

Wet Deposition Sampling



Asia Pacific Mercury
Monitoring Network



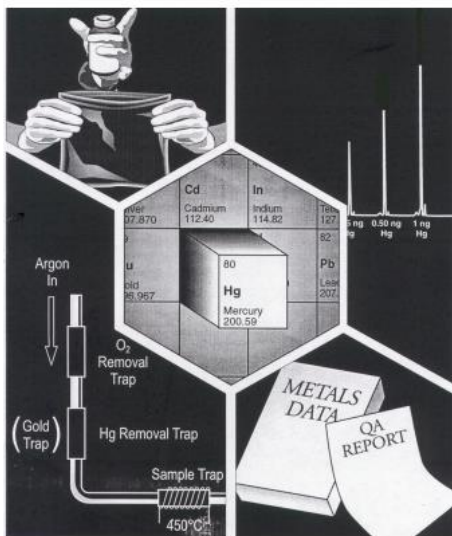
Center for Environmental
Monitoring and Technology
National Central University

Reference



Method 1631, Revision E: Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry

August 2002



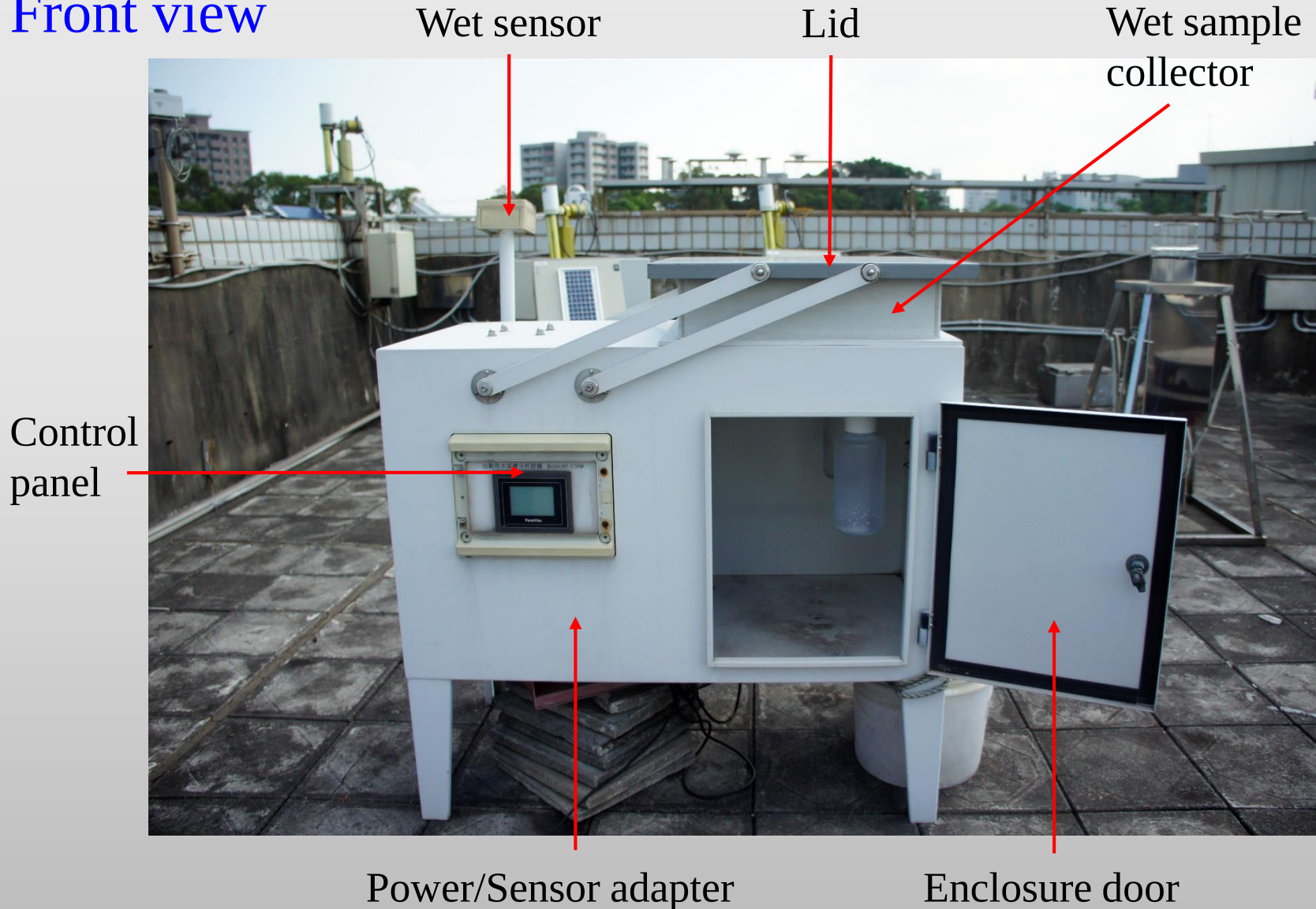
Asia – Pacific Mercury Monitoring Network (APMMN)

Mercury Wet Deposition Network Field Standard Operating Procedures

Version 1.3-, February, 2015

Wet-only precipitation collector-MIC type

Front view

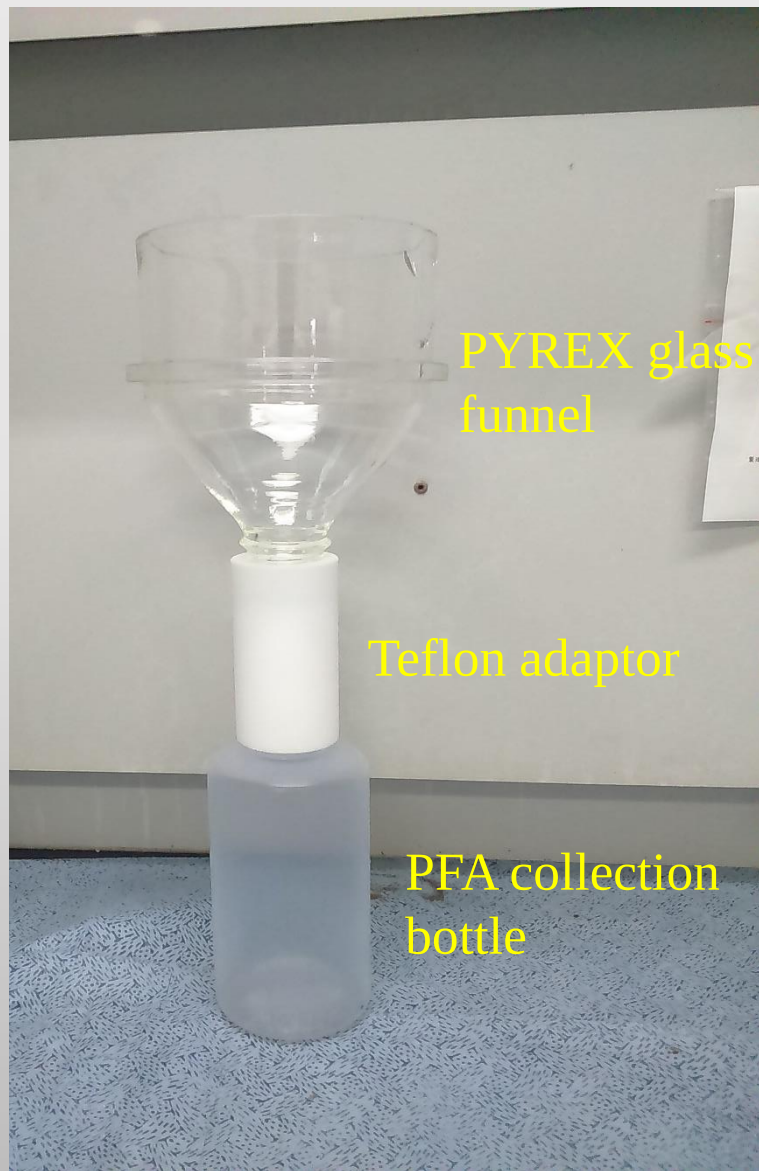


MIC type

Top view



Mercury collection device



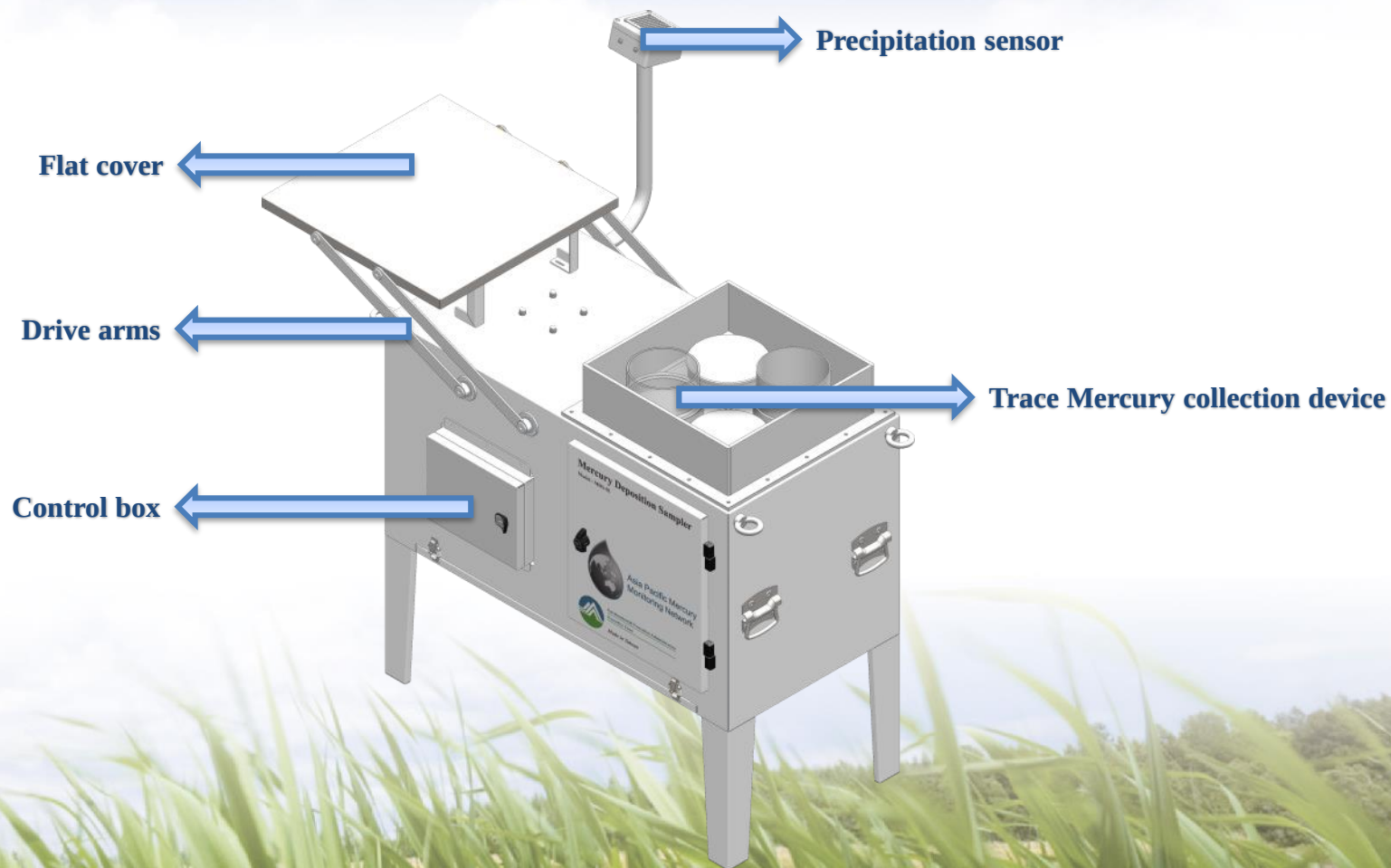
Mercury Deposition Sampler



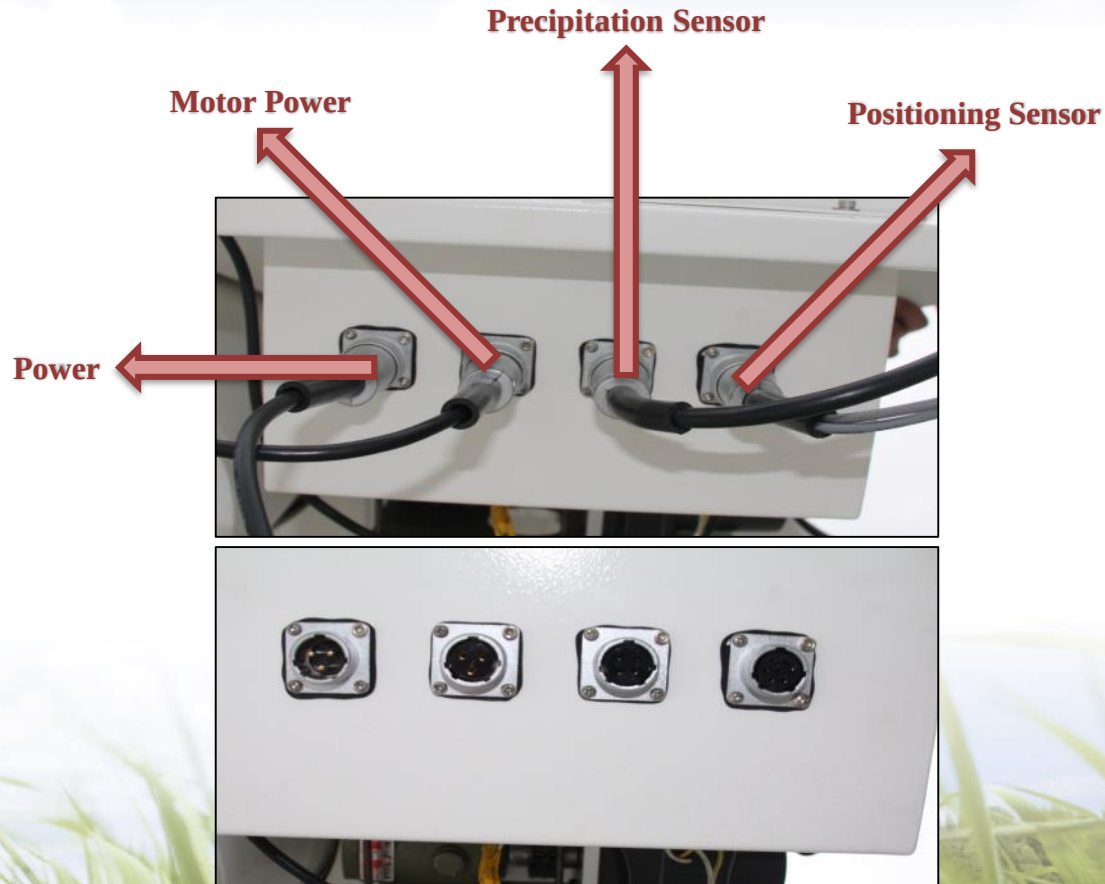
General Manager
Cheng Jung Huang

E-mail : asir@machine-shop.com.tw

External item of the equipment



Internal item of the equipment



Internal item of the equipment



Shaft coupling

Sensor positioning sheet

Flat cover closing positioning sensor

Flat cover opening positioning sensor

Description of Operation

When precipitation sensor detects precipitation.



“Precipitation” light on controller monitor will be on. Then “Heater” will light on and shine followed by setting.

Cover open	Precipitation	Manual OFF
		
Cover close	Heater	Auto ON
		
Setting	Stop	

For example, set Heater ON to 10 seconds and Heater OFF to 5 seconds. “Heater” light will repeat shining 10 seconds and then going out 5 seconds until “Precipitation” light off.

Description of Operation

When “Precipitation” lights on, flat cover will open and start to collect mercury deposition



While the flat cover opening, Sensor positioning sheet will synchronously rotate with it until be detected by Flat cover opening positioning sensor with lighting on. Then flat cover will stop. “Cover open” on controller monitor will light on.



Cover open	Precipitation	Manual
☒	☒	
Cover close	Heater	Auto
☐	☒	
Setting	Stop	ON

Description of Operation

When precipitation sensor doesn't detect precipitation.



“Precipitation” light on controller monitor will be off. Then “Heater” will light of.

Cover open	Precipitation	Manual OFF
		
Cover close	Heater	Auto ON
		
Setting	Stop	

Description of Operation

When “Precipitation” lights off, flat cover will close.



While the flat cover closing, Sensor positioning sheet will synchronously rotate with it until be detected by Flat cover closing positioning sensor with lighting on. Then flat cover will stop. “Cover close” on controller monitor will light on



Cover open	Precipitation	Manual OFF
☐	☐	
Cover close	Heater	Auto ON
☒	☐	
Setting	Stop	

Description of Operation

When “Precipitation” lights off, flat cover will close.

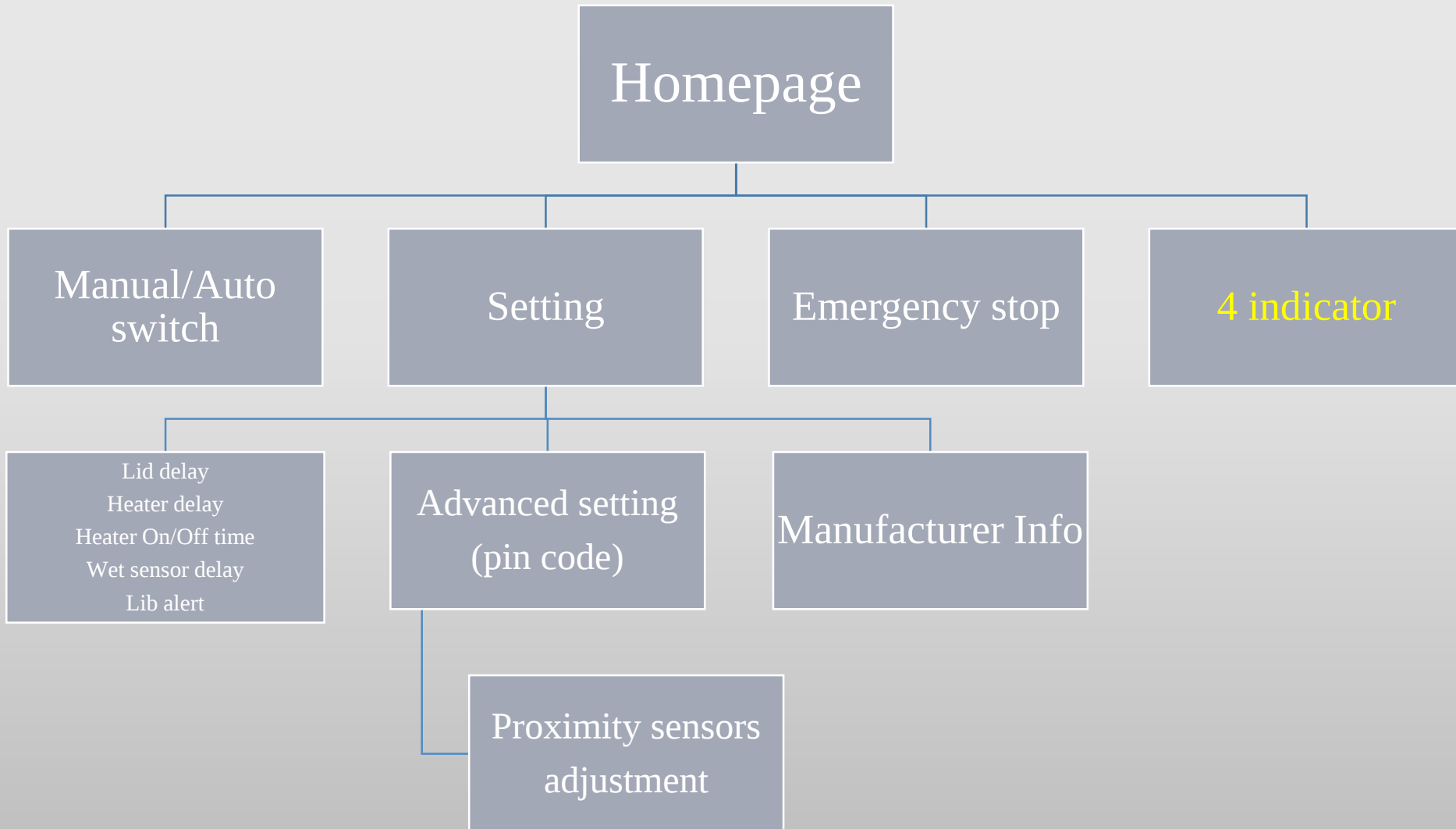


While the flat cover closing, Sensor positioning sheet will synchronously rotate with it until be detected by Flat cover closing positioning sensor with lighting on. Then flat cover will stop. “Cover close” on controller monitor will light on



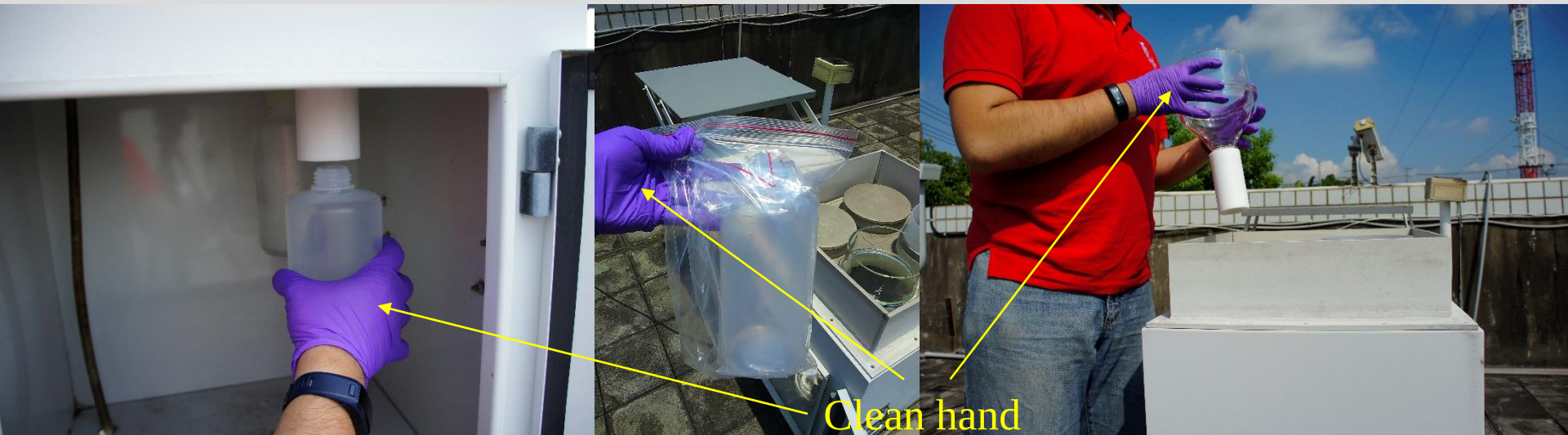
Cover open	Precipitation	Manual OFF
☐	☐	
Cover close	Heater	Auto ON
☒	☐	
Setting	Stop	

Control panel



Retrieve your sample

- Changes on Tuesday morning between 8 to 10 AM local time.
- Approach collector **facing into the wind**
- Fill in the NOF



Network Observer Form (NOF)



Asia Pacific Mercury
Monitoring Network

OBSERVER FORM

Rev. 10/18

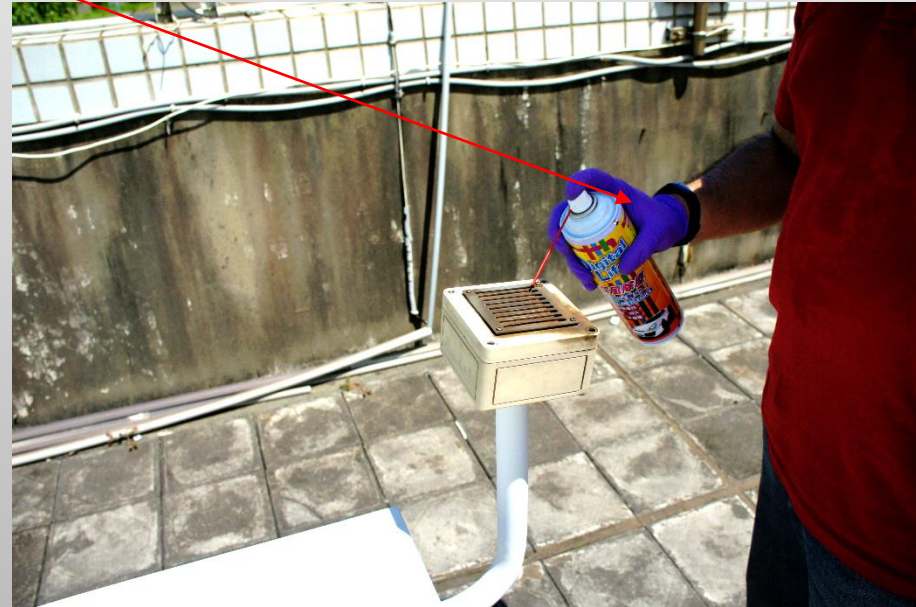
Courier/Tracking # _____

LAB ID		Central Laboratory Use Only																																									
		Sample Receipt																																									
1. STATION Name _____ ID <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td>A</td><td>P</td><td></td><td></td><td></td><td></td></tr> </table>		A	P					2. OBSERVER ON OFF Name _____ Name _____																																			
A	P																																										
3. BOTTLE Date <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td>Month</td><td>Day</td><td>Year</td></tr> </table> Time <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td>Hour</td><td>Minute</td></tr> </table> ON <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table> OFF <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>		Month	Day	Year	Hour	Minute													4. ANALYSIS TYPE Total Mercury <table border="1" style="display: inline-table; width: 40px; height: 20px; text-align: center;"> <tr><td></td></tr> </table> Field Blank <table border="1" style="display: inline-table; width: 40px; height: 20px; text-align: center;"> <tr><td></td></tr> </table> Other <table border="1" style="display: inline-table; width: 40px; height: 20px; text-align: center;"> <tr><td></td></tr> </table>																								
Month	Day	Year																																									
Hour	Minute																																										
5. OBSERVATIONS Check yes or no if samples were observed to have any of the following. Describe all observations in Block 10 <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td>Yes</td><td>No</td></tr> </table> <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 1. Bird Droppings <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 2. Cloudy or discolored <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 3. Soot/ash/dirt particles <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td>Yes</td><td>No</td></tr> </table> <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 4. Insect/animal matter <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 5. Leaves/twigs/pollen/plant matter <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 6. Handling contamination		Yes	No							Yes	No							6. SITE OPERATIONS <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td>Yes</td><td>No</td></tr> </table> <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td></tr> </table> 1. Collector sensor and motor are operating properly. Lid in correct position 2. Rain gauge operated properly during the week 3. Rain gauge data has been submitted to the Program Office or Belfort Chart is with the OF		Yes	No																						
Yes	No																																										
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Yes	No																																										
7. PRECIPITATION RECORD R – Rain only S – Snow Only M – Mixture U – Unknown <table border="1" style="width: 100%; text-align: center;"> <tr> <th></th> <th>MON</th> <th>TUE</th> <th>WED</th> <th>THU</th> <th>FRI</th> <th>SAT</th> <th>SUN</th> <th>MON</th> <th>TUE</th> <th>WED</th> </tr> <tr> <td>Precipitation Type</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> <td>R S M U</td> </tr> <tr> <td>Precipitation depth</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table> Total Precipitation <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td><td></td><td></td></tr> </table> mm			MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED	Precipitation Type	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	Precipitation depth																8. OVERFLOW Yes <table border="1" style="display: inline-table; width: 40px; height: 20px; text-align: center;"> <tr><td></td></tr> </table> No <table border="1" style="display: inline-table; width: 40px; height: 20px; text-align: center;"> <tr><td></td></tr> </table> _____ g			
	MON	TUE	WED	THU	FRI	SAT	SUN	MON	TUE	WED																																	
Precipitation Type	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U	R S M U																																	
Precipitation depth																																											
10. REMARKS For example: equipment malfunction, extreme weather conditions, contamination, burning, leakage, etc.		9. ENCLOSURE TEMPERATURE MAXIMUM <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td></tr> </table> °C MINIMUM <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td></tr> </table> °C HCl <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td><td></td><td></td></tr> </table> mL BrCl <table border="1" style="display: inline-table; width: 100px; height: 20px; text-align: center;"> <tr><td></td><td></td><td></td><td></td><td></td></tr> </table> mL																																									

Cleaning the collector

- Clean any surface have dirt with paper towel
- Clean any debris off sensor by brush or compressed air

Dirty hand



Deployment of new sample collector

- Use new gloves !
- Install new sample collector
- Avoid to touch the inner wall of glass funnel
- Start the next week NOF
- Loose $1/8$ turn of PFA bottle – prevent pressure lock



Weigh, transfer and storage

- Weigh the sample bottle and subtracting the pre-sample weight of bottle (recode it on the NOF)
- Transfer the sample from 1L to 150ml sample bottle
- Label the sample with sampling site ID, start/end date
- Place the sample into **double** sealable plastic bag
- Store the sample in a **Hg-free and secure place** (or refrigerator) if not shipping immediately.
- Capture rain gauge data
- Complete the NOF



Sample label

- The most important part of taking sample

Site ID

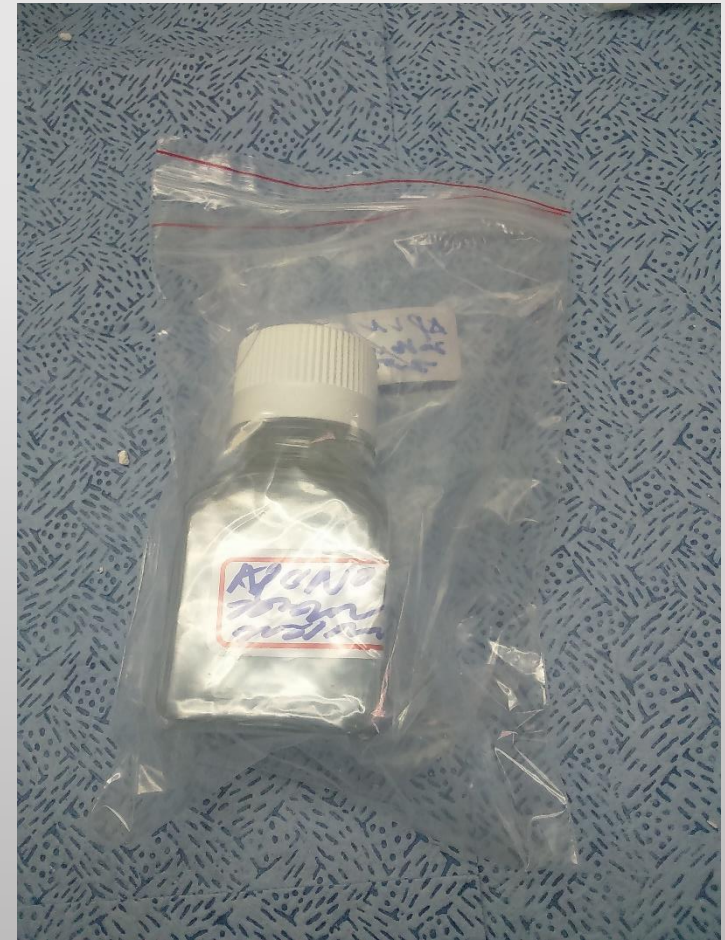
Start Date (MM/dd/yyyy)

End Date

APTW01

06/04/2019

06/11/2019



Code of Federal Regulations

40 CFR 136.3 - Identification of test procedures.

DEP-SOP-001/01
FS 1000 General Sampling Procedures

Table FS1000-4

40 CFR Part 136 TABLE II: Required Containers, Preservation Techniques, and Holding Times*
Applicable to all Non-Potable Water Samples (includes wastewater, surface water, and groundwater)

Parameter No./Name (refers to parameter number on Tables IA,B, C, D,E, F, G & H as noted)	Container ¹	Preservation ^{2, 3}	Maximum holding time ⁴
35. Mercury (CVAA)	P, FP, G	HNO ₃ to pH<2	28 days
35. Mercury (CVAFS)	FP, G; and FP-lined cap	5 mL/L 12N HCl or 5 mL/L BrCl ¹⁷	90 days ¹⁷
3, 5–8, 12, 13, 19, 20, 22, 26, 29, 30, 32–34, 36, 37, 45, 47, 51, 52, 58–60, 62, 63, 70–72, 74, 75. Metals, except boron, chromium VI, and mercury.	P, FP, G	HNO ₃ to pH<2, or at least 24 hours prior to analysis ¹⁹	6 months

¹⁷ Samples collected for the determination of **trace level mercury (<100 ng/L)** using EPA Method 1631 must be collected in tightly-capped fluoropolymer or glass bottles and **preserved with BrCl or HCl solution within 48 hours of sample collection**. The time to preservation may **be extended to 28 days if a sample is oxidized in the sample bottle**. A sample collected for dissolved trace level mercury should be filtered in the laboratory within 24 hours of the time of collection. However, if circumstances preclude overnight shipment, the sample should be filtered in a designated clean area in the field in accordance with procedures given in Method 1669. If sample integrity will not be maintained by shipment to and filtration in the laboratory, the sample must be filtered in a designated clean area in the field within the time period necessary to maintain sample integrity. A sample that has been collected for determination of total or dissolved trace level mercury must **be analyzed within 90 days of sample collection**.

Acid Clean of Collection Devices

Material/Equipment

- Personal Protective Equipment
- Deionized water – $\rho \geq 18.2 \text{ M}\Omega$
- **Hydrochloric acid** – J.T Baker Hydrochloric Acid, 36.5-38.0%, BAKER INSTRA-ANALYZED[®] Reagent or equivalent
- PE box/tank

Certificate of Analysis

Hydrochloric Acid, 36.5–38.0%
BAKER INSTRA-ANALYZED® Reagent
For Trace Metal Analysis



Material No.: 9530-00
Batch No.: 0000083492
Manufactured Date: 2014/04/22
Retest Date: 2019/04/21

Certificate of Analysis

Test	Specification	Result
ACS – Assay (as HCl) (by acid-base titrn)	36.5 – 38.0 %	37.7
ACS – Color (APHA)	<= 10	5
ACS – Residue after Ignition	<= 3 ppm	1
ACS – Specific Gravity at 60°/60°F	1.185 – 1.192	1.190
ACS – Bromide (Br)		
ACS – Extractable Organic Substances		
ACS – Free Chlorine (as Cl ₂)		
Phosphate (PO ₄)		
Sulfate (SO ₄)		
Sulfite (SO ₃)		
Ammonium (NH ₄)		
Trace Impurities – Arsenic (As)		
Trace Impurities – Aluminum (Al)		
Arsenic and Antimony (as As)		
Trace Impurities – Barium (Ba)		
Trace Impurities – Beryllium (Be)		
Trace Impurities – Bismuth (Bi)		
Trace Impurities – Boron (B)		
Trace Impurities – Cadmium (Cd)	<= 20.0 ppb	< 5.0
	<= 1.0 ppb	< 1.0

Hydrochloric Acid, 36.5–38.0%
BAKER INSTRA-ANALYZED® Reagent
For Trace Metal Analysis

Material No.: 9530-00
Batch No.: 0000083492

Test	Specification	Result
Trace Impurities – Germanium (Ge)	<= 3.0 ppb	< 2.0
Trace Impurities – Gold (Au)	<= 4.0 ppb	< 0.2
Heavy Metals (as Pb)	<= 100 ppb	< 50
Trace Impurities – Iron (Fe)	<= 15.0 ppb	1.9
Trace Impurities – Lead (Pb)	<= 1.0 ppb	< 0.5
Trace Impurities – Lithium (Li)	<= 1.0 ppb	< 1.0
Trace Impurities – Magnesium (Mg)	<= 10.0 ppb	< 1.0
Trace Impurities – Manganese (Mn)	<= 1.0 ppb	< 1.0
Trace Impurities – Mercury (Hg)	<= 0.5 ppb	0.3
Trace Impurities – Molybdenum (Mo)	<= 10.0 ppb	< 5.0
Trace Impurities – Nickel (Ni)	<= 4.0 ppb	< 0.3
Trace Impurities – Niobium (Nb)	<= 1.0 ppb	< 1.0
Trace Impurities – Potassium (K)	<= 9.0 ppb	< 1.0
Trace Impurities – Selenium (Se), For Information Only	ppb	1.0
Trace Impurities – Silicon (Si)	<= 100.0 ppb	< 10.0
Trace Impurities – Silver (Ag)	<= 1.0 ppb	< 1.0
	ppb	< 5.0
	ppb	< 1.0
	ppb	< 0.9
	ppb	< 5.0
	ppb	< 0.8
	ppb	< 1.0
	ppb	< 1.0
	ppb	< 1.0
	ppb	< 1.0

Country of Origin: US

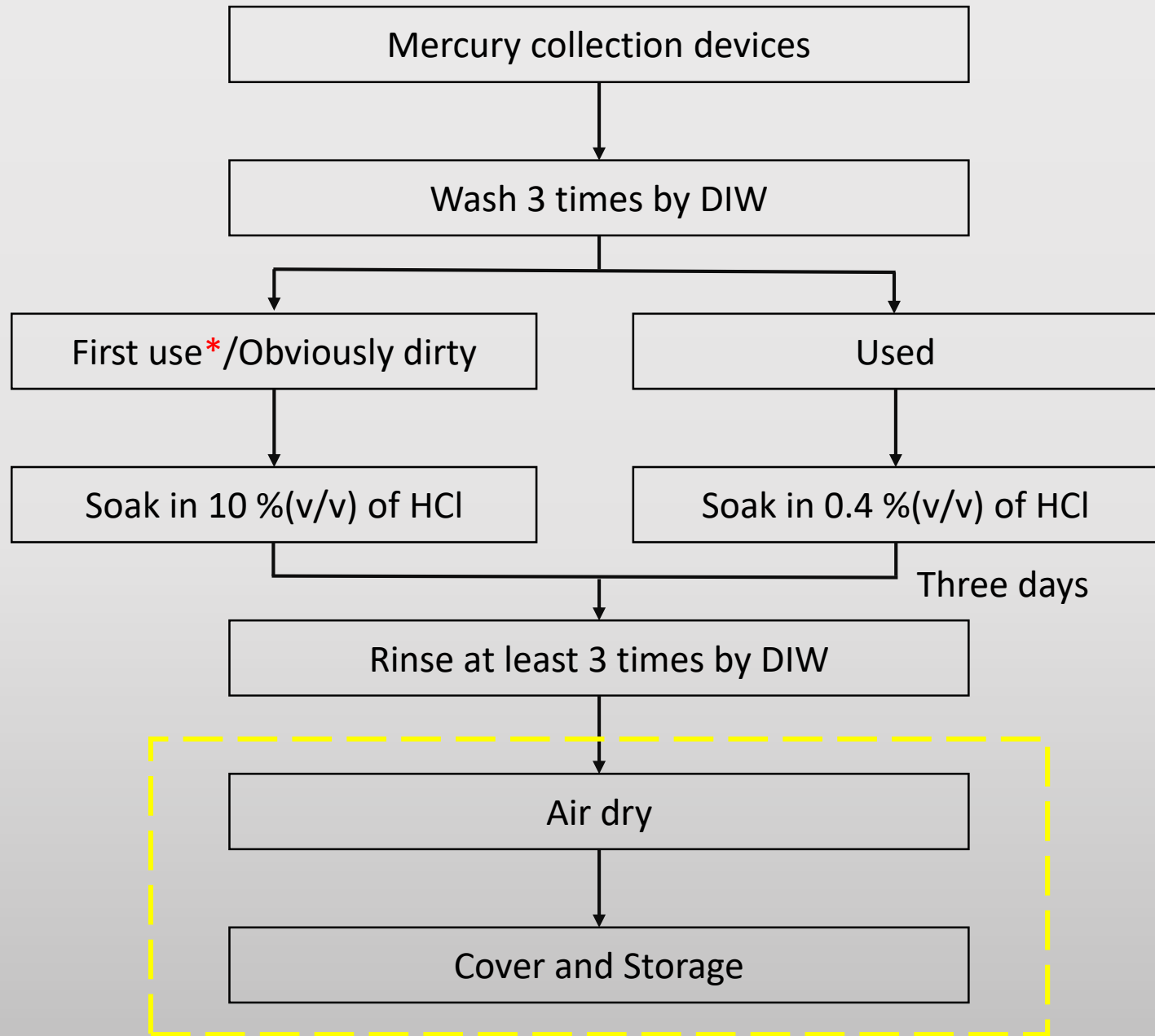
ACS – Assay (as HCl) (by acid–base titrn) 36.5 – 38.0 % 37.7

Trace Impurities – Mercury (Hg) <= 0.5 ppb 0.3



Phillipsburg, NJ 9001:2008, 14001:2004
Paris, KY 9001:2008
Mexico City, Mexico 9001:2008
Deventer, The Netherlands 9001:2008, 14001:2004, 13485:2003
Gliwice, Poland 9001:2008, 17025:2005
Selangor, Malaysia 9001:2008
Delhradun, India, 9001:2008, 14001:2004, 13485:2003
Mumbai, India, 9001:2008, 17025:2005
Panoli, India 9001:2008

Richard M. Siberski
Richard M Siberski
Vice President Global Quality



* : independent tank, fresh solution

Under the clean room/clean bench

Acid Clean of Collection Devices

- Separate the collection device and wash by DIW



Acid Clean of Collection Devices

- Soak within hydrochloric acid for 72 hours (**except O-ring**)



Acid Clean of Collection Devices

- Rinse thoroughly each component with deionized water ($\rho \geq 18.2 \text{ M}\Omega$) at least **3 times**



Acid Clean of Collection Devices

- Air dry each component in the clean bench



Acid Clean of Collection Devices

- Cover each component with clean plastic bag and store
- Assemble each component before use



Da-Wei Lin
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Asia Pacific Mercury
Monitoring Network



Center for Environmental
Monitoring and Technology
National Central University