environmental and ecological data collection networks, such as the National Atmospheric Deposition Program's (NADP), to monitor precipitation chemistry. NADP obtains wet deposition samples from a combination of the National Trends Network (NTN) and the Global Atmospheric Watch (GAW) program, which are programs of the World Meteorological Organization (WMO). NEON analyzes and archives wet deposition samples (see Section 4.2.4.2) using third party laboratories for chemistry and stable isotopes analysis.

Wet Deposition Collectors are located at specific Terrestrial and Aquatic sites (Table 1 and Table 2).

Table 1. NEON Terrestrial sites with wet deposition collectors

Domain	Site ID	Site Name	Site Type
1	HARV	Harvard Forest	Core
1	BART	Bartlett Experimental Forest	Relocatable
2	SCBI	Smithsonian Conservation Biology Institute	Core
2	BLAN	Blandy Experimental Farm	Relocatable
2	SERC	Smithsonian Environmental Research Center	Relocatable
3	OSBS	Ordway-Swisher Biological Station	Core
3	JERC	Jones Ecological Research Center	Relocatable
4	GUAN	Guanica Forest	Core
5	UNDE	University of Notre Dame Environmental Research Center	Core
5	STEI	Steigerwald Land Services	Relocatable
6	KONZ	Konza Prairie Biological Station	Core
6	UKFS	The University of Kansas Field Station	Relocatable
7	ORNL	Oak Ridge National Laboratory	Core
7	GRSM	Great Smoky Mountains National Park, Twin Creeks	Relocatable
7	MLBS	Mountain Lake Biological Station	Relocatable
8	TALL	Talladega National Forest	Core
8	DELA	Dead Lake	Relocatable
8	LENO	Lenoir Landing	Relocatable
9	WOOD	Woodworth	Core
9	NOGP	Northern Great Plains Research Laboratory	Relocatable
10	CPER	Central Plains Experimental Range	Core
10	STER	North Sterling, CO	Relocatable
10	RMNP	Rocky Mountain National Park, CASTNET	Relocatable
11	CLBJ	LBJ National Grassland	Core
11	OAES	Klemme Range Research Station	Relocatable
12	YELL	Yellowstone Northern Range (Frog Rock)	Core
13	NIWO	Niwot Ridge Mountain Research Station	Core
13	MOAB	Moab	Relocatable

14	SRER	Santa Rita Experimental Range	Core
15	ONAQ	Onaqui-Ault	Core
16	WREF	Wind River Experimental Forest	Core
17	SJER	San Joaquin Experimental Range	Core
18	TOOL	Toolik	Core
18	BARR	Barrow Environmental Observatory	Relocatable
19	BONA	Caribou Creek - Poker Flats Watershed	Core
19	HEAL	Healy	Relocatable
20	PUUM	Pu'u Maka'ala Natural Area Reserve	Core

Table 2. NEON Aquatic sites with wet deposition collectors

Domain	Site ID	Site Name	Site Type
4	CUPE	Rio Cupeyes	Core
4	GUIL	Rio Guilarte	Relocatable
10	ARIK	Arikaree River	Core
11	BLUE	Blue River	Relocatable
11	PRIN	Pringle Creek	Core
14	SYCA	Sycamore Creek	Core
15	REDB	Red Butte Creek	Core

4.2.2 Stable Isotopes Overview

Stable isotopes analysis is an additional form of analysis NEON is conducting on precipitation samples collected from the Wet Deposition Collector. Stable isotopes naturally occur in the environment; natural abundances vary depending on the environmental condition. Common stable isotopes are outlined in Table 1 below. The partitioning or ratios of stable isotopes of a substance may characterize biological, geological, and hydrological processes from the past and present.

Table 3. Common stable isotopes

Common Stable Isotopes	
Hydrogen	$^{2}H/^{1}H$
Carbon	$^{13}C/^{12}C$
Nitrogen	$^{15}N/^{14}N$
Oxygen	$^{18}O/^{16}O$

NEON is focusing on the stable isotopic signatures of water ($\delta^{18}O$ and $\delta^{2}H$) from precipitation samples, and employing best practice guidelines from the Global Network of Isotopes in Precipitation (GNIP), the International Atomic Energy Agency (IAEA), and the WMO.

4.2.3 Collector Overview

The Wet Deposition Collector, Model N-CON TM 00-127-07, encompasses a white powder coated environmental enclosure with internal insulation and dual sample chimneys at the top of the enclosure to allow for the collection of two simultaneous "wet only" precipitation samples. The collector is an automated, temperature controlled, collector of both liquid (i.e., rain) and frozen (e.g., snow, hail, ice) precipitation. It is designed to only collect samples during precipitation events using a precipitation sensor. When the Collector senses precipitation, a motor driven cover opens to allow for the collection of samples. It closes when precipitation ceases.

The internal temperature range of the enclosure is set at 3° C (37.4° F) and 25° C (77.0° F) and internal thermostats command and control the thermo-electric chiller unit. An additional five-inch-long Thermometrics PRT independently monitors enclosure temperature and an internal fan circulates air to aid in maintaining the temperature range.

Table 4. Overview of the N-CON TM 00-127-07 Wet Deposition Collector

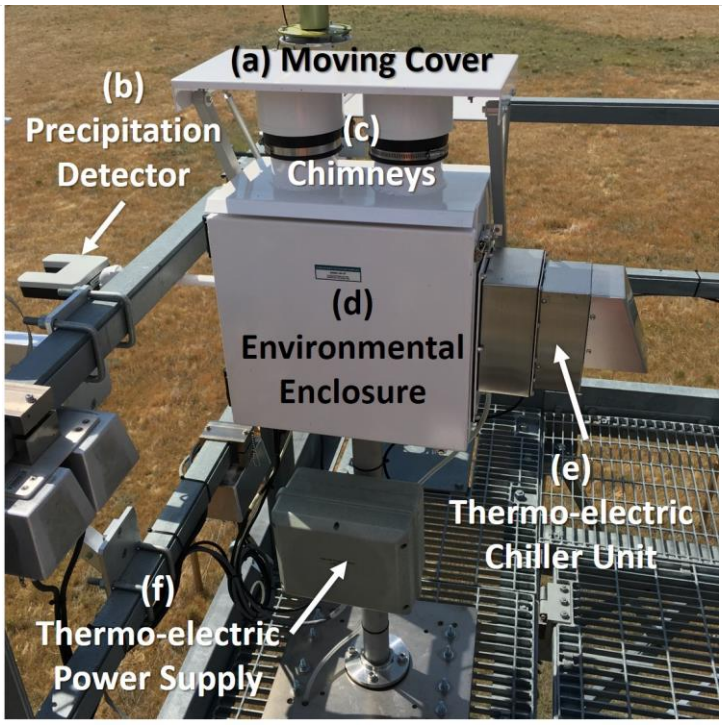


Figure 1. A front view of the main components of the N-CON TM 00-127-07 wet deposition collector. See also Figure 2 and Figure 3.

(a) Moving cover

(b) Precipitation detector

(c) Two collection chimneys

(d) Environmental enclosure

(e) Thermo-electric chiller unit

(f) Thermo-electric power supply

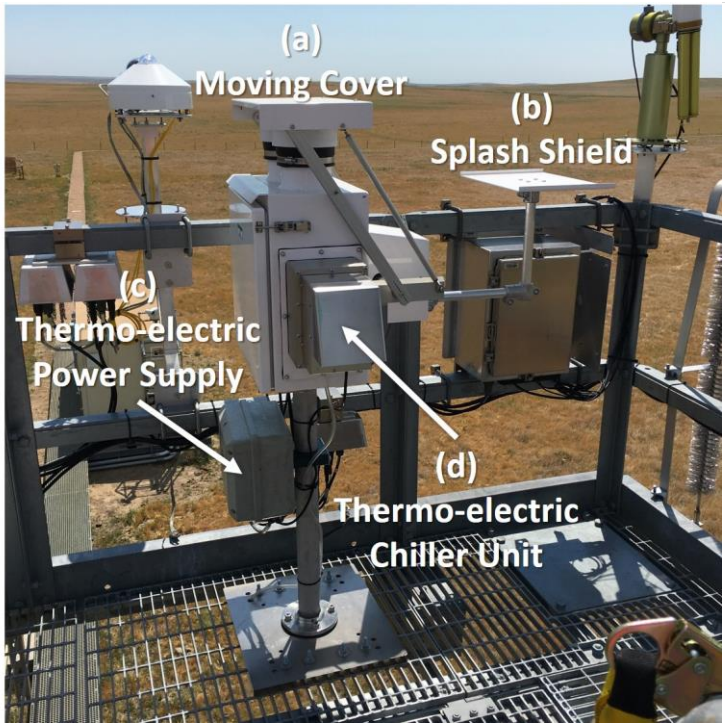


Figure 2. A side view of the main components of the N-CON TM 00-127-07 wet deposition collector. See also Figure 1 and Figure 3.

(a) Moving cover

(b) Splash shield

(c) Thermo-electric power supply

(d) Thermo-electric chiller unit

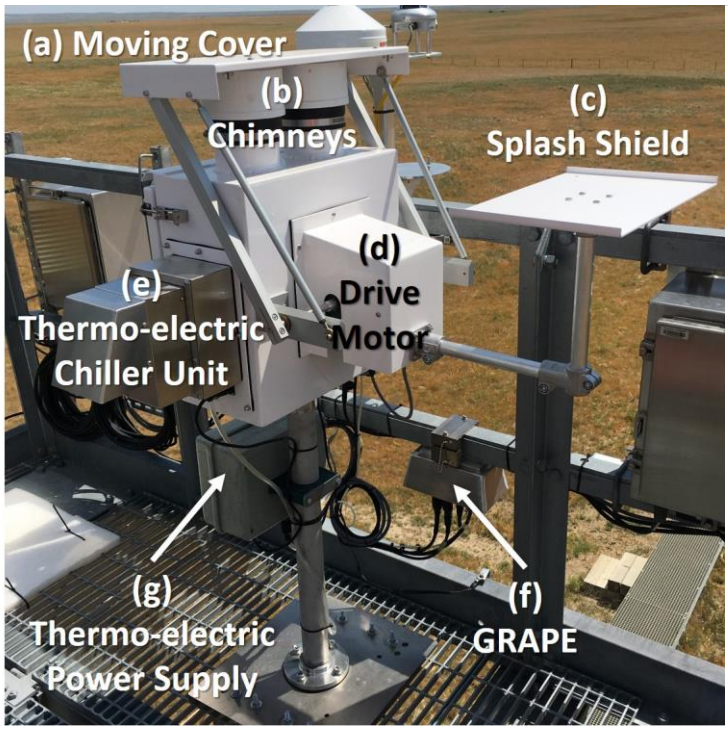


Figure 3. A rear view of the main components of the N-CON TM 00-127-07 wet deposition collector. See also Figure 1 and Figure 2.

(a) Moving cover

(b) Two collection chimneys

(c) Splash shield

(d) Drive motor

(e) Thermo-electric chiller unit

(f) Associated Grape

(g) Thermo-electric power supply

Figure 4. A view of the precipitation detector. This unit is typically located on an extension arm projecting from the environmental enclosure.

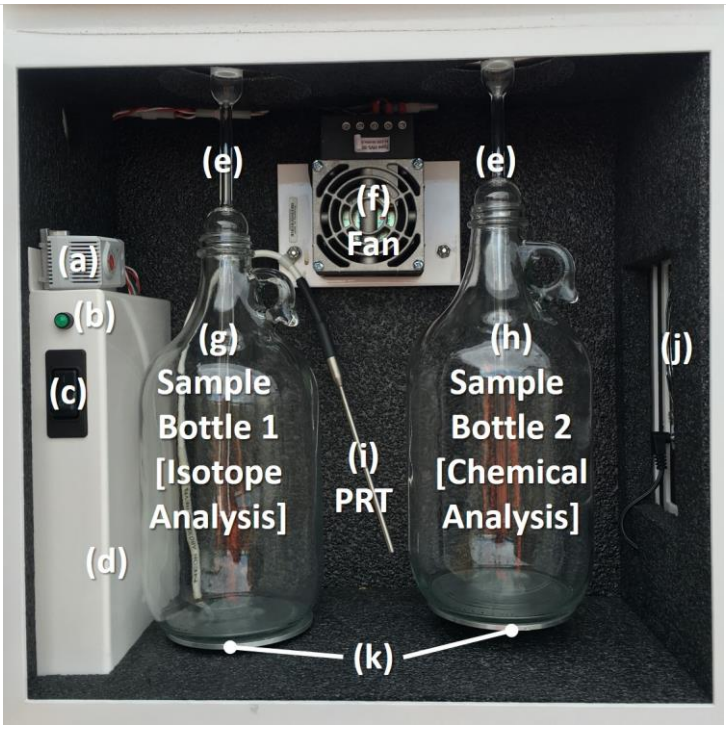


Figure 5. The inside view of the environmental enclosure.

(a) Temperature Controller

(b) Power on LED

(c) Power Switch

(d) Power Supply

(e) Glass Sample Train

(f) Fan

(g) Sample Bottle 1 – for Isotope Analysis

(h) Sample Bottle 2 – for Chemical Analysis

(i) PRT

(j) Thermo-electric Chiller Unit

(k) Sample Bottle Tray Holder

Figure 6. Overflow catch basins placement.

NOTE: Domains 03, 04, 08, and 20 may require the installation of overflow catch basins to accommodate overflow during heavy rainfall events (e.g., hurricane season).

NOTE: The overflow catch basins have an overflow capacity of 2L (67 oz.).

See Table 7 for details of the overflow catch basins.

Figure 7. Inside each chimney is an automated silicon strip heater. This heater melts snow accumulation within the glass funnel.

Figure 8. A view of one of the internal Temperature Controllers. See Figure 5 for the location of this Temperature Controller.

This temperature controller has the set point temperature for heater activation.

The temperature scale here is measured in Fahrenheit (°F).

Figure 9. View of the Thermo-electric chiller unit from inside the enclosure (see Figure 5j for its location).

Notice there is a Temperature Controller in the lower right. This Temperature Controller has the set point temperature for when the chiller is to be activated.

The temperature scale here is measured in °F.

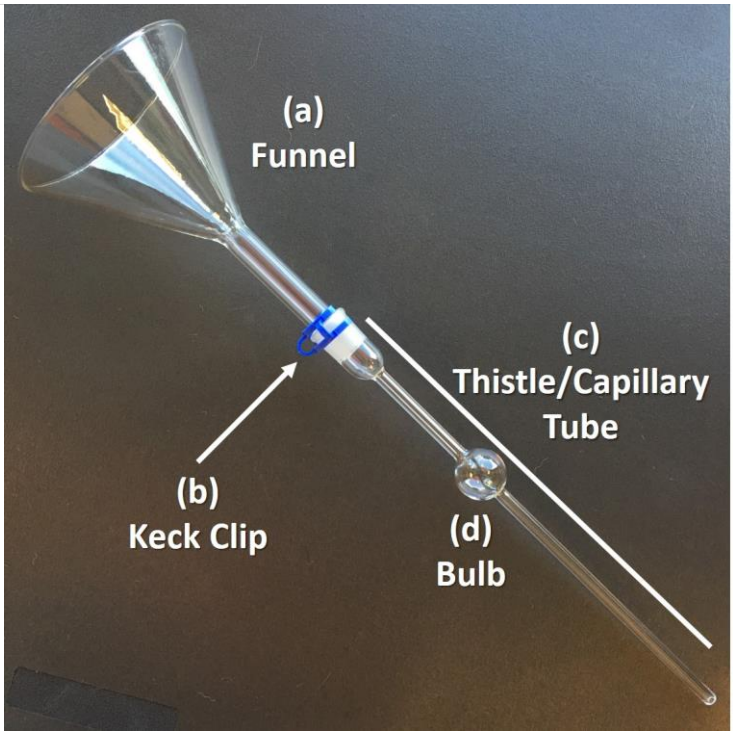


Figure 10. A fully assembled glass sample train includes:

(a) Funnel

(b) 19/22 Keck Clip

(c) Thistle/Capillary Tube (hereafter referred to only as thistle tube)

The funnel and thistle tube have frosted glass ends that mate together, which are held together by the Keck clip.

The 19/22 signifies the joint size of the Keck clip.

The parts of the sample train should come from the lab cleaned and packaged separately. See also **Figure 11**.

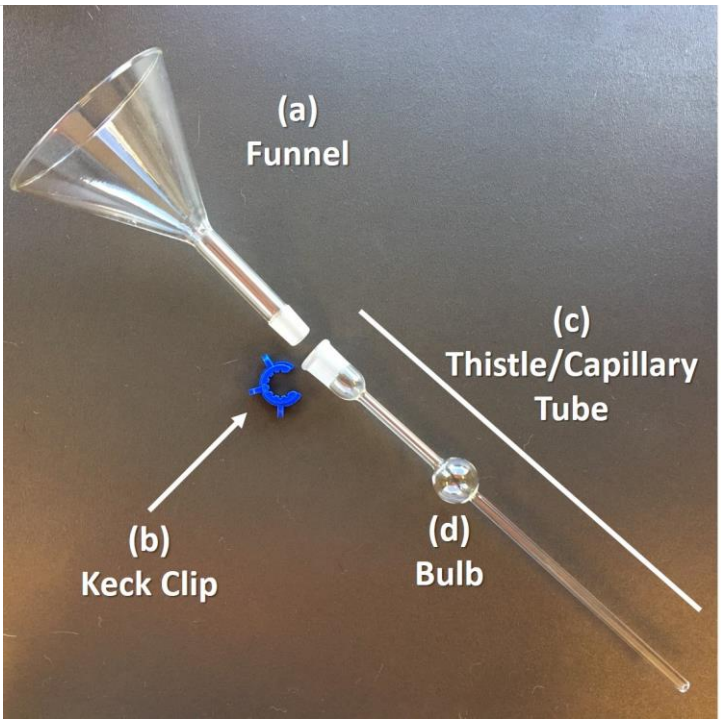


Figure 11. The glass sample disassembled.

(a) Funnel

(b) 19/22 Keck Clip

(c) Thistle/Capillary Tube

See also **Figure 10** for a fully assembled glass sample train.

The parts of the sample train should come from the lab cleaned and packaged separately.

4.2.4 Sample Overview

The collection of two samples occur during each precipitation event. Samples from the left sample bottle (see Figure 5) are sub-sampled and sent to a contract laboratory for isotopic analysis (see Section 4.2.4.1 Isotope Analysis). Samples from the right sample bottle (see Figure 5) are sent to a second contract lab for chemical analysis (see Section 4.2.4.2 Chemical Analysis).

4.2.4.1 Isotope Analysis

Analysis is performed on a sub-sampling of a wet deposition sample using isotope-ratio mass spectrometry (IRMS) for the stable isotopes of ^{2}H and ^{18}O in water. Any sample remaining following sub-sampling, will be archived at 4 °C.

4.2.4.2 Chemical Analysis

Several types of chemical analyses of a wet deposition sample are performed, depending on the amount of available sample:

Table 5. Precipitation sample volume and chemical analysis performed

Precipitation Sample Volume	Analysis
≤ 8.0 mL	pH and Conductivity
8 mL to 30.5 mL	Same analysis as above, plus total dissolved chemical ion concentrations of: SO_4^{2-} NO_3^- Cl^- Br^- NH_4^+ PO_4^{3-} Ca^{2+} Mg^{2+} K^+ Na^+
≥ 30.5 mL	Same analysis as above, plus any left-over sample is archived at 4 °C

4.3 Sensor Specific Handling Precautions

IMPORTANT: To avoid contamination of the samples, clean powder-free nitrile gloves **must** be worn at all times (specifically when conducting maintenance on the unit, and/or handling of the sample train or sample bottles). Avoid touching the inside of the sample train funnel, the inside of the bottle, or the inside of the bottle cap. Avoid handling the end of the thistle tube below the bulb.

4.3.1 Grapes and Platinum Resistance Thermometer (PRT)

The Wet Deposition Catawba Grape (24V) and PRT contain ESD sensitive parts; therefore, the Grape and PRT require ESD (antistatic) packaging and handling during inter- and intra-site transport, reception, and storage. As a rule, when handling (installing, removing, and servicing) these electrical components, all Technicians must ground themselves. Wear an anti-static wristband and frequently touch grounded metal objects (such as unpainted metal with clear ground path) to redirect electrostatic discharge away from sensitive devices.

4.4 Operation

When there are at least five drops of precipitation by the unit's infra-red precipitation sensor, the internal drive motor moves the cover and exposes the two sampling chimneys.

The collection of precipitation that falls into the two sampling chimneys occurs via two glass sample trains, and two glass 64 oz. bottles. A silicon strip heater resides within each chimney stack to assist in melting any frozen precipitation accumulation.

The collector lid closes the cover after 25 seconds of sensing no precipitation.

5 INSPECTION AND PREVENTIVE MAINTENANCE

NOTE: If precipitation is occurring (e.g., raining, snowing, hailing) during the scheduled routine maintenance of the system, wait until it stops and the cover of the collector closes before proceeding. If precipitation is imminent and likely to start while performing maintenance on this system, stop and conduct maintenance at a time that it could be performed without interruption.

Begin preventive maintenance by first reviewing Section 5.1, Preventative Maintenance Procedural Sequence, to understand the order of the procedure.

5.1 Preventive Maintenance Interval Schedule

Table 6. Preventive maintenance tasks and interval schedule

Maintenance	Bi-Weekly	Monthly	Quarterly	Bi-Annual	Annual	As Needed	Notes
EXTERIOR							
Visual Inspection							
Mounting Hardware	X						
Cables and Connectors	X						
Moving Cover Lid Seal	X						
Chimney Gaskets	X						
Precipitation Sensor	X						
Moving Cover	X						
Thermo-Electric Chiller	X						
Clean							
Exterior	X						
Splash Shield	X						
Moving Cover Lid Seal	X						
Chimney Gaskets	X						
Thermo-Electric Chiller	X						
Precipitation Sensor	X						
Adjustments							
Moving Cover						X	
Replacement							
Grape - Catawba 24V					X	X	Requires annual calibration/validation
Moving Cover Motor						X	
Moving Cover Lid Seal					X	X	Twice a year
Chimney Gaskets						X	

	Mounting Hardware						X	
	Thermo-Electric Chiller						X	
INTERIOR								
Visual Inspection								
	Interior	X						
	Door Seals	X						
	Glassware - Sample Trains	X						
	Glassware - Sample Bottles	X						
	Overflow Basins	X						If applicable
	Insulating Foam	X						
	Funnel Strip Heaters	X						
	PRT	X						
	Temperature Set Points	X						
Clean								
	PRT	X						
Adjustments								
	Temperature Set Points						X	
Replacement								
	Glassware - Sample Trains	X						
	Glassware - Sample Bottles	X						
	PRT						X	
	Chimney Gaskets						X	
	Insulating Foam						X	
	Mounting Hardware						X	
	Funnel Strip Heaters						X	
	Internal Fans						X	
	Door Seals						X	

5.2 Preventative Maintenance Procedural Sequence

The sequence for routine preventative maintenance of the Wet Deposition Collector is, as follows:

1. Preparation for the site visit.
    a. Check maintenance schedule (Section 5.1)
    b. Inspect glassware (Section 5.3.1)
    c. Assemble supplies and consumables (Section 5.3.2)
2. Initial Inspection (Section 5.6.1)

3. Verify operation of the Moving Cover (Section 5.6.2)
4. Inspect the Thermo-Electric Chiller Unit (Section 5.6.3)
5. Cross-check internal enclosure temperature (Section 5.6.4)
6. Remove sample bottles and sample trains (Section 5.6.5)
    a. Sub-sampling for water isotope analysis (Section 5.6.5.1)
7. Verify temperature set points (Section 5.6.7)
8. Clean the collector (Section 5.6.8)
9. Inspect the funnel strip heaters (Section 5.6.9)
10. Deploy new sample bottles and sample trains (Section 5.6.10)
11. Restart the collector (Section 5.6.11)

5.3 Preparation for Site Visit

5.3.1 Inspect Glassware

An external laboratory cleans and delivers pre-cleaned and pre-packaged sample bottles and glass sample train components (funnels, thistle tubes, bottle caps). Each set of glassware should have their own shipping container with two of each piece of glassware.

5.3.1.1 Glass Sample Train Components and Sample Bottles

1. Verify that the shipping container has a combination lock(s) securing the lid closed.
2. Open the shipping container holding the pre-cleaned and pre-packaged sample bottles and glass sample train components.
3. Put on a new and clean pair of powder-free nitrile gloves *BEFORE PROCEEDING.*
    a. Verify there is a form or paper from the contract analytical laboratory indicating the glassware is *clean*.
    b. Verify there are two bottle caps inside individually sealed plastic bags.
        i. The tare weight should be etched on each bottle cap.
    c. Verify there are at least two Keck clips in a plastic bag.
        i. If they are missing obtain some from Domain inventory (or the backup set).
4. **Do not remove the glass sample train components or sample bottles from their plastic packaging!** Remove and inspect each sample train components for missing pieces, cracks, chips, and/or breaks in the glassware.
    a. Verify there are two of each sample train component, and two sample bottles, and that each component is individually packaged in sealed plastic bags.
        i. If any appear to be broken, or you suspect possible contamination, do not use that piece. Obtain a piece from the backup set.
            1. Contact the contract laboratory for a clean replacement piece for the backup set.

b. Inspect the two sample bottles. The tare weight should be etched on the side of the bottle.
    i. If there is no tare weight etched on the bottle, proceed to Section 5.3.1.2 Obtaining the Tare Weight of the Sample Bottle, below.
5. Return inspected glassware back into their shipping container, lock case, and stage with equipment for the site.
6. Repeat Steps 1-5 above for the second set of glassware (your backup set).

NOTE: Due to the delicate nature of glass sample train components, and the possibility of glass contamination during maintenance, ensure two full sets of clean glass sample bottles and sample train components are brought to each site visit.

5.3.1.2 Obtaining the Tare Weight of the Sample Bottle

NOTE: This section will only be done if the sample bottles do not already have their tare weight engraved on the bottle itself.

1. Put on a new clean pair of powder-free nitrile gloves *BEFORE PROCEEDING.*
2. Remove the glass sample bottle from the plastic packaging, and remove the cap.
    a. Place the cap face-up in a clean location.
3. Weigh the bottle (without the cap) and make a note of its weight into a field notebook, or mobile recording app.

NOTE: For consistency, use the same scale as the field measurement.

4. Re-cap the bottle.
5. Write the bottle weight on the outside of the bottle to the nearest tenth decimal (e.g., Tare: 1015.2 g).
6. Place the bottle back inside its plastic bag and reseal.
7. Return inspected glassware back into their shipping container, lock case, and stage with equipment for the site.

5.3.2 Assemble Supplies and Consumables

This maintenance procedure requires the use of several items and consumables. See Section 5.4 Equipment for a list of items.

IMPORTANT: Be sure to have the three types of NEON Sample ID barcodes for Wet Deposition: CHM (see Table 11, Step 29a), ISO (see Table 11, Step 29b), and ISO – test (see Table 12, Step 12).

5.4 Equipment

Table 7. Tools, consumables, and resource lists for preventive maintenance

Item No.	Description	Quantity
	Tools	
1	19/22 Keck Clip [Maximo: 0303560007] Sensor Acsry, Keck Clip - Funnel/Thistle Tube Connector	2
2	Laptop with Network Connection & Data Monitoring Software	1
3	Handheld Mobile Recording Device or Tablet	1
4	Allen Wrench set (including 3/16th & 1/8th)	1
	Consumable items	
1	Formula 409, Multi-surface Cleaner (32 oz. spray bottle)	A/R
2	Distilled or Deionized water (Squirt/Spray Bottle)	A/R
3	Lint-free cloths, or microfiber cloths, or Kimwipes	A/R
4	Powder-free Nitrile Gloves	5-6 pairs
5	4” x 6”, 4 mil[1], Clear Reclosable Plastic Bag [Maximo: MX111032]	1
6	12” x 15”, 4 mil, Clear Reclosable Plastic Bag [Maximo: MX109419]	2
7	10” x 12”, 4 mil, Clear Reclosable Plastic Bag [Maximo: MX100592]	4
8	16 milliliter (mL) Clear Glass Vial with Black Phenolic Cap and 14B Liner [Maximo: MX108274]	2
9	60 mL syringes, with Luer-Lok tip, 1 mL graduations [Maximo: MX100554]	2
10	Syringe Filter, Nonsterile, Nylon, 0.20µm, Diameter: 33 millimeter (mm) [Maximo: MX109591]	4
11	Paraffin Film	A/R
12	NEON Sample ID Barcodes – Wet Deposition (CHM), (ISO), and (ISO – test)	2-4
	Resources	
1	Portable Digital Scale (5 kilogram (kg) capacity) OHAUS CS Series Compact Scale, Model CS5000	1
2	Handheld IR Thermometer Fluke 62 MAX Infrared Thermometer	1
3	64 oz. Glass Sampling Bottle [Maximo: 0303560006] Sensor Acsry, 64oz Sample Container with Lid	2

[1] Mil represents one thousandth of an inch; a form of measurement to measure thickness of an object.

4	Glass Sample Funnel [Maximo: 0303560003] Sensor Acsry, Sample Train Funnel	2
5	Glass Thistle Tube [Maximo: 0303560005] Sensor Acsry, Thistle Tube	2
6	Overflow Catch Basins[2] 1 Gallon Epoxy Lined Empty Paint Can	2
Shipping Containers		
1	Bel-Air ReadyCase Shipping Case, 21.3" x 15.8" x 9.8" • Holds: two glass sample funnels, two glass thistle tubes, two 64 oz. glass sample bottles, two spare bottle caps, and two Keck clips [SKU: TS2116 - https://shop.bel-air-cases.com/product/bel-air-ready-case-21x16/]	1

5.5 Subsystem Location and Access

The subsystem is located at the top of the tower at terrestrial instrumentation sites, and on the ground at aquatic instrumentation sites.

5.6 Maintenance Procedure

See Section 5.1 for a table of the preventive maintenance interval schedule.

5.6.1 Initial Inspection

1. Observe the immediate area surrounding the collector if any conditions are found that may affect the integrity of the samples (e.g., insect or bird nests nearby, fire in the vicinity, wind storm, vandalism, dirt, pollen, or debris accumulation).
    a. Record these observations on the datasheet (see Section 7).
2. Inspect the exterior for any damage.
    a. Record damage on the datasheet and/or the mobile recording app.
3. Inspect connections and ensure they are secure.
    a. Use caution for electrical connections: power down the sensor via removing the Ethernet cable from the Concord Grape to de-energize the Grape to mitigate damage to the equipment or switch off the communications box in the tower top breaker, then power down the sensor and check connections to Grape or Sensor for corrosion at connection site, over-heating, dust and/or debris.

[2] For use at select Domains that may incur heavy precipitation.

b. Remove dust by dabbing electrical areas with a lint free cloth. Wiping may cause static, which imposes a risk in the event the power is not off.
c. Do not use compressed air around power supply units or breaker terminals.

4. If there is snow accumulation on the instrument, use a clean soft bristle brush to sweep away the snow from:
    a. Splash Shield
    b. Moving Cover
    c. Top of the Precipitation Detector
    d. Area around the dual chimneys
5. Inspect the arms of the Moving Cover and ensure there is no debris blocking its operation.
6. Inspect the internal PRT and make sure it is not touching the enclosure foam, the glass sample bottles, or (if installed) the overflow catch basins.

5.6.2 Verify Operation of the Moving Cover

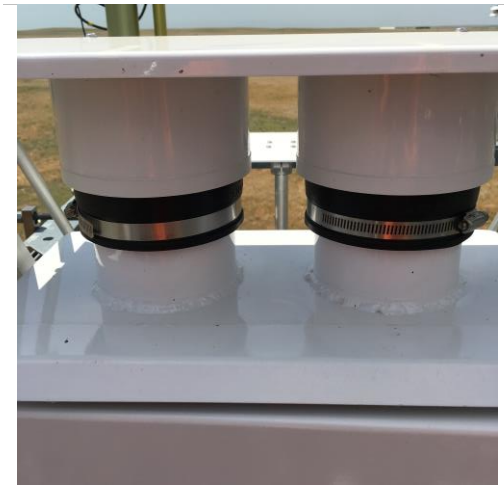
Table 8. Procedure for verifying the operation of the moving cover

	**Step 1.** Wave fingers or hand slowly vertically in-and-out of the Precipitation Detector until the Moving Cover begins to open. Moving a hand vertically in-and-out of the detector simulates a precipitation event, and opens the Moving Cover.

Step 2. As the Moving Cover opens, observe its full range of motion. Movement should be smooth and consistent.

The Moving Cover should move all the way to the Splash Shield without touching it.

NOTE: If no precipitation occurs within 25 seconds, the sensor starts to close, so additional hand movements may be needed to have the lid open fully.



Step 3. Observe the Moving Cover as it closes. Again, the movement should be smooth and consistent. If it is not, record it on the datasheet/submit a ticket via the issue reporting system.

The Moving Cover stops on top of the two sample chimneys when fully closed.

Step 4. Inspect the seal between the bottom of the Moving Cover and the top of the two chimneys.

The bottom of the seal should rest snugly on top of the two chimneys without a gap.

Step 5. Inspect the black rubber gasket and the hose clamp.

Ensure the rubber is not cracked or ripped, and the hose clamp holds the rubber gasket snugly to the chimney.

Step 6. Inspect the arms of the Moving Cover. Gently twist the rear arms, they should move slightly and should not be seized.

If these are extremely difficult to move, or seized, see next Step.

Step 7. Inspect the four spherical ball joints at the end of the rear Moving Cover arms. There should be some movement when the arms are slightly twisted (previous Step).

If there are issues with the Moving Cover, the arms, and/or the operation of the drive motor, please make a note and submit a ticket via the issue reporting system.

5.6.3 Inspect the Thermo-Electric Chiller Unit

Table 9. Procedure to inspect the thermo-electric chiller unit

Step 1. Look underneath the shroud of the thermo-electric chiller unit. Inspect the fan and heatsink fins.

Remove obstructions, if present.

5.6.4 Cross-Check Internal Enclosure Temperature

Cross-check internal PRT temperature of the environmental enclosure against the outside temperature via an external, independent temperature sensor. Monitor the internal PRT using a laptop with Network connection and active data monitoring software.

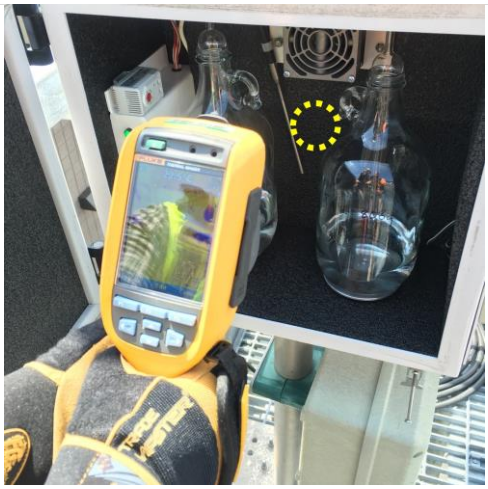
Table 10. Procedure to cross-check the internal enclosure temperature

Step 1. Connect laptop to the internal network, and using your data monitoring software, call up the PRT temperature from the Wet Deposition Collector.

Record the internal PRT temperature via a datasheet and/or mobile recording app.

NOTE: Keep the data monitoring software open, as you may need to refer back to this temperature.

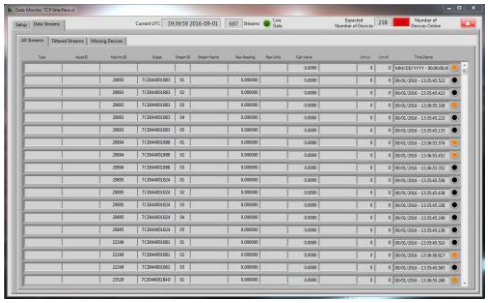
Step 2. Unlatch the two latches on the closed door and open the door.



Step 3. Using a handheld infrared (IR) thermometer, measure the black insulation right next to the center area of the PRT.

Record this temperature in Celsius (°C).

NOTE: If direct sunlight is hitting the area around the PRT, throw some shade on the measurement area.

	**Step 4.** Determine the temperature differential between the internal PRT and the temperature via the IR thermometer. *If the temperature differential is > 3°C, submit a ticket via the NEON project's issue reporting system.*

5.6.5 Remove Sample Bottles and Sample Trains

Two identically configured glass sampling trains and bottles are employed in the Wet Deposition Collector. The preventive maintenance procedure below is the same for both. For consistency, conduct these procedures from the right sample to left sample. This will align with the instructions in Table 11 below.

Table 11. Procedure for removing glass sample bottles and sample trains

	**Step 1.** Unlatch the two latches holding the closed door and open the door.

Step 2. Inspect the condition of two sample bottles. Make a note on each separate sample, or both if their conditions are the same.

Noteworthy considerations:

1. Do the samples display contamination in any way?
2. Do the sample bottles show evidence of overflow?

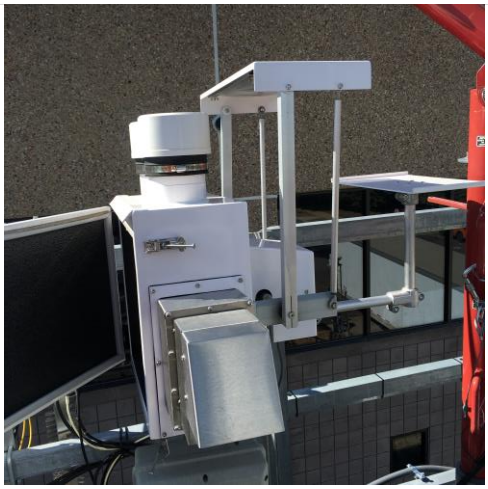
Photos of the samples may be helpful as well.

Step 3. If using overflow catch basins, and evidence of overflow on the sample bottles exist, ensure the overflow basin did not overflow, as well.

If the overflow basins appear overflowed, make a note and submit a ticket via the issue reporting system.

NOTE: Discard any water in the overflow basin. Water within basins are not samples for analysis.

Step 4. Slowly wave a hand (with fingers spread open) vertically in-and-out of the Precipitation Detector until the Moving Cover begins to open.

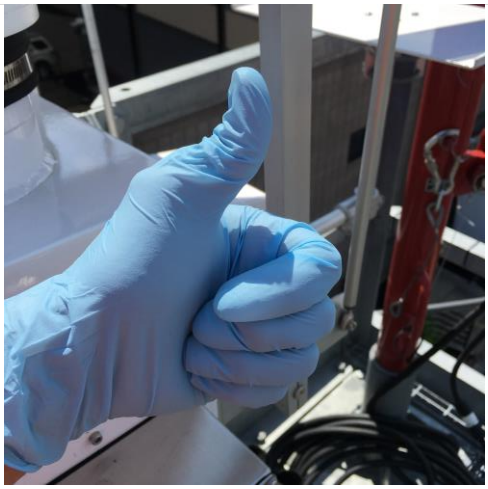


Step 5. Allow the Moving Cover to open until it is about half-way to fully open, or until the lid is vertical, and flip the power switch (see **Figure 5**) to the off position.

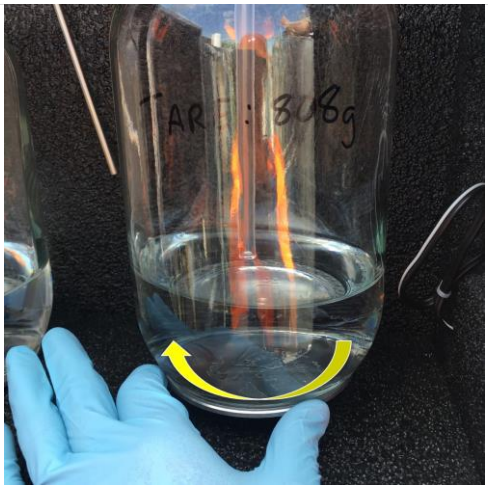
Turning the power off stops the Moving Cover in place.

NOTE: The Moving Cover must provide enough clearance to not hinder the removal of the glass sample trains.

Step 6. Locate the lab provided barcode on the shipping case, and scan with your mobile recording app, or record the number on the datasheet.



Step 7. Put on a new pair of powder-free nitrile gloves.



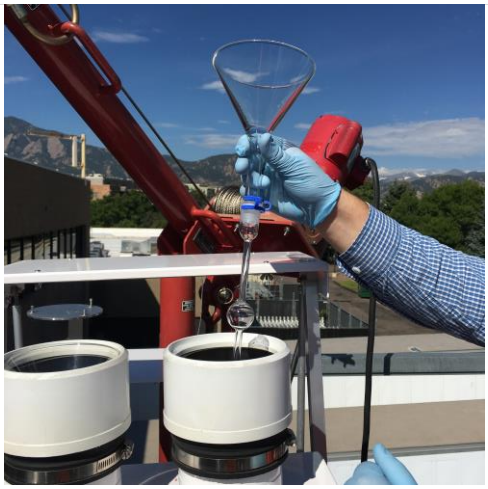
Step 8. Lower the glass sample bottle by rotating the metal bottle holder tray **clockwise** until the bottom of the bulb of the thistle tube clears the opening of the sample bottle.

Step 9. Carefully grasp and lift the thistle tube up.

Lift it high enough to safely grab the outside of the funnel from of the top of the chimney.

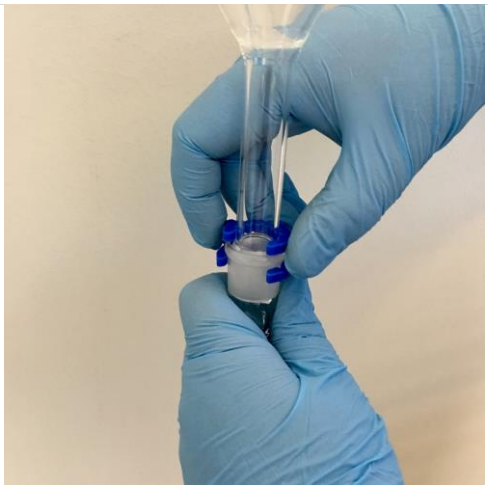
Step 10. With the other hand, grasp the outside of the funnel.

NOTE: Make it a habit to never touch the inside of the funnel. Only handle the glass sample train from its outside surfaces.



Step 11. Lift out the entire glass sample train from the chimney.

NOTE: Try to pull the sample train as straight as possible to avoid hitting the sides of the sample bottle, and the insides of the chimney.



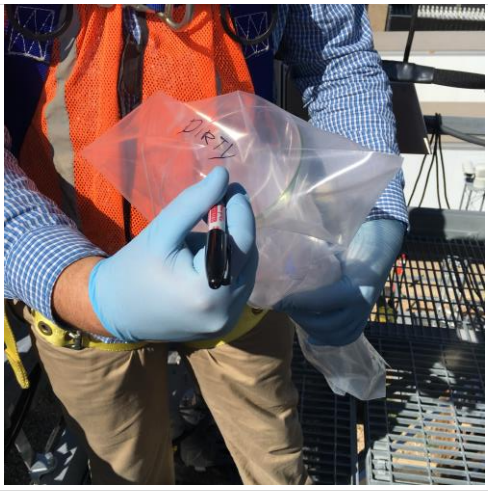
Step 12. Carefully remove the Keck clip from the assembled sample train and set aside.

NOTE: The Keck clips will be used again with the new cleaned sample trains.

Step 13. With a slight twisting motion, carefully disassemble the funnel from the thistle tube.

Step 14. Locate the lab provided barcode on the funnel, and scan with your mobile recording app, or record the number on the datasheet.

Step 15. Place the funnel into a 10” x 12”, 4 mil, reclosable plastic bag and seal.



Step 16. Label the plastic bag, or use some other form of mark or tag (e.g. tape, flagging) to indicate the glass sample train is dirty or used.

Immediate labeling of the plastic bags mitigates confusion between clean glassware.

Place bagged funnel into the shipping case.

Step 17. Locate the lab provided barcode on the thistle tube, and scan with your mobile recording app, or record the number on the datasheet.

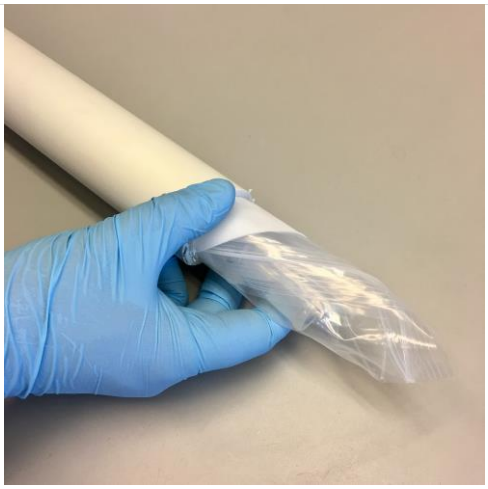
Step 18. Place the thistle tube into a 10” x 12”, 4 mil, reclosable plastic bag and seal.

Step 19. Label the plastic bag, or use some other form of mark or tag (e.g. tape, flagging) to indicate the glass component is dirty or has been used.

Immediate labeling of the plastic bags mitigates confusion between clean glassware.

Place bagged funnel into the shipping case.

Step 20. Carefully roll the bag up around the thistle tube.

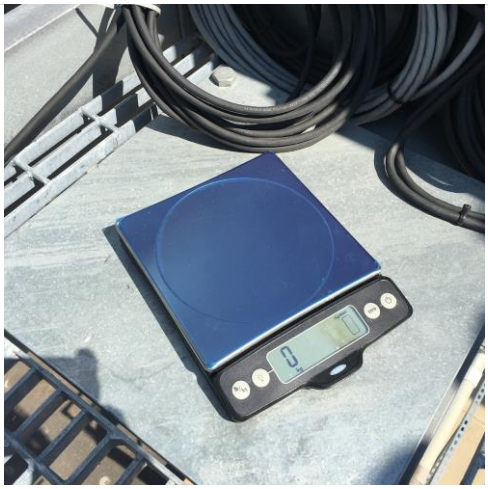


Step 21. Place the thistle tube into the PVC carrier, and cap.

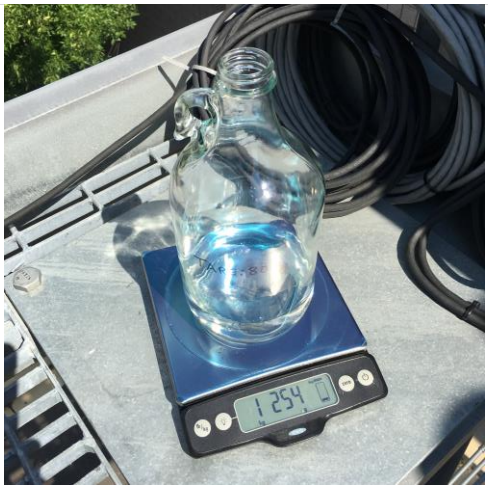
Place the PVC carrier into the shipping case.

NOTE: If the tube does not easily fit, don't force it, rather reroll the bag tighter and try again.

NOTE: Lightly place the cap on the PVC tube. Pressing it on too much makes it too difficult to remove later on.



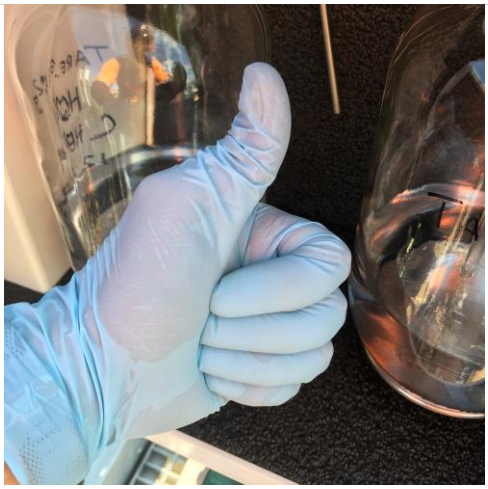
Step 22. Remove the field scale from its travel case and turn on. Place in a stable, flat and level location.



Step 23. Place the sample bottle on the scale and record the weight.

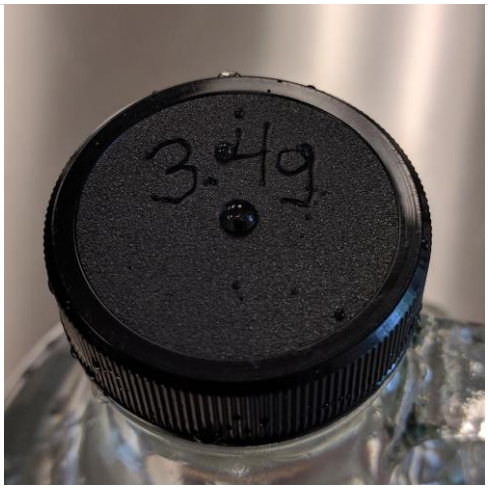
Using the tare weight already existing on the bottle (etched on bottle or tare weight from Section 5.3.1.2), determine and record the sample-only weight.

NOTE: The mouth of the sample bottle is now exposed, use care to avoid contamination. Do not touch or allow anything to come into contact with the open mouth of the sample bottle.



Step 24. Put on a new pair of powder-free nitrile gloves.

Step 25. Remove a clean bottle cap from its plastic bag.



Step 26. Enter the tare weight that is etched into the top of the cap into the mobile recording app or datasheet.

Step 27. Cap and tighten the bottle.

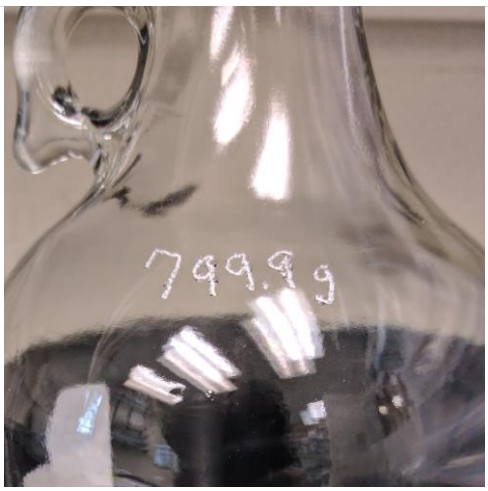
Step 28. Locate the lab provided barcode on the sample bottle and scan with your mobile recording app, or record the number on the datasheet.

Step 29a. Place an appropriate NEON-provided sample barcode on the bottle and scan with the mobile recording app, or note down the number on the datasheet.

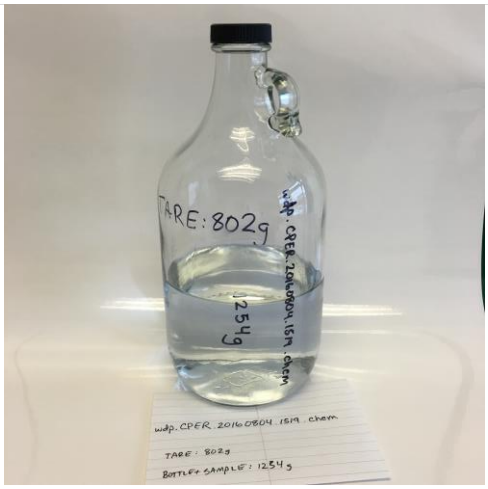
Bar codes for chemistry analysis samples will have **CHM** written on them.

Step 29b. Place an appropriate NEON-provided sample barcode on the bottle and scan with the mobile recording app, or note down the number on the datasheet.

Bar codes for isotope analysis samples will have **ISO** written on them.



Step 30. Locate the tare weight of the bottle that is etched into the side of the bottle and record this in the mobile recording app, or datasheet.

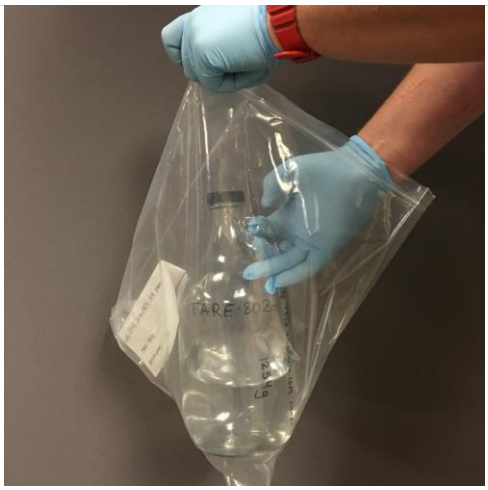


Step 31. Label the bottle and a separate sheet of paper with the information below. Also enter this into the mobile recording app, or data sheet.

Tare weight (if not already etched in)
Bottle+Sample weight

Sample ID:
wdp.XXXX.YYYYMMDD.HHMM.zzzz

wdp = wet deposition
XXXX = Site ID
YYYY = Year
MM = Month
DD = Day
HH = Hour (24 hour clock)
MM = Minute
zzzz = iso or chem
iso = isotope, chem = chemistry



Step 32. Place the labeled and sealed glass sample bottle into a 12” x 15”, 4 mil, reclosable plastic bag and seal.

Place the bagged sample bottle in to the shipping container.

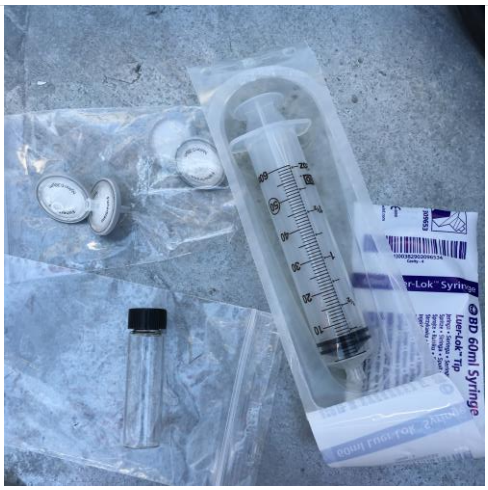
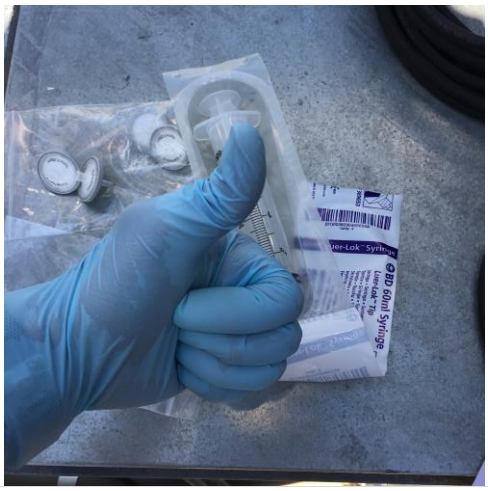
Step 33. Repeat **Step 7** through **Step 32** above for the second sample bottle.

IMPORTANT:

- Once both sample bottles are weighed, labeled, and capped, proceed to **Section 5.6.5.1 Sub-sampling for Water Isotope Analysis** below.

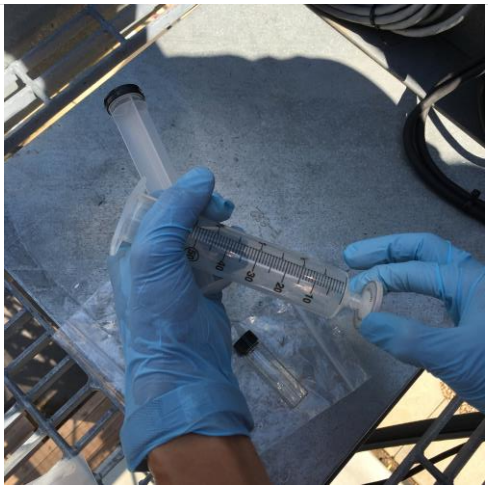
5.6.5.1 Sub-sampling for Water Isotope Analysis

Table 12. Sub-sampling procedure for water isotope analysis

	**Step 1.** Locate and stage the 20 mL glass sample vial, 60 mL syringe, and a couple of the 0.2 µm filters in a clean location. To avoid handling contamination, keep each item in their sealed containers until ready for use. NOTE: Depending on the condition of the sample (clean versus contaminated), more than one filter may be necessary. Bring extra filters, just in case.
	**Step 2.** Put on a new pair of powder-free nitrile gloves.

Step 3. Remove the 60 mL syringe from its packaging and pull the plunger out by pulling firmly. Hold the syringe plunger in the same hand as the syringe.

NOTE: Do not allow the plunger or the tip of the syringe to touch anything. Avoid touching the inside of the syringe.



Step 4. Attach the 0.2 µm filter and secure to the Luer-Lok tip at the end of the syringe. Continue holding the syringe plunger in the same hand.

Step 5. Using the other hand, grab the open glass sample bottle and pour the water sample into the syringe. Fill the syringe to the 30 mL mark. If there is not enough of the collected sample to fill to the 30 mL mark, pour in the entire sample.

NOTE: The sample bottle may be full or too heavy to manage with the opposite hand. In this case, plan or acquire help from a fellow technician. If help is not available, tip the glass sample bottle from its location in the enclosure to aid in filling (see picture to the left).

Step 6. Place the plunger back on to the syringe.

Step 7. Tip the syringe up and push on the plunger to squeeze out excess air.

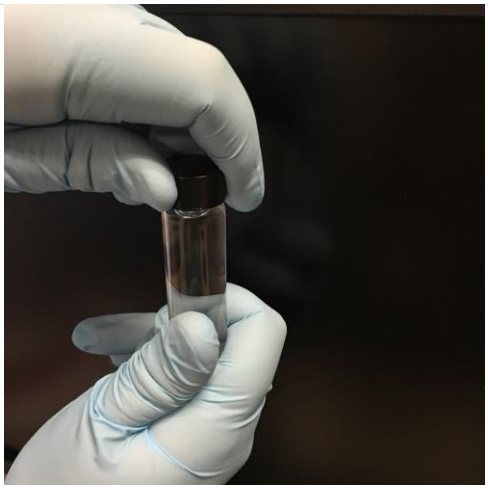
NOTE: Less air in the syringe enables easier filtering of the sample; it also reduces the extension of the plunger for easier handling.

Step 8. Open the cap of the 16 mL glass vial, and set the cap aside.

Step 9. Apply even pressure plunging the sample through the filter into the 16 mL glass vial.

Step 10. Fill the bottle so there is ~5% of head space.

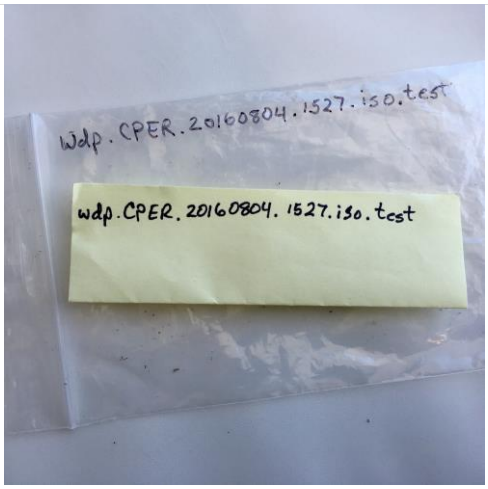
NOTE: Minimizing the head space is important to reduce additional isotopic fractionation of the water. Also, having ~5% of head space available accommodates for thermal expansion that may occur during shipping.



Step 11. Tighten the vial's cap and secure the lid to the vial using several wraps of parafilm.

Step 12. Place an appropriate NEON-provided sample barcode on the vial and scan with the mobile recording app, or note down the number on the datasheet.

Bar codes for isotope analysis sub-samples will have **ISO - test** written on them.



Step 13. Label the bag and a separate sheet of paper with the information below.

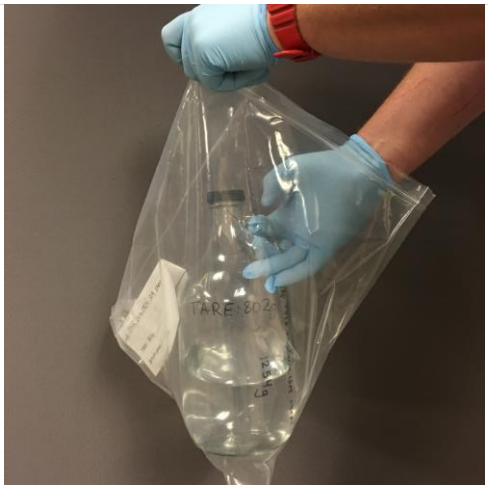
Sample ID:

wdp.XXXX.YYYYMMDD.HHMM.iso.test

wdp = wet deposition
XXXX = Site ID
YYYY = Year
MM = Month
DD = Day
HH = Hour (24 hour clock)
MM = Minute
zzz = **iso** or chem
iso = isotope, chem = chemistry
test = identifier for the sub-sample

Step 14. Place the labeled and sealed glass sample vial into a 4” x 6”, 4 mil, reclosable plastic bag and seal.

Place the bagged sample bottle away and in a safe place. This sample will be sent to the isotope analysis laboratory for analysis.



Step 15. Place isotope analysis sample bottle back into a 12” x 15”, 4 mil, reclosable plastic bag and seal.

Place the bagged sample bottle in to the shipping container.

Step 16. Discard the used filter, syringe, and gloves.

5.6.6 Package Sample Bottles and Sample Train Components

Table 13. Procedure for packing the used glassware

	**Step 1.** Carefully place the glass sample train components and the glass sample bottles into their respective locations within the shipping case. The glassware and the samples are shipped to external laboratories for separate analysis from the Domain office. The glassware is returned to the Domain office *clean* to continue the collection of precipitation samples. The NEON project HQ will provide FOPS and the Domain Manager the address to these laboratories.
	**Step 2.** Place the second layer of foam over the glassware.

Step 3. Complete packing up the case.

NOTE: You can put any spare Keck clips and bottle caps on top of the case to be sent back to the lab.

Step 4. Secure the case with the combination lock.

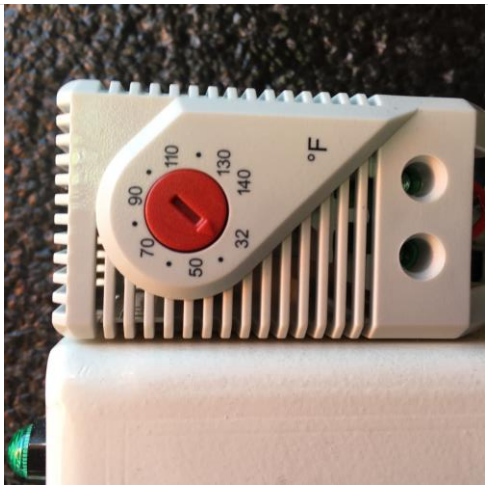
NOTE: If no lock is available, a zip tie will also work to help secure the shipping case.

5.6.7 Verify Temperature Set Points

The temperature range within the environmental enclosure is set to 3° C (37.4° F) and 25° C (77.0° F). Two Temperature Controllers are located within the environmental enclosure to control this temperature range. One is located on top of the power supply (see **Figure 5**), which controls for the temperature set point to active the heaters. The other is located on the Thermo-electric chiller unit (see **Figure 5**, and **Figure 9**).

The temperature set points are typically set by SI&V during the time of installation of the unit, verifying the temperature during each maintenance interval ensures accurate set points and mitigates any accidental changes (particularly, the temperature controller on the Thermo-electric chiller unit).

Table 14. Procedure for verifying the temperature set points

	**Step 1.** Verify the set point is ~37 °F via the Temperature Controller on top of the power supply (see **Figure 5**).
	**Step 1.** Verify the set point is ~77 °F on the Temperature Controller on the Thermo-electric chiller (see **Figure 5** and **Figure 9**).

5.6.8 Cleaning the Collector

Once the samples and glassware are removed, access to the main components of the collector are ready for cleaning. The external surfaces of the collector may be cleaned with a multi-surface cleaner (e.g., Formula 409); however, surfaces that may lead to the potential contamination of samples/sample areas, please use distilled/deionized water.

Always spray the multi-surface cleaner and/or distilled/deionized water directly onto a cloth and **not** onto the surface of the collector. Multiple changes of powder-free nitrile gloves and frequent discarding

of lint-free cloths are necessary to conduct the next set of procedures; ensure an ample supply of these items are available.

Table 15. Procedure for cleaning the sensor body and associated components

	**Step 1.** Put on a new pair of powder-free nitrile free gloves.
	**Step 2.** Spray the Formula 409 Multi-Surface Cleaner on to a clean lint-free cloth.

NOTE: Considerable buildup of dirt may occur on the external surfaces of the collector. If the lint-free cloth becomes excessively dirty, please exchange the cloth for a new one and repeat as necessary.

Step 3. Clean both of the white chimney caps by wiping down the neck of the chimneys. Start from the top of the chimney down. Re-apply cleaner to the lint-free cloth, if necessary.

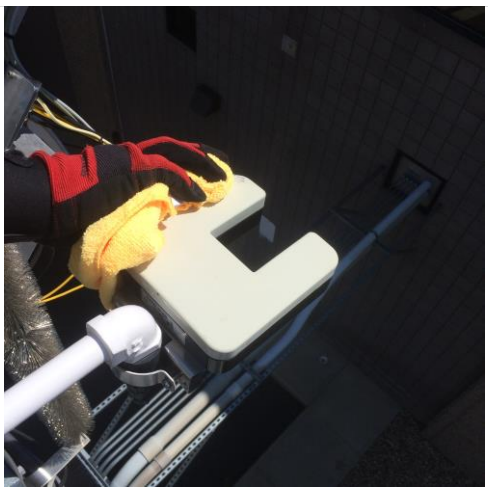
Step 4. Remove the PVC cap and inspect the gasket. Clean if necessary.

Ensure the rubber is not cracked or ripped, and the hose clamp holds the rubber gasket snugly to the chimney.

Step 5. Clean the top surface of the body of the collector, and wipe down the sides, as well. Re-apply cleaner to the lint-free cloth, if necessary.

Step 6. Clean the top surface of the Moving Cover.

Step 7. Clean the top surface of the Splash Shield.



Step 8. Clean the Precipitation sensor.

Step 9. Discard all dirty and used lint-free cloths, and gloves.

Step 10. Put on a new pair of powder-free nitrile free gloves and ready a fresh lint-free cloth.

Step 11. Spray/squeeze distilled/deionized water onto the lint-free cloth.

NOTE: The cloth pictured may look dirty, but is not. It is just a murky gray colored cloth.

Step 12. Clean the underside of the seal on the Moving Cover with the distilled/deionized water.

IMPORTANT: The lid seal should only be cleaned with distilled/deionized water.

While cleaning, inspect the condition of the seal material for cracks and/or tears.

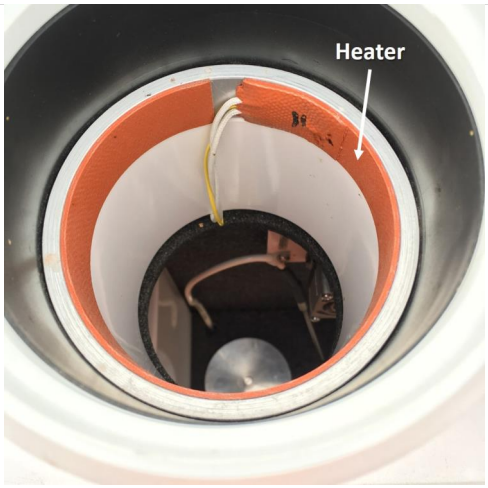
If there are issues with the seal, please make a note and submit a ticket via the issue reporting system.

5.6.9 Inspecting the Funnel Strip Heaters

Now that the sampling glassware is removed, and the exterior of the housing has been cleaned, the two funnel strip heaters should now be inspected.

A silicon strip heater resides within each chimney stack to assist in melting any frozen precipitation accumulation within the glass sample funnel.

Table 16. Procedure to inspect the funnel strip heaters



Step 1. Check the condition of the strip heaters within each chimney stack.

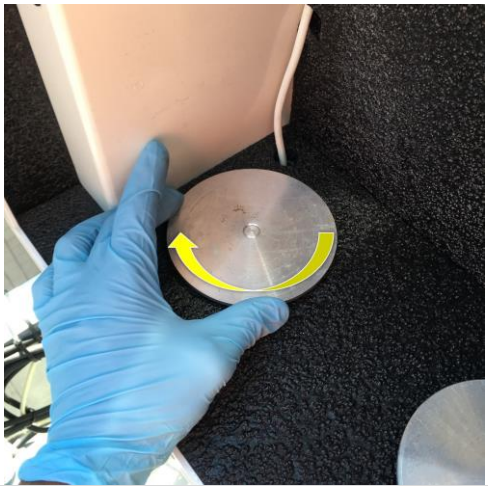
NOTE: Look for whether the heaters are pulling away from the inside of the chimney.

If there are issues with the funnel strip heaters, submit a ticket via the NEON project's issue reporting system.

5.6.10 Deploying New Sample Bottles and Sample Trains

The next step following the removal of the samples and glassware, and the cleaning of the detector body and associated components is the installation of the new glass sample bottles and glass sample trains. Start with deploying the sample bottle located on the right and do not move on to the left until each component to the right are installed (the glass sample train). Repeat the process on the left. This aligns with the procedures outlined below.

Table 17. Procedures to deploy new sample bottles and sample trains

	**Step 1.** Put on a new pair of powder-free nitrile free gloves.
	**Step 2.** Lower the sample bottle holder by turning it clockwise until it is all the way down.

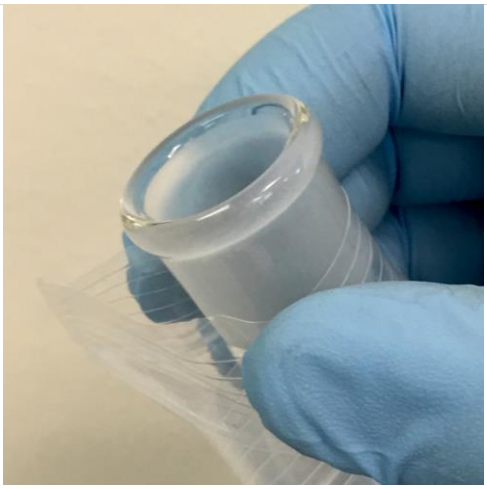
Step 3. Remove a clean glass sample bottle from the container and place it on the bottle holder.

Step 4. While still inside the plastic bag, orient the narrow end of the funnel so it is facing towards the reclosable seal.

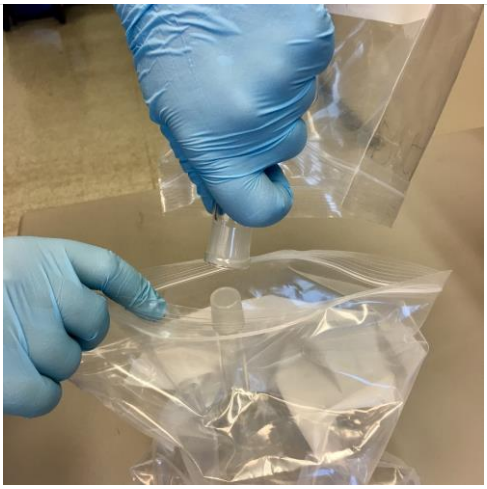
The funnel may already come from the contract laboratory in the correct orientation.

Step 5. Place the funnel with the wide end at the bottom on a stable surface, and open the plastic bag, but do not remove the funnel just yet.

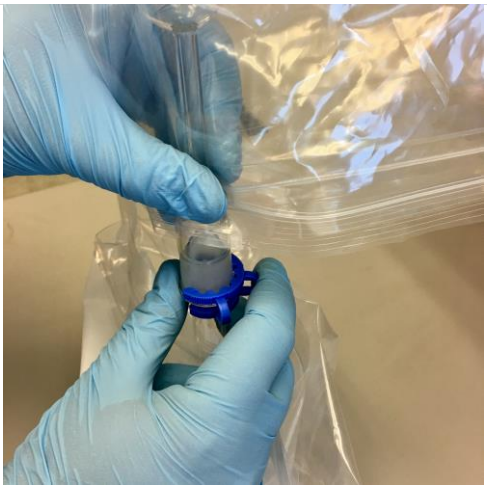
NOTE: Never touch the inside of the funnel. Only handle the funnel from its outside surfaces.



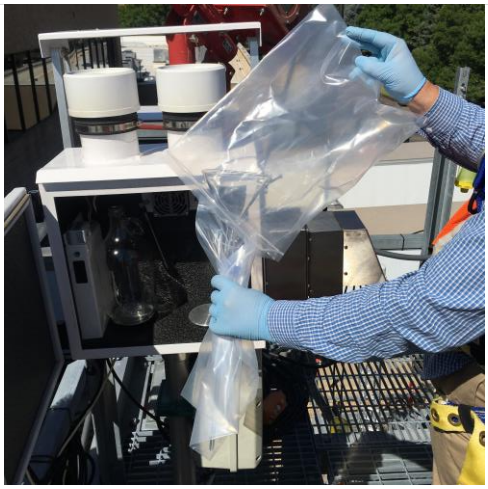
Step 6. Open the plastic bag holding the thistle tube and have the frosted glass end pulled out. Keep rest of thistle tube within the bag.



Step 7. While holding the funnel and thistle tube, attach the thistle tube to the funnel.



Step 8. Hold the thistle tube in place, and attach the Keck clip.



Step 9. Hold the assembled sample train so the funnel is up, and remove the plastic bag that is over the funnel only.

NOTE: Never touch the inside of the funnel. Only handle the glass sample train from its outside surfaces.

Step 10. Carefully hold the glass sample train by the funnel and remove the bottom plastic bag.

Step 11. Gently place the sample train into the same chimney that the sample bottle is in.

NOTE: Try to insert the sample train in as straight as possible. Avoid hitting/bumping the sides of the chimney or the outside of the glass sample train.

Step 12. Guide the thistle tube into the sample bottle and help settle the funnel into the chimney.

NOTE: Only handle the thistle tube above the bulb. This will help prevent sample contamination.

Step 13. Turn the bottle holder counter-clockwise to raise the bottle until the mouth of the bottle touches the thistle bulb.

Ensure the top of the sample bottle is touching the thistle bulb – **not** lifting the thistle tube up.

Step 14. The thistle bulb should be resting snugly within the opening of the glass sample bottle.

Ensure the top of the sample bottle is touching the thistle bulb – **not** lifting the thistle tube up.

Step 15. Ensure the top of the funnel is below the top of the chimney sides as displayed in the corresponding photo.

NOTE: The funnel must be resting within the chimney – **not** above the sides of the chimney.

If the funnel is above the chimney sides, it may interfere with the closing of the Moving Cover and damage the funnel or sample train.

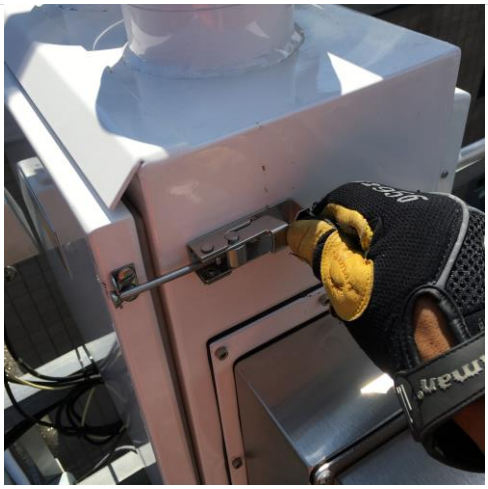
Step 16. Repeat **Step 3** through **Step 15** for the second sample bottle and second sample train.

5.6.11 Restarting the Collector

Table 18. Procedure for restarting the collector

Step 1. Turn the power back on.

This will cause the Moving Cover to close.

	**Step 2.** Check the seal between the Moving Cover and the top of the chimneys once more. Ensure the seal is complete and snug. If not, adjustments to the Moving Cover may be necessary (see Section 5.6.13)
	**Step 3.** Close and secure the door to the collector. Record the date and time of the installation/deployment of the new sample glassware on the datasheet and/or the mobile recording app.

5.6.12 Changing the Moving Cover Lid Seal

The Moving Cover Lid Seal should be replaced twice a year, or as needed if damaged (see Section 5.6.12)

Table 19. Procedure to change the moving cover lid seal

Step 1. Slowly wave a hand (with fingers spread open) vertically in-and-out of the Precipitation Detector until the Moving Cover begins to open.

Step 2. Allow the Moving Cover to open until it is about half-way to fully open, or until the lid is vertical, and flip the power switch (see **Figure 5**) to the off position.

Turning the power off stops the Moving Cover in place.

Step 3. Loosen (but do not remove) the wing nuts on one side of the seal.

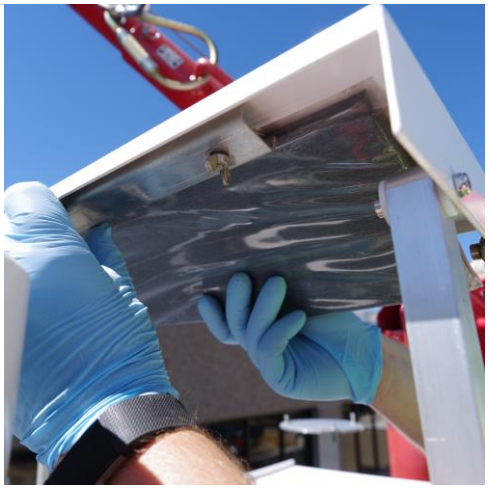
The wing nuts secure aluminum bars that hold the seal in place.

Step 4. Loosen and remove the wing nuts on the other side along with the aluminum bar.

The seal will drop down but should still be held in place by the other side.

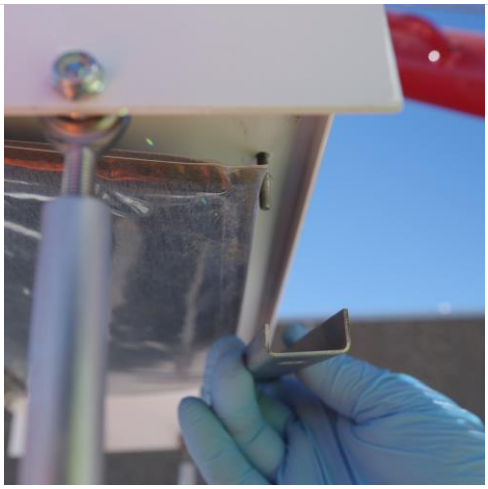
Step 5. Remove the lid seal.

Step 6. Put on a new pair of powder-free nitrile free gloves and ready a fresh lint-free cloth.



Step 7. Smooth out the new lid seal and slide it under the aluminum bar that was loosened in **Step 3** above.

Align the seal and tighten the wing nuts.



Step 8. Press the lid seal towards the other side and hold in place with the aluminum bar from **Step 4** above.

NOTE: The shorter side of the aluminum bar is towards the seal.

Step 9. Hold the aluminum bar in place and tighten on the wing nuts.

Step 10. Spray/squeeze distilled/deionized water onto the lint-free cloth.

Step 11. Clean the underside of the lid seal with the distilled/deionized water.

⚠**IMPORTANT:** The lid seal should only be cleaned with distilled/deionized water.

Step 12. Turn the power back on.

This will cause the Moving Cover to close.

Step 13. Check the seal between the Moving Cover and the top of the chimneys once more.

Ensure the seal is complete and snug. If not, adjustments to the Moving Cover may be necessary (see Section 5.6.13)

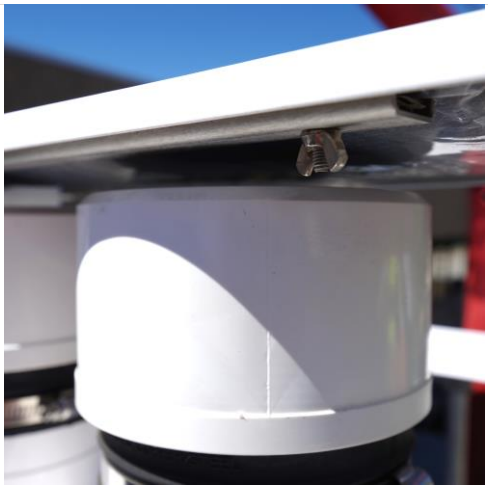
5.6.13 Adjusting the Alignment of the Moving Cover

Table 20. Procedure to adjust the alignment of the Moving Cover

Step 1. Slowly wave a hand (with fingers spread open) vertically in-and-out of the Precipitation Detector until the Moving Cover begins to open.

Step 2. Allow the Moving Cover to open just a few inches, and flip the power switch (see **Figure 5**) to the off position.

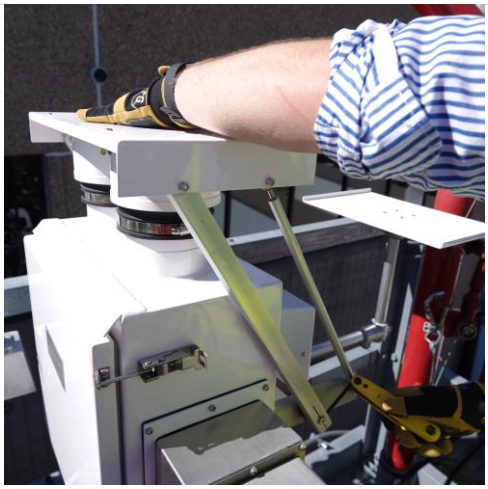
Turning the power off stops the Moving Cover in place.



Step 3. Turn the system back on. The cover will begin to close, and when the lid is about a ½ inch above the chimney tops, turn power off again.

The cover should now be about a ½ inch over the chimney tops.

Step 4. Loosen the 4 cap screws holding the drive arms to the motor axles so the lid comes down on top of the chimneys.



Step 5. Hold the lid firmly on top of the chimneys and retighten the cap screws firmly to secure the drive arms.

Step 6. Repeat opening and closing the Moving Cover to ensure that the lid seals properly on the chimneys.

Lid seal should completely and evenly seat on the chimneys.

6 REMOVAL AND REPLACEMENT (SUBSYSTEM ONLY)

6.1 Equipment

Table 21 contains a list of equipment to conduct sensor refresh for specific instrumentation and/or subsystem components that require calibrations and validations. This also includes unique equipment necessary for removal and replacement procedures. Equipment recommendations and applicability may adjust over time as the implementation of NEON sensors and subsystems mature.

Table 21. Tools, consumables, and resource lists for removal and replacement of the collector

Item No.	Description	Quantity
Tools		
1	Screw Driver (specifically a ¼" straight blade)	1
2	Allen Wrench set (including 3/16th & 1/8th)	1
3	Magnetic Tray	1
Consumable items		
1	Powder-free Nitrile Gloves	2
2	Lint-free Cloths/KimTech Wipes 4.5" x 8.5"	A/R (3+)
3	Distilled/Deionized Water	A/R
4	Multi-surface Cleaner (e.g., Formula 409)	1
5	Screws	2
6	Wing Nuts	A/R
7	Lid Seal (N-Con)	2
8	Red Reject Tag (MX: MX104219)	A/R
Resources		
1	Glass funnel, glass thistle tube, glass sample bottle (64 oz.)	A/R
2	Cable, PRT Submersible, 6 Feet, NADP	A/R

Note: Carry back-up tools and consumables up the tower in the event of dropping the original tools/consumables.

Note: Maintain original product packaging, if possible, for use in future sensor swaps (calibration and validation), temporary storage, or to return faulty equipment.

The heavy-duty motor for the Moving Cover is rated for 20 years of typical service. All parts are easy to replace without special tools. If the sensor subsystem is found inoperable due to unforeseen circumstances, document and report the incident via the NEON project Issue Management System for specific corrective action procedures.

6.2 Removal and Replacement Procedure

The Field Operations Domain Manager is responsible for managing the removal and replacement of the sensors on site. The NEON project Calibration, Validation and Audit Laboratory (CVAL) is responsible for the calibration and validation of sensors, as appropriate.

The Wet Deposition Catawba Grape (24V) is the only component requiring annual calibration and validation. No routine or scheduled calibration and validation requirements are necessary for the Wet Deposition Collector and PRT after initial installation.

The Wet Deposition Catawba Grape (24V) mounts to the tower top railing next to the sensor (see Figure 12). Reference AD [05] for the *TIS Interconnect Mapping*.

Figure 12. Wet Deposition Catawba Grape (24V) with Grape Shield

To minimize data downtime and optimize the availability of sound data, coordinate instrumentation and subsystem **annual** calibration, validation and preventive maintenance requirements to occur within the same timeframe. See Table 22 and Table 6 for sensor refresh requirements applicable to the Wet Deposition.

Table 22. Wet Deposition Subsystem Sensor Refresh Requirements

	LOCATION		TIMEFRAME			COMMENTS
	CVAL	*FIELD*	*BIWEEKLY*	*ANNUAL*	*NA*	
Wet Deposition Catawba Grape (24V)	X			X		Only Concords, Merlots, and Catawbas require annual refresh.

Always verify that the Grape is de-energized prior to connecting or disconnecting sensor cables. Failure to disconnect power before connecting or disconnecting sensor cables may permanently damage the Grape.

6.2.1 Grape Removal and Replacement

To remove a Grape, disconnect the Ethernet cable. This action de-energizes the Grape. Once the Ethernet cable (RJF) is disconnected, disconnect the Wet Deposition sensor's direct connections to the Grape. Remove the Grape from the tower top railing. Maintenance the Grape or package the Grape for sensor refresh in an ESD bag.

As a reminder, please maintain ESD (antistatic) packaging and handling during inter- and intra-site transport, reception, and storage of Grapes.

To replace a Grape, connect the direct connections per AD [05] outside of the Ethernet cable that connects to the Power over Ethernet (PoE) Switch (in this case, the Environmental Enclosure PoE Switch via the Belly Pan). Connect the Ethernet cable and verify Grape is on the network via the Location Controller (LC). As a rule, ***always plug the Ethernet cable in last*** – ***after the enclosure/sensor connections are secure on the Grape***. The Ethernet cable is the last connection to secure on the Grape. Cap Grape connections not in use.

CAUTION: Always disconnect (first) and reconnect (last) the Grape's Ethernet cable before plugging and unplugging sensor connections.

Always shutdown the power prior to removing or replacing any components. If removing a portion of the sensor or subsystem for corrective action, de-energize the Catawba Grape (24V) the sensor directly connects by removing the Ethernet Cable from the Grape.

If removing/replacing the sensor connection in the Environmental Enclosure, switch the circuit breaker on the Hut for the Environmental Enclosure and the circuit breakers in the Environmental Enclosure.

A label resides on the inside of the Environmental Enclosure door that identifies the disconnects at the breaker panels on the side of the Hut. Please maintain the label.

6.2.2 Replacement Installation Instructions (As Appropriate)

6.2.2.1 Sensor Installation

1. Remove the four wing nuts on the side of the sampler that will be used to install the precipitation sensor.
2. Hold sensor up to mounting studs and connect the keyed Molex connector to the Molex connector. Push the connected Molex assembly back into the housing.
3. Align the holes in the sensor mounting with the studs on the housing and secure the mounting to the housing with the four wing nuts provided.
4. Tighten firmly.

6.2.2.2 Splash Shield Alignment

1. If the unit is off, turn the unit on (power switch located inside housing). Allow at least one minute for sensor to warm up. If the unit is on, move on to the next step.
2. Open the sampler Moving Cover by waving fingers between sensor heads. (Movement is required. Stationary object will not open sampler cover.) The Moving Cover opens after approximately 25 seconds. Allow the Moving Cover to come to a stop at a fully open position.
3. Turn off the system so that the cover remains open (and will not automatically close when it does not sense precipitation).
4. Adjust the Splash Shield to a level just below the Moving Cover (no contact).
5. Ensure that the shield is level and tightened completely to prevent rotation.
6. Power the unit on and to return the Moving Cover to its normally closed position.

6.2.2.3 Sample Train Installation

1. Follow instructions in Section 5.6.10, Deploying New Sample Bottles and Sample Trains.

6.2.2.4 Alignment of Moving Cover

1. Turn on power and check that moving cover seats properly. Funnel(s) should rest evenly on the white chimney supports.
2. Lid seal should completely and evenly seat on the chimney(s).

NOTE: If the lid seal does not seat properly on to the chimneys, see Section 5.6.13, Adjusting the Alignment of the Moving Cover

6.2.2.5 Close and Latch Sampler

1. Close and latch unit.

2. There are two latches to insure even seal. Be sure to close latch on underside of unit.

6.2.2.6 Final Check Out

- ☐ Ensure the power cord is connected and secured to underside of sampler or stanchion
- ☐ Ensure the System switch is turned on. (System LED will be on.)
- ☐ Wave your fingers between sensor heads to simulate precipitation.
- ☐ Observe cover opening and resting evenly just above splash shield.
- ☐ In about 2 minutes, the cover should return to the closed position.
- ☐ Check that the cover seats uniformly on the chimney(s) and seal is complete.

6.3 Cleaning & Packaging of Returned Sensor

Field Operations staff clean, package, and ship the sensors back to the CVAL at the NEON project HQ (Battelle Ecology) for annual sensor swap/calibration requirements. (Please note: if a sensor is defective, submit a trouble ticket and affix a red tag with the trouble ticket number on it. See *Section 7* for additional instruction). Clean the Grapes (also known as decontamination; *Reference AD [06])* by removing all biologics from the device prior to capping the connections and placing in ESD packaging.

In the event the Wet Deposition sensor requires maintenance, remove the sample bottles by following Section 5.6.5 Remove Sample Bottles and Sample Trains, then remove any external dirt/debris and follow Section 5.6.8 Cleaning the Collector.

For the PRT, maintain original packaging. The ID chip in the PRT that collects the temperature data is static sensitive; use caution and employ ESD (electrostatic discharge) handling procedures.

🕷 *Please remove all arachnids and/or insects from tower instruments prior to packing and shipping.*

For Grapes, conduct the following steps:

1. Remove Ethernet cable to power down the Grape.
2. Remove Sensor connections.
3. Remove the Catawba Grape from the tower top railing using an Allen wrench.
4. Check mounting holes for spiders and spider webs. Remove biologics and clean each connector.
5. Cap connections and place the device in an ESD bag and shipping container.
6. Update asset records via the NEON's project Asset Management and Logistic Tracking System (e.g., MAXIMO). NEON HQ, Logistics Warehouse (LOGWAR) receives the Grapes for refresh and distributes to CVAL.
7. Provide an electronic packing list to CVAL with the Box number and Asset Tag number (14-digit Property Tag ID ("Property of") number) of each item. CVAL uses this information to verify items via LOGWAR/general HQ distribution of shipments.

8. Prepare a Bill of Lading.

For any Non-CVAL initiated sensor returns, please notify CVAL of the return.

For Sensor Refresh, package sensor items via packaging from CVAL HQ with packing list or per guidance via the Issue Management System and return to the NEON project HQ using the following address:

BATTELLE ECOLOGY, **ATTN: CVAL**
1685 38TH STREET, SUITE 100
BOULDER, CO 80301

Only include sensors/subsystems for refresh. Additional equipment must ship separately as they may require attention from other NEON HQ departments. Sensor refresh shipments go direct to CVAL. If sensors are shipping to HQ to address a trouble ticket, per guidance via the Issue Management System, return to the NEON project HQ using the following address:

BATTELLE ECOLOGY, **ATTN: REPAIR LAB**
1685 38TH STREET, SUITE 100
BOULDER, CO 80301

6.4 Sensor Refresh Record Management of Assets

In addition to the physical movement of devices, the sensor refresh process requires dedicated and accurate record management of asset movement and location.

6.4.1 NEON Asset Management and Logistic Tracking System Requirements

Technicians must update the instrumentation records via the NEON's project Asset Management and Logistic Tracking System (MAXIMO). NEON HQ must maintain accurate record keeping on the location, date, and time offline of an instrument to ensure NEON HQ, Computer Infrastructure, Data Products, and CVAL are aware to apply the correct algorithms, calibrations, and processing factors. Ensure the CFG location reflects the current site of the sensor.

6.4.2 Command and Control Program Information Requirements

Provide notification of the new sensor/subsystem NEON Asset Tag Number via the Asset Management and Logistic Tracking System (MAXIMO), which is the 14-digit Property Tag ID ("Property of") number on

the sensor/subsystem and EPROM ID[3] via the NEON project issue management and reporting system. This ensures integration of the new sensors/subsystems into the NEON Command and Control program. Route and/or add NEON Engineering to the ticket to notify the appropriate points of contact.

[3] A type of read-only non-volatile memory that maintains its programmed information even when not powered.

7 ISSUE REPORTING OUTPUTS

Table 23: Metadata output checklist

Issue Reporting Datasheet		
Datasheet field	**Entry**	
NEON Site Code		
Maintenance Date		
Maintenance Technician		
Preventive Maintenance	**Issue Noted**	**Issue Summary**
Environmental Information Surrounding Area Check	☐	
Exterior Damage	☐	
Cables & Connectors Condition Check	☐	
Snow/Ice Accumulation	☐	
Funnel Strip Heater	☐	
Moving Cover Operation	☐	
Moving Cover Lid Seal	☐	
Black Chimney Gaskets	☐	
Moving Cover Arms	☐	
Thermo-Electric Chiller Unit	☐	
Cross-check Internal Temperature	☐	Internal PRT Temperature: _____°C Handheld IR Temperature: _____°C Temperature Differential: _____°C
Sample Present	☐	☐ Yes ☐ No
Sample Condition	☐	☐ Bird droppings ☐ Cloudy or discolored ☐ Soot/ash/dirt particles ☐ Insects/animal matter ☐ Leaves/twigs/pollen/plant matter ☐ Handling contamination
Shipping Case – Lab Barcode	☐	Barcode #:_____

Issue Reporting Datasheet		
Used Funnel – Lab Barcode	☐	Barcode #: _____
Used Thistle Tube – Lab Barcode	☐	Barcode #: _____
Chemical Analysis Sample Bottle	☐	Sample + Bottle Weight: _____g Bottle Cap Tare Weight: _____g Lab Barcode #: _____ Bottle Tare Weight: _____g Sample Only Weight: _____g
Chemical Analysis Sample ID	NEON Sample Barcode #: _____ wdp._____._____._____.chem	
Isotope Analysis Sample Bottle	☐	Sample + Bottle Weight: _____g Bottle Cap Tare Weight: _____g Lab Barcode #: _____ Bottle Tare Weight: _____g Sample Only Weight: _____g
Isotope Analysis Sample ID	NEON Sample Barcode #: _____ wdp._____._____._____.iso	
Isotope Analysis Sub-Sample ID	NEON Sample Barcode #: _____ wdp._____._____._____.iso.test	

Issue Reporting Datasheet		
Temperature Set Points	☐	☐ 37 °F or Other: _____ ☐ 77 °F or Other: _____
Sensor Body Cleaned	☐	
New Sample Bottles and Trains Deployed	☐	☐ Chemistry Analysis ☐ Isotope Analysis
Sensor Turned Back on	☐	

Notes

For Wet Deposition Sensor/Subsystem corrective actions, ensure proper tracking of the asset via the NEON issue management and tracking system (e.g., JIRA) to establish a chain of custody of the asset between Engineering Repair Laboratory and CVAL.

Conduct the following tasks to ensure the proper management of the asset between sites:

1. For each issue where NEON, HQ is replacing a defective instrument/subsystem at a TIS site, please create a sub-task in the NEON Issue Management and Reporting System for the defective asset from the reported issue. Resolution of an issue does not occur with the installation of a replacement, but with the root cause analysis of the issue deriving from the defective asset. FOPS may resolve the ticket upon installation of the replacement if a sub-task exists for the defective asset for NEON HQ to conduct root cause analysis[4]. Figure 13 displays where to create a sub-task from an issue involving a defective asset returning to NEON HQ.

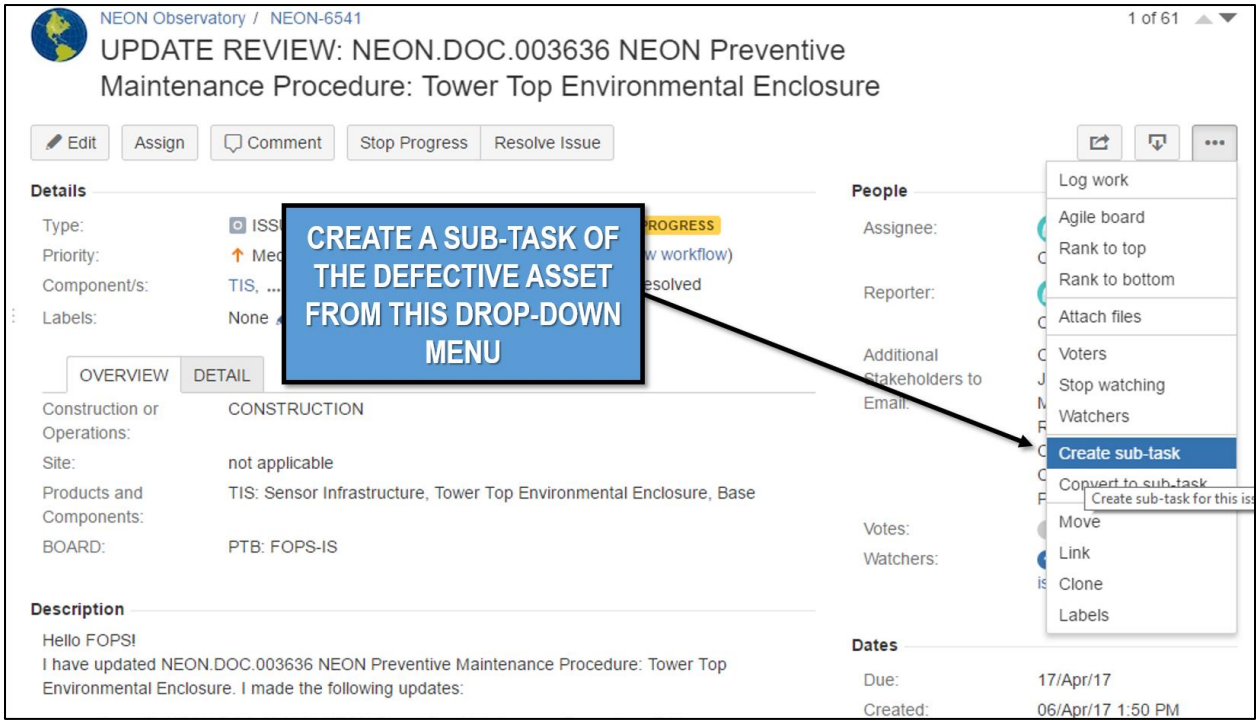


Figure 13. Create a Sub-Task for Chain of Custody of the Defective Asset for Root Cause Analysis via ENG Repair Lab and/or CVAL

2. Ship all defective equipment/assets with a red "Rejected" tag. Figure 14 displays the minimum information requirements for each tag.

[4] JIRA-5848 is a good example for reference.

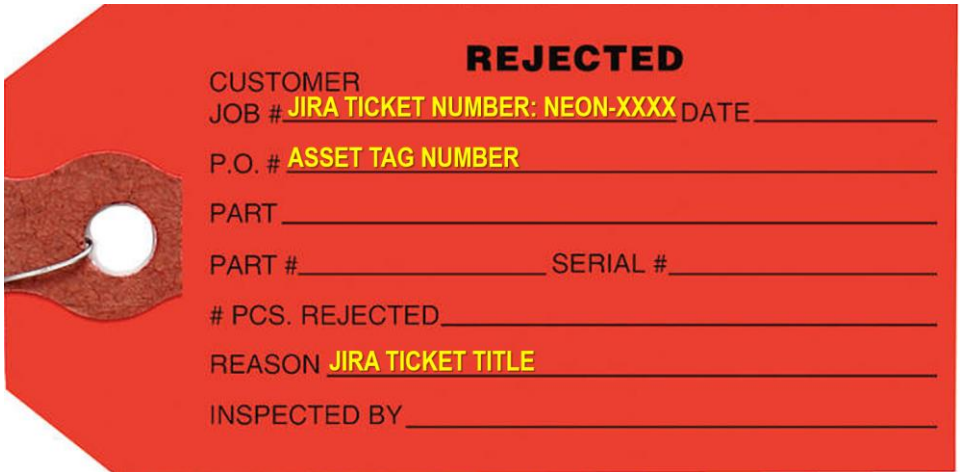


Figure 14. Red Rejected Tag for Defective Assets (MX104219)

8 APPENDIX

- 8.1 - Glassware and Shipping Container Requirements per Domain
- 8.2 - Kitting Out the Wet Deposition Glassware Cases
- 8.3 - Troubleshooting

8.1 Glassware and Shipping Container Requirements per Domain

- (4) sets[5] of complete sample trains and 64 oz. sample bottles
    - (1) active set – inside collector
    - (1) swap set – set that will be swapped at maintenance
    - (1) back-up set –in case of any breakage/contamination during maintenance
    - (1) next deployment set – in case there is a delay in the return of a glassware set from the contract laboratory

- (4) shipping containers for the assembled sample trains and 64 oz. sample bottles
    - Bel-Air ReadyCase™ Shipping Case, 21.3” x 15.8” x 9.8”
        - Holds: two glass sample funnels, two glass thistle tubes, two 64 oz. glass sample bottles, two spare caps, and two Keck clips
        - [SKU: TS2116 - https://shop.bel-air-cases.com/product/bel-air-ready-case-21x16/]

[5] A set is two of each item

8.2 Kitting Out the Wet Deposition Glassware Cases

NOTE: This will probably only have to be done when the glassware and shipping cases are new. Once the glassware and shipping cases are received by the contract lab, they should arrive to each Domain office with *clean* glassware and each piece of glassware individually packaged in reclosable plastic bags.

There will be one shipping case for each complete set[6] of wet deposition glassware. Thistle tubes will be placed in the top layer of pick and pluck foam (inside capped PVC protective tubes), and the 64 oz. sample bottles and funnels will occupy the bottom two layers of pick and pluck.

For the first round of cleaning, we will not put bottles and funnels in plastic bags. Thistle tubes must always be packed in a 10 x 12 inch plastic bag to provide some cushion in the PVC carriers. The thistle tubes are extremely delicate and cannot be placed inside the case without an additional protective casing. The cardboard tube they originally came in will not stand up to repeated long term use. A PVC carrier has therefore been devised.

Step 1. Purchase 1-1/2 inch internal diameter PVC pipe, and corresponding PVC caps.

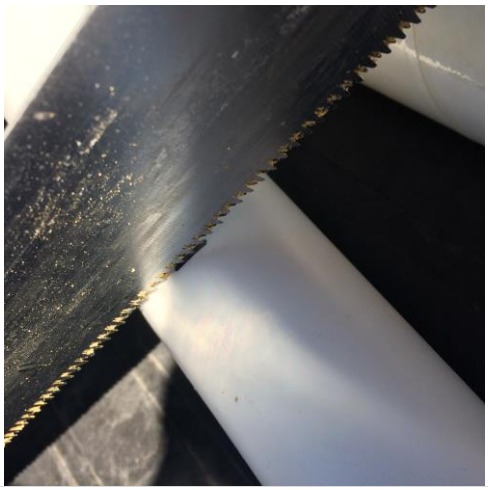
At Home Depot, the product numbers are:

- 754826203441 – 1-1/2 in. x 10 ft. PVC Schedule 40 Pipe
- 049081136864 – 1-1/2 in. PVC cap

[6] A set is two of each item

Step 2. Use the cardboard tube the thistle tubes were shipped in as a guide for how long to cut the PVC.

The length is typically 13-14 inches.



Step 3. Cut the PVC to length with a saw.

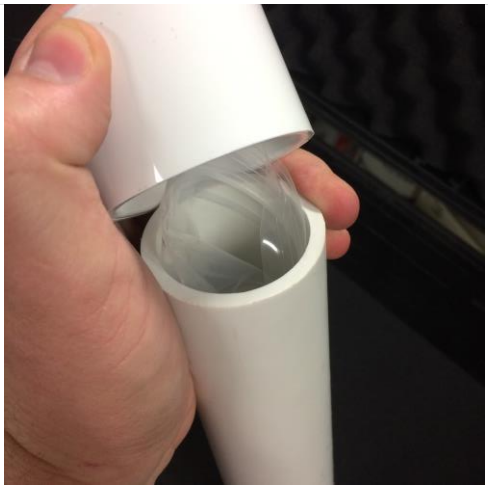
Step 4. Place a PVC cap on one end of the newly cut pipe section.

Step 5. Place the thistle tube into a 10 x 12 in. reclosable plastic bag as shown.

Step 6. Carefully roll the bag up around the thistle tube.

Step 7. Place the thistle tube into the PVC carrier.

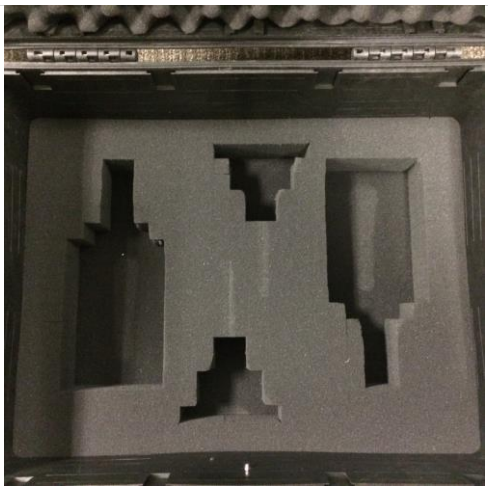
NOTE: If the tube does not easily fit, don't force it, rather reroll the bag tighter and try again.



Step 8. Cap the open end.

8.2.1 Packing the Glassware

The designated shipping case (see Table 7) has three thick layers of pick-and-pluck foam inserts that will have to be specifically cut to accommodate the sample bottles, and sampling trains. Below are instructions on how to properly arrange and cut each foam insert.



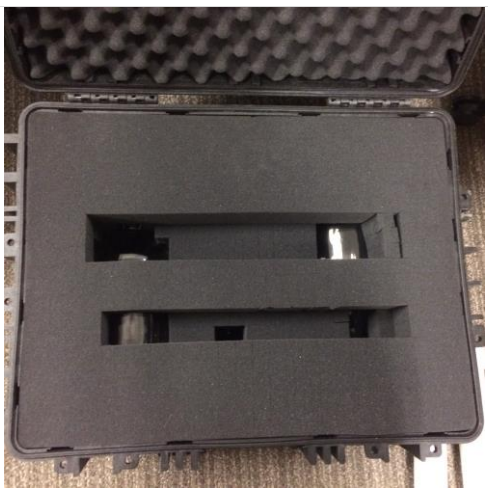
Step 1. Remove the top two foam layers out of the case. The bottom layer should be picked for the bottles and funnels as shown to the left.

NOTE: Do not pick out a spot for the stem of the funnels. The stems will be sandwiched between the two layers.

Step 2. Place the bottles and funnels into the case as shown to the left. The bottles and funnels should be snug within the foam cutouts.

Step 3. Repeat the same pattern as in Step 1 above for the next layer of foam and place over the glassware.

NOTE: Do not pick out a spot for the stem of the funnels. The stems will be sandwiched between the two layers.



Step 4. Place the top layer of foam on top of the glassware and pick out the foam to fit the size of the capped PVC thistle tube carriers.

NOTE: The PVC tubes should be placed towards the center of the foam mat so they don't rest on the funnels. They will contact the bottles, but that is okay.

Step 5. Place the PVC thistle tube carriers into the cutouts. They should be snug.

Step 6. Place each bottle cap into separate reclosable plastic bags, and the two Keck clips in their own reclosable plastic bag. They can be laid out on the top layer of foam.

NOTE: For shipping, the bagged caps and Keck clips can be laid out on the top layer of foam.

Step 7. Close and lock the case with a combination lock.

NOTE: It is recommended that all Domains use the same combination code so the contract laboratory could easily open each case.

Step 8. Ship to the contract lab.

8.3 Troubleshooting

Problem	Possible Cause	Check	Action	Notes
System will not power on	No power to device	Fuses, power connections	Replace or reconnect as necessary	
	Motor cable not connected	Motor cable connection	Check connection or reconnect	Motor cable must be properly connected to the base of the unit for the instrument to power on
Moving Cover will not open	No power to device	Fuses, power connections	Replace or reconnect as necessary	
	Power switch is OFF	Power switch position	Turn to ON position	See Figure 5
Moving Cover will not open (but power is ON)	Rain sensor not functioning	Check rain sensor	1. Turn power OFF 2. Remove sensor arm via the four wing nuts 3. Disconnect the Molex connector 4. Attach Sensor Simulator 5. Turn power ON 6. Activate Simulator switch - If unit opens, rain sensor is faulty	See ER [01], page 17
	Drive motor faulty	Check driver motor	Replace as necessary	
Moving Cover does not rest on chimneys	Misalignment of moving cover	Alignment of the moving cover	Adjust moving cover	See Section 5.6.13