

Manual Atmospheric Mercury Sampling



Asia Pacific Mercury
Monitoring Network



Center for Environmental
Monitoring and Technology
National Central University

Reference

EPA/625/R-96/010a

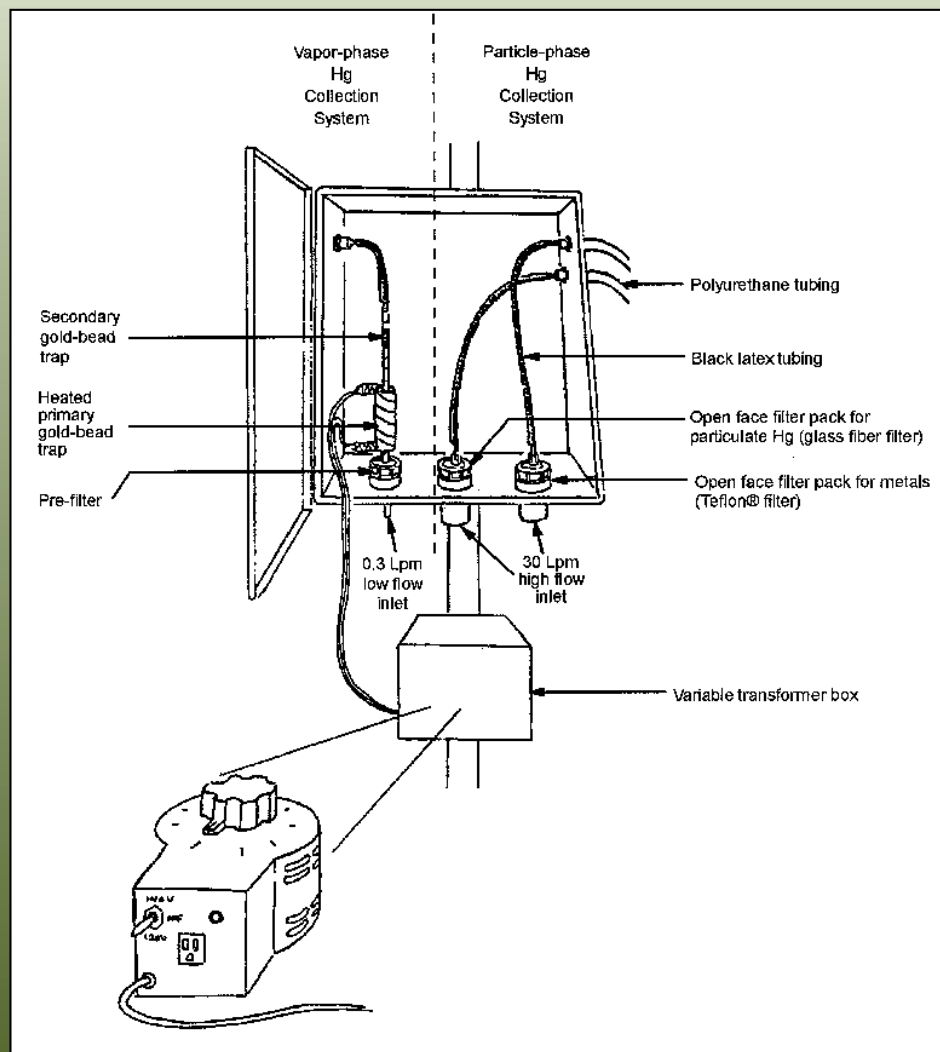
Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air

Chapter IO-5

SAMPLING AND ANALYSIS FOR ATMOSPHERIC MERCURY

Center for Environmental Research Information
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, OH 45268

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Method Summary

- The collection of mercury, from **ambient air in the vapor and particulate phase**, involves use of gold-coated bead traps and glass-fiber filters.
- **Vapor-phase Hg** is collected using gold-coated glass bead traps. Air is pulled through the vapor-phase sampling system using a mass-flow controlled vacuum pump at a nominal flow rate of **0.3 Lpm**.

Method Summary

- Particle-phase Hg is collected using a glass-fiber filter in an open-faced Teflon[®] filter pack. Air is pulled through the particulate sampling system using a vacuum pump at a nominal flow rate of 30 Lpm.
- The detection limits achieved using Method IO-5 are 30 pg/m³ for particulate Hg and 45 pg/m³ for vapor mercury.

Definitions

- Particle-phase Hg is collected using a glass-fiber filter in an open-faced Teflon[®] filter pack. Air is pulled through the particulate sampling system using a vacuum pump at a nominal flow rate of 30 Lpm.
- The detection limits achieved using Method IO-5 are 30 pg/m³ for particulate Hg and 45 pg/m³ for vapor mercury.

Equipment

Sampling box/Shelter

Stand

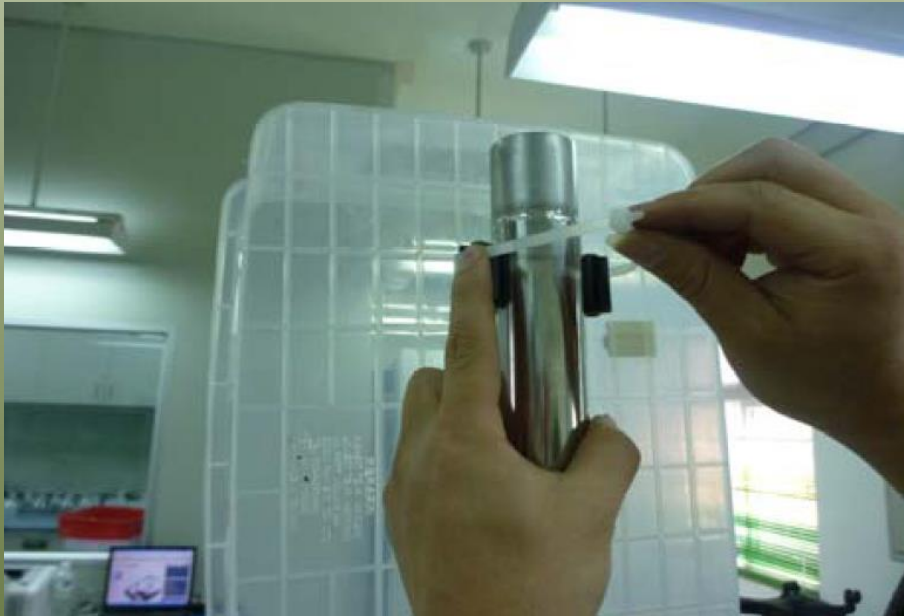
Flow control box

- Pump
- Needle Valve
- Mass Flow Meter
- Exhaust fan



Set Up

Set up the sampling box/Shelter



Set Up

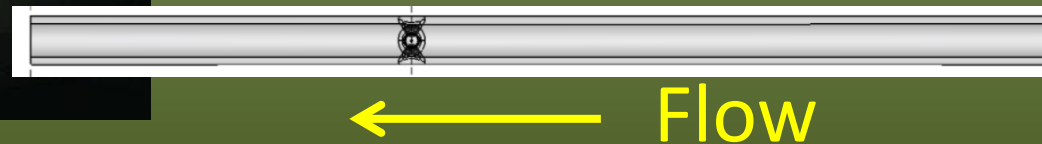
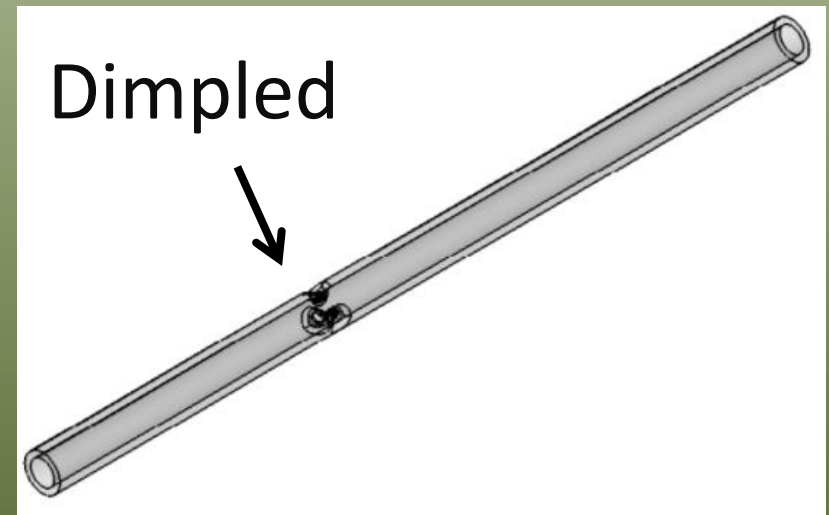
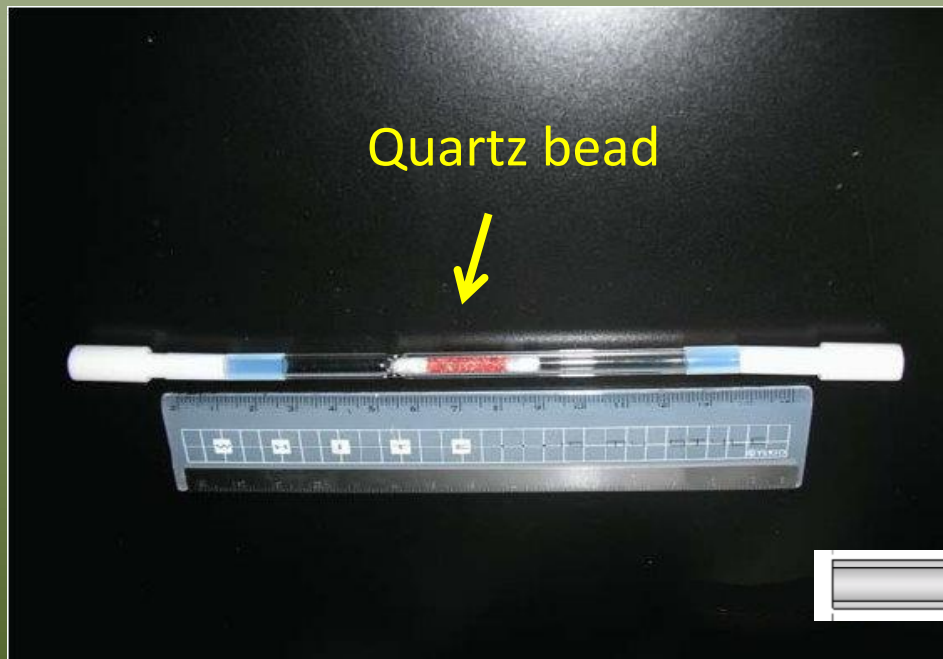
Connect and fix tubing



Developed Sample

Amalgamation cartridge

- Quartz glass tube
- Gold coated quartz bead
- Two traps as a set



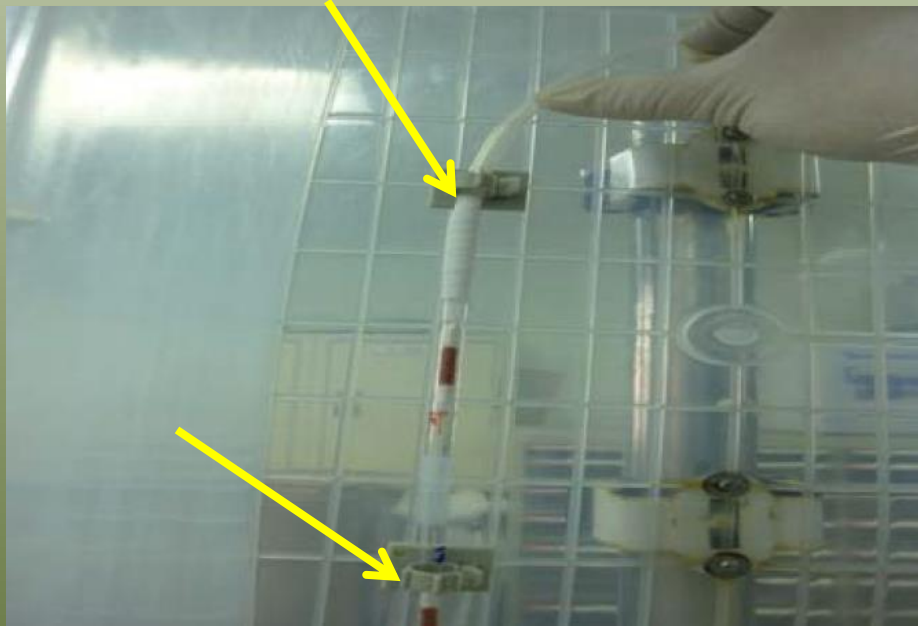
Developed Sample



Pretrap/Sodalime

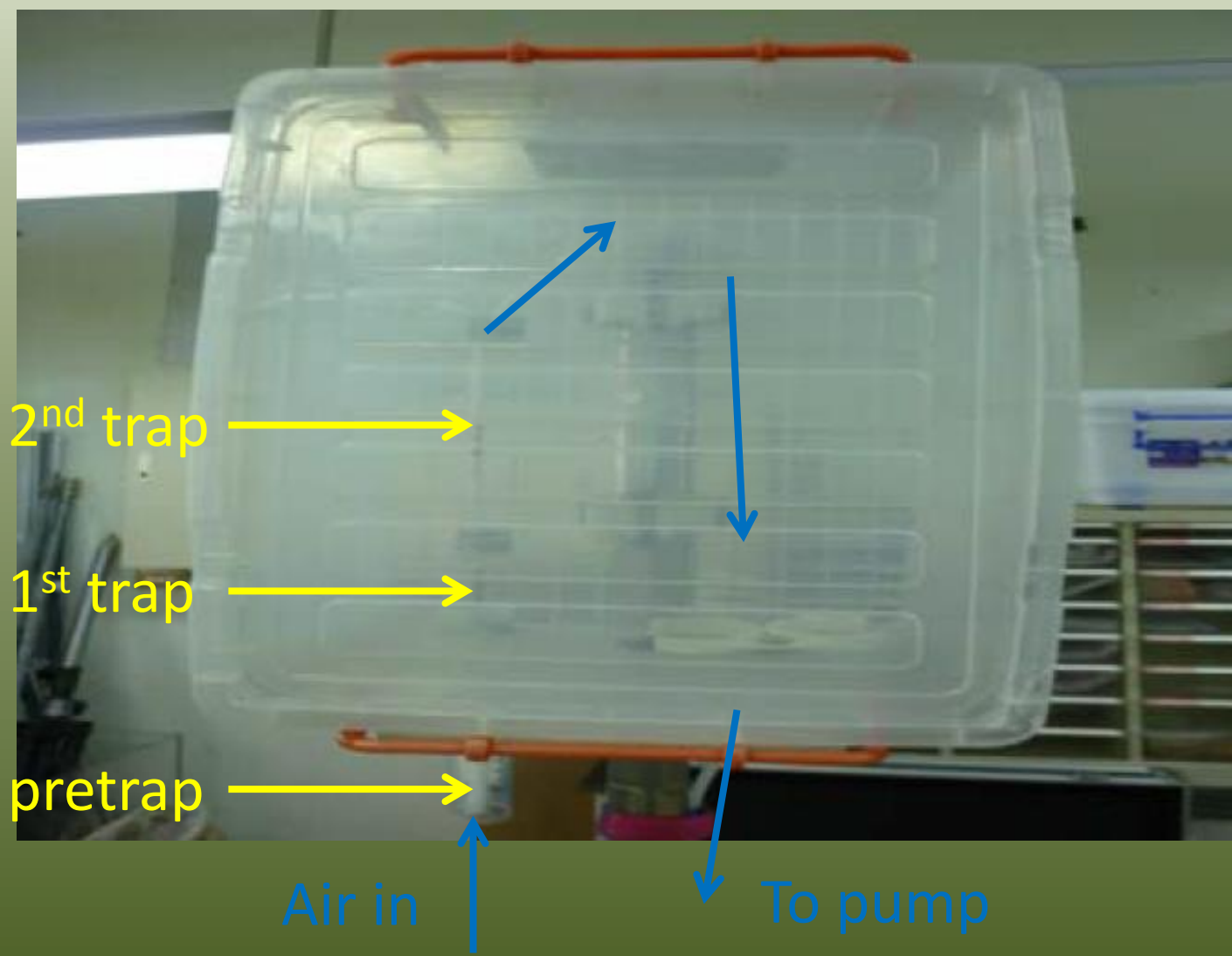
Developed Sample

Secured for sampling trap



Prevent to take raindrop

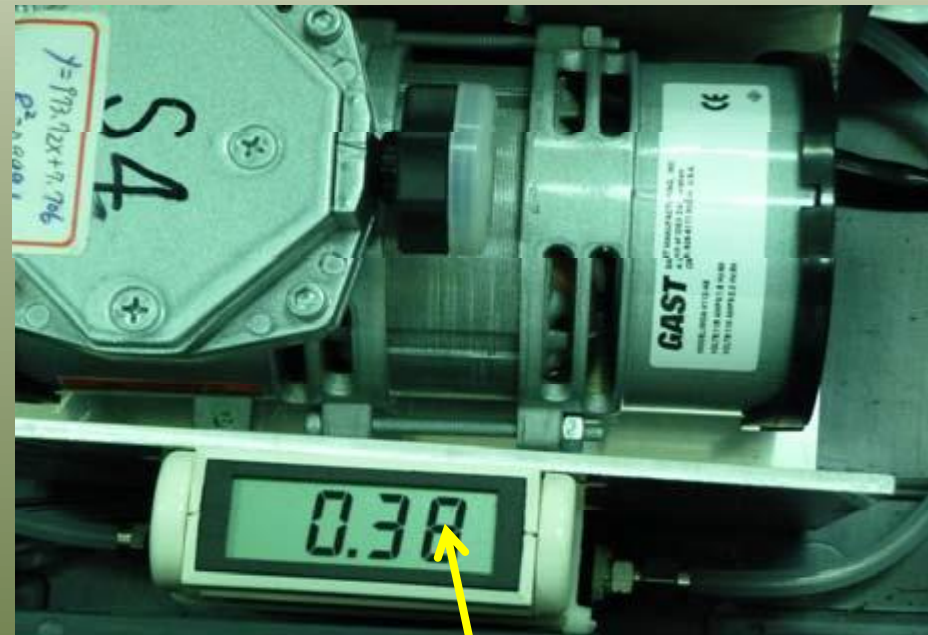
Developed Sample



Sampling



Needle valve
Adjust flow rate



Mass flow meter
~0.3 Lpm

Sampling

Field Test Data Sheet

Project _____			
Site _____			
Location _____	Barometric Pressure (mmHg)	Before	After
Date _____	Ambient Temperature (°C)		
Height above ground _____	Rain (Y/N)		
Operator _____	Relative Humidity (%)		

General
information

Met. data

CARTRIDGE INFORMATION

Vapor-phase System
Primary gold-bead "A" trap I.D. Number _____
Secondary gold-bead "B" trap I.D. Number _____
Heated primary trap temperature (°C) _____

Particle-phase System
Filter pack I.D. Number _____

Cartridge/filter
information

FIELD DATA INFORMATION

Clock Time (24-hr)	Flow Check (•)	Vapor-phase System		Particle-phase System		Total Sample Time, minute	Total Sample Volume, L.
		Mass Flow Control Setting	Flow Rate (Q ₂) (Lpm)	Dry Gas Reading	Flow Rate (Q ₂) (Lpm)		

Field data

comments

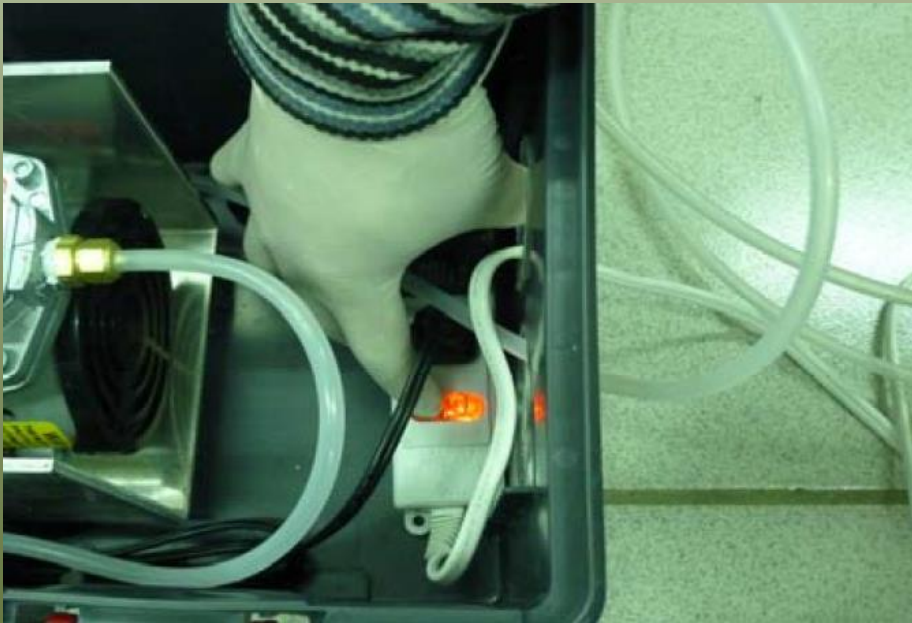
Comments _____

Figure 2. Field test data sheet (FTDS) for sampling vapor and particle phase mercury in ambient air.

Retrieve sample

Record flow rate and
turn off pump

Disconnect tubing



Retrieve sample

Remove pretrap



Cap with teflon sleeve

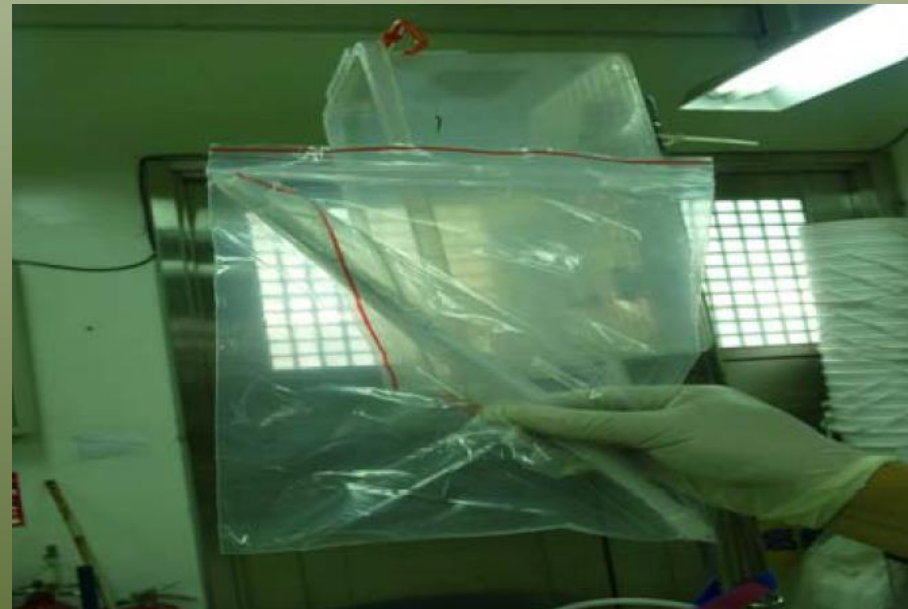


Retrieve sample

Seal ends



Pack with double PE bag



Retrieve sample

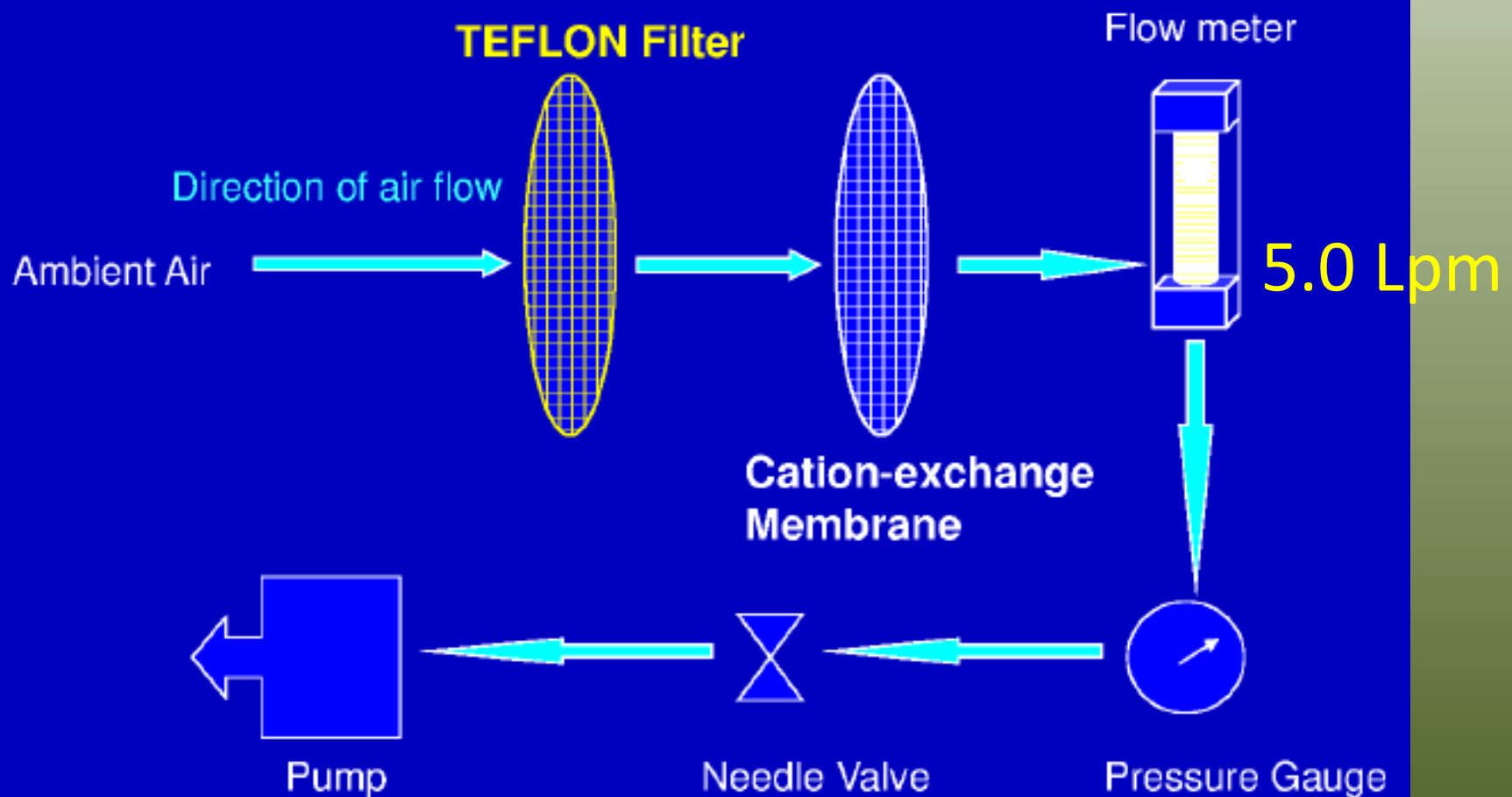
Name the sample



Ready for analysis !

Filter Sampling

2-stage Filter Pack Sampling System



Filter Sampling

- Glass fiber
- Teflon (PTFE)
- Cation exchange membrane
- Nylon
- ...

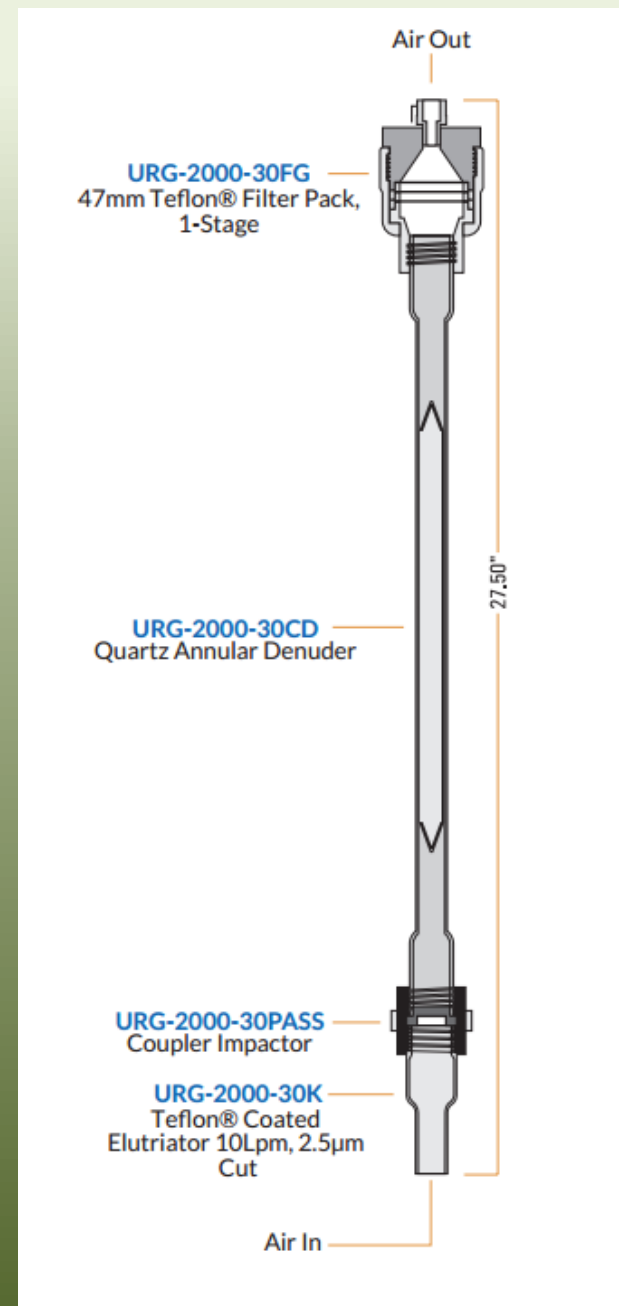
URG 3000M

Manual sampling instrument
for **RGM** and **PBM**



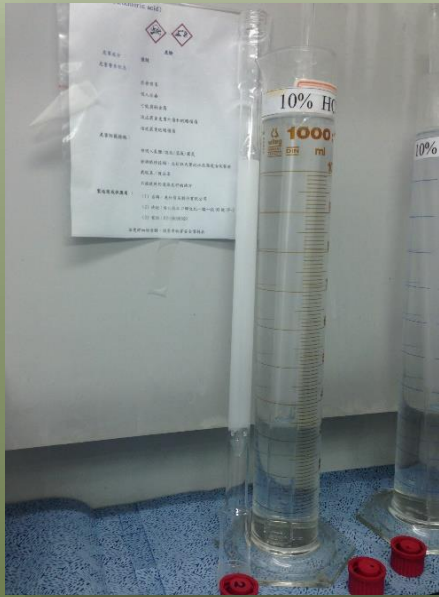
Introduction

URG Teflon coated PM_{2.5} inlet coupled to a **quartz annular denuder**. The aerosol is collected on a URG 47 mm Teflon filter pack supported by a quartz or nickel screen. This sampling arrangement eliminates positive Hg(p) measurement artifacts.



Denuder coating

Acid cleaning



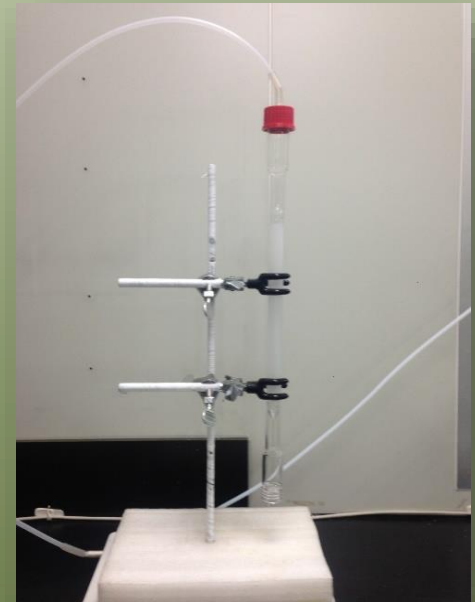
10% (v/v) HCl
72 hours

Rinsing



DIW (3~5 times)
Methanol

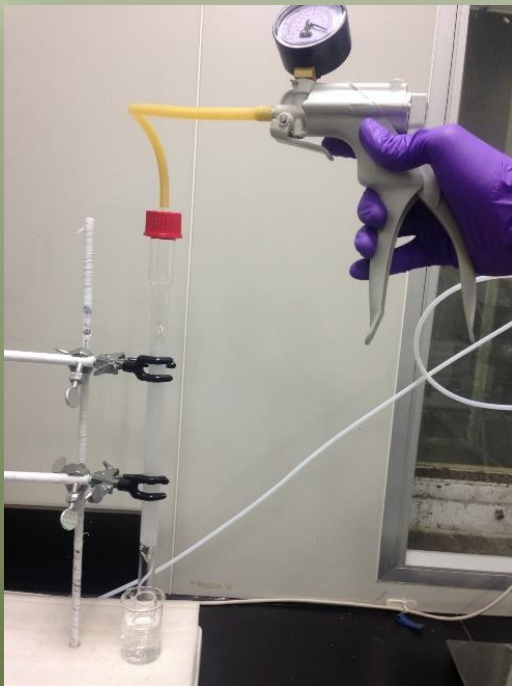
Drying



Ar supply

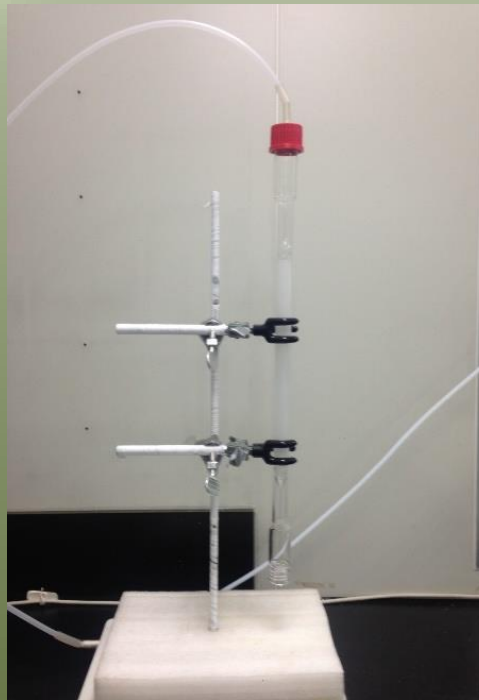
Denuder coating

Coating



3M KCl

Drying



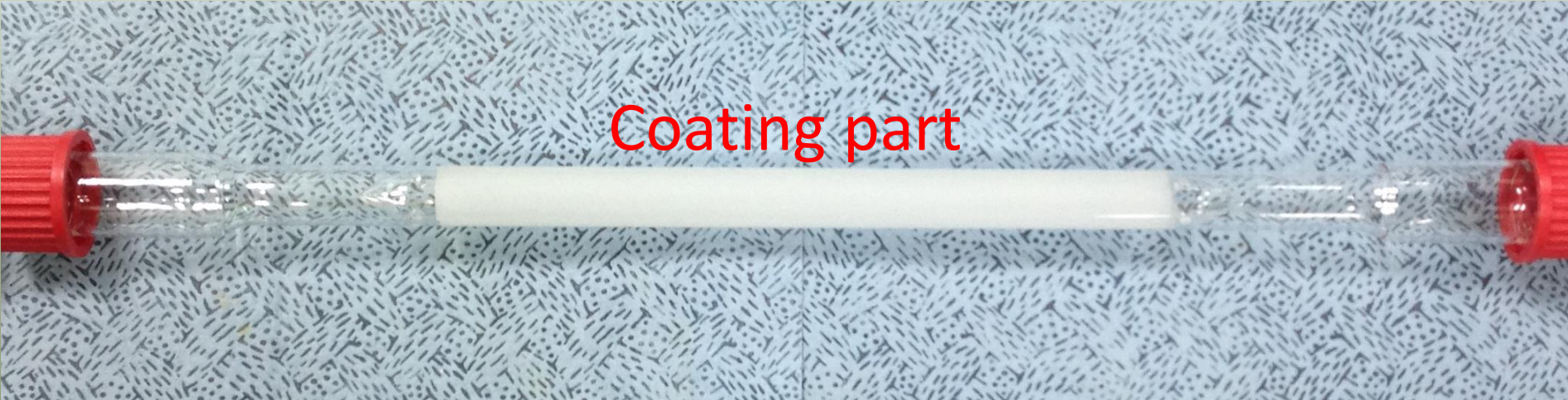
Ar supply

Blanking



Set 500°C, 30mins
Ar purge

Denuder coating



Coating part

A photograph of a glass tube with a white coating in the center. The tube has red caps at both ends. The background is a blue and white patterned surface. The text 'Coating part' is written in red above the white section of the tube.



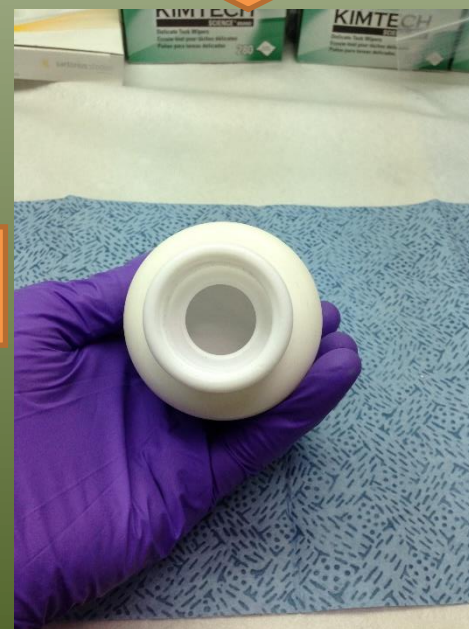
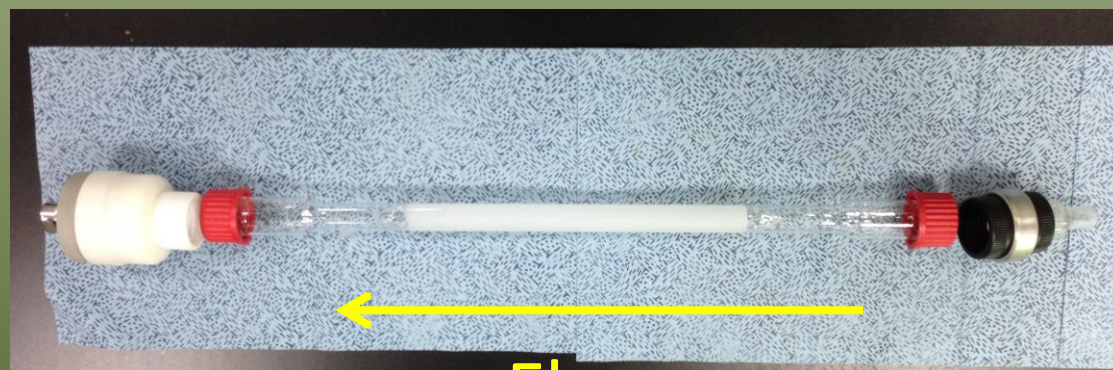
Ready for use

A photograph of a cardboard tube with red caps at both ends, set against a black background. The text 'Ready for use' is written in yellow to the right of the tube.

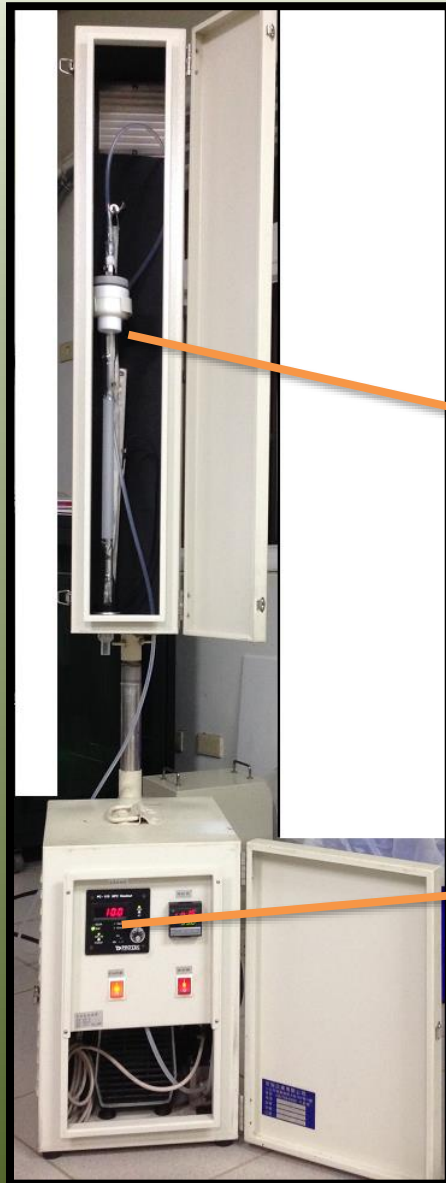
Cyclone and filter



Elutriator/Cyclone
2.5 μ m cut-off



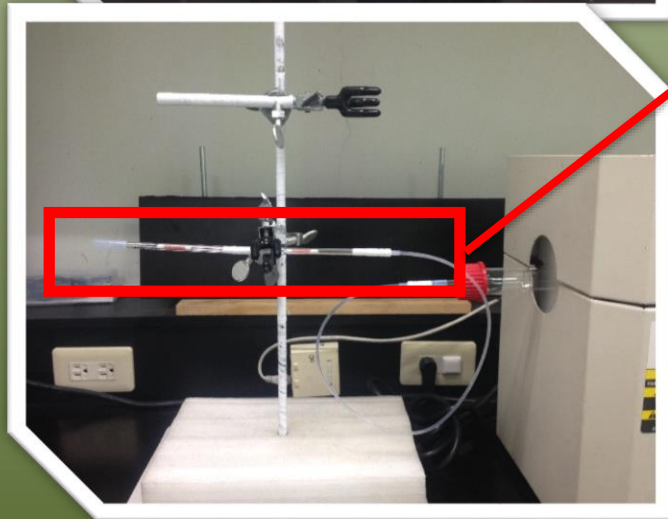
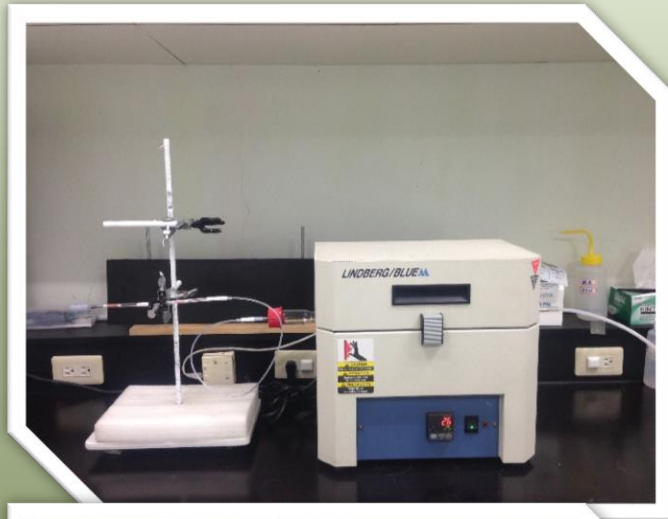
Setup and Sampling



Flow rate: 10 L/min



Thermal desorption

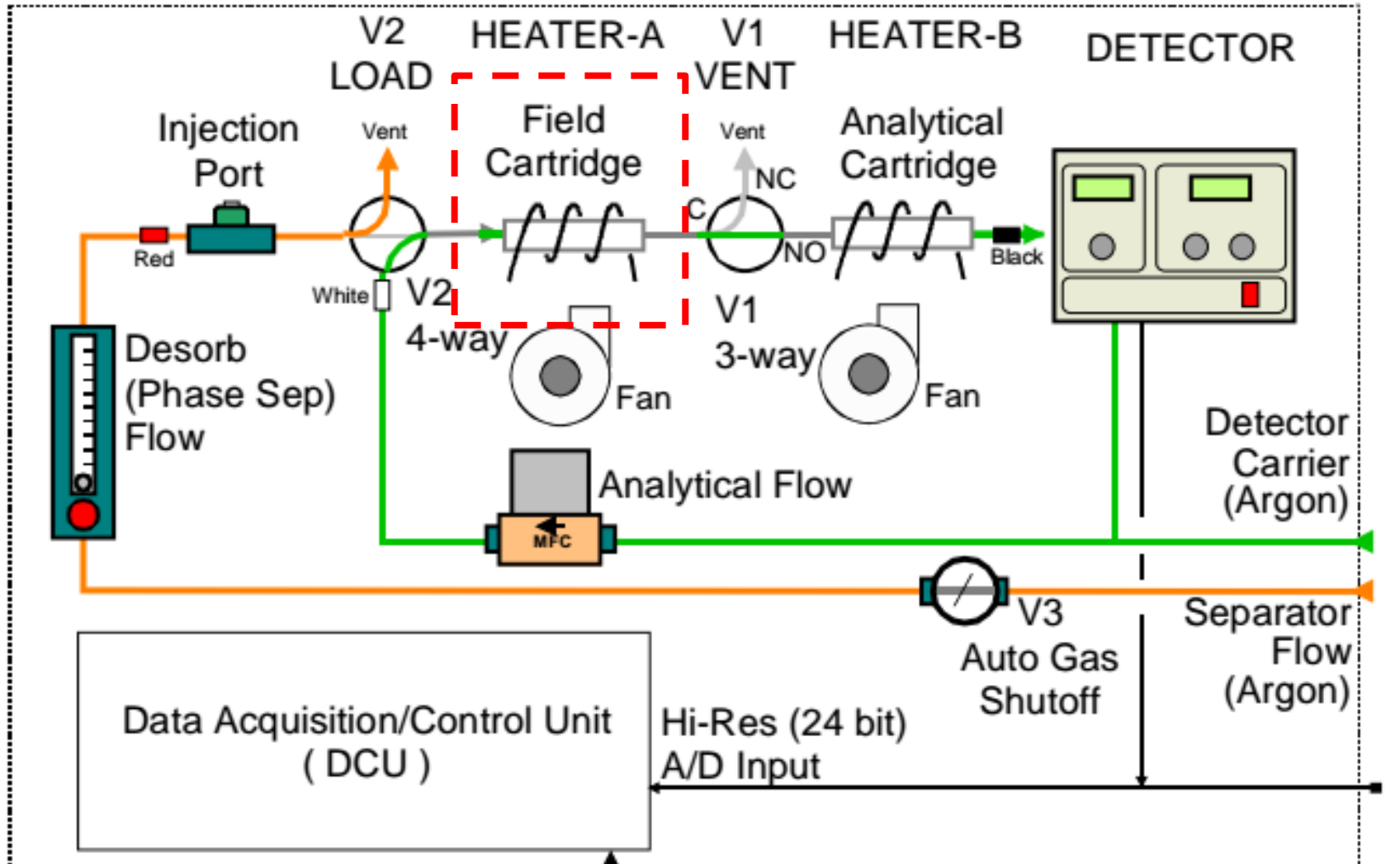


2600 analyzer

30 min; max temp: 500°C; Ar : 0.3 Lpm

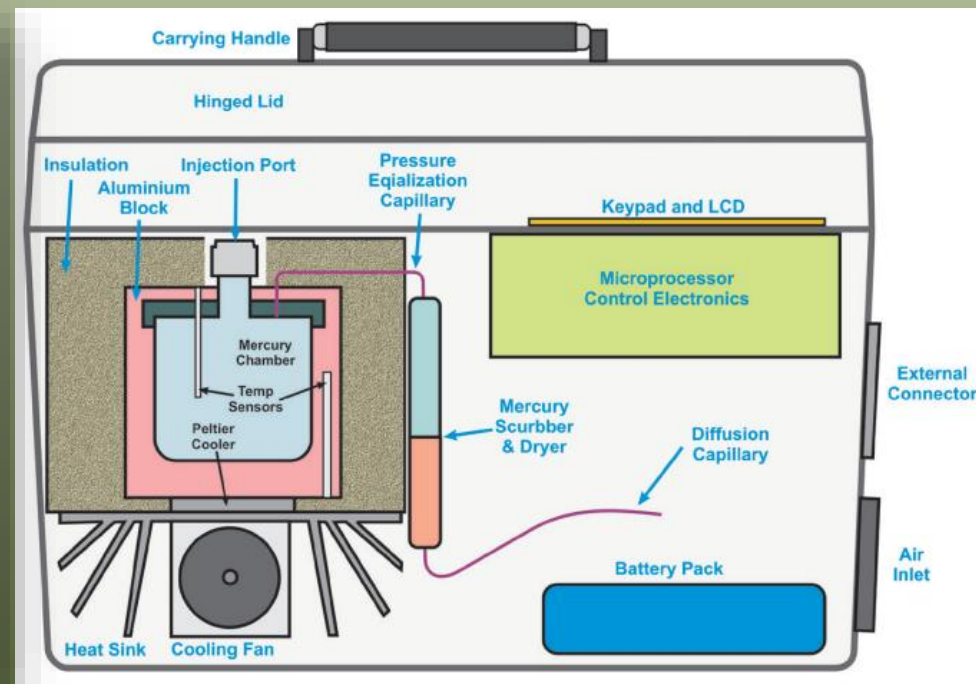
Flow Diagram

Model 2600 - System Control Module **IO-5 mode**



Mercury Vapor Primary Calibration Unit

Tekran model 2505



I05 method operation

Calibration curve and duplicate

1, 5, 10, 25, 50, 75, ... μL

HgAmt: 331.775P9
25.000 @ 20.087°C

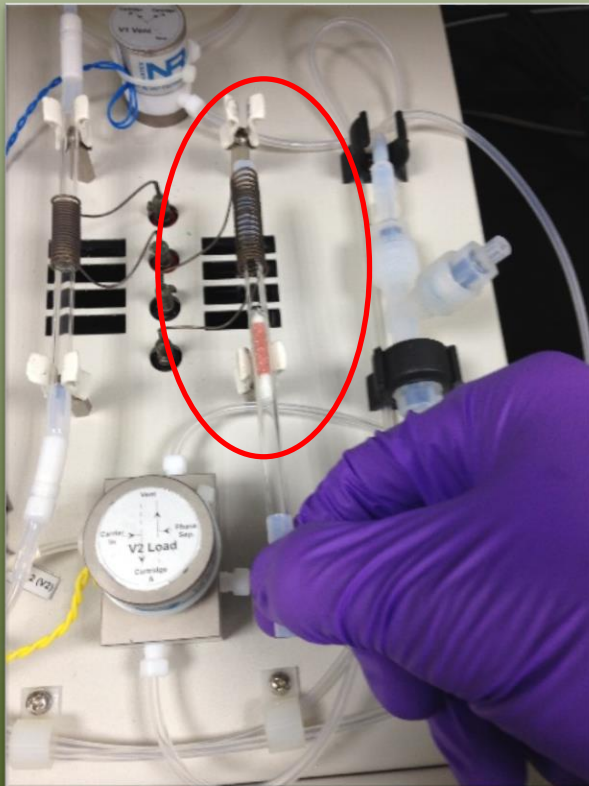
INPUT VOLUME 7	INPUT AMOUNT 8	INPUT TEMP 9	ESC
PRINT MODE 4	READ SYRINGE 5	CONT READ 6	NEXT -
COOLER SETPOINT 1	LOW POWER 2	FULL POWER 3	PREV .
SETUP MENU 0	◀	▶	ENTER



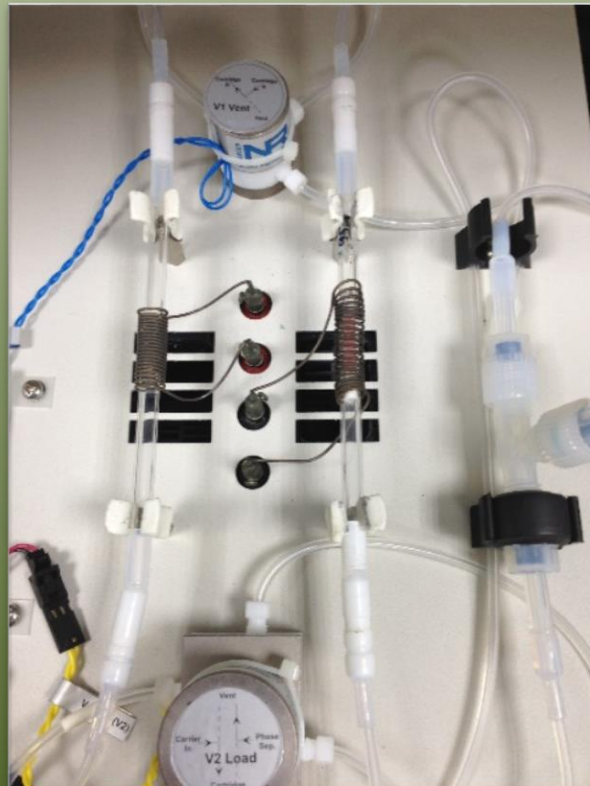
I05 method operation

Sample analysis

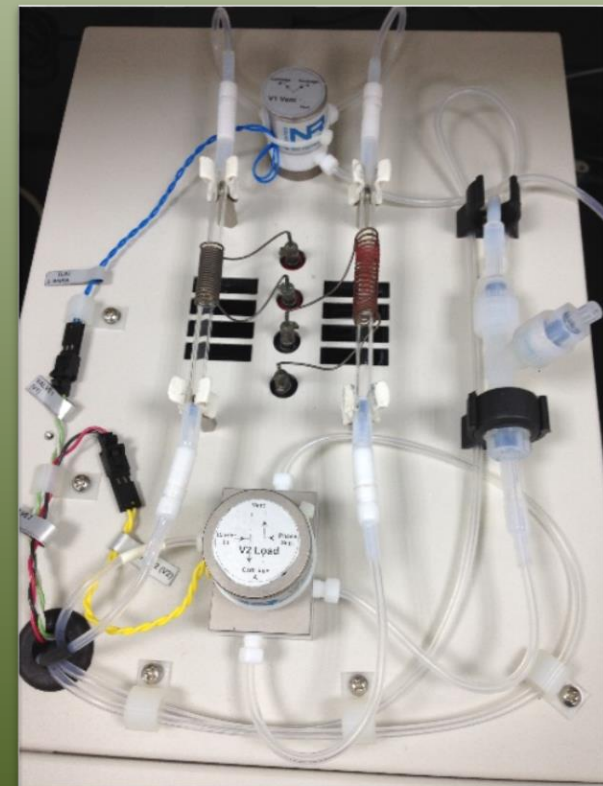
Remove the
original trap



Connect the
sampling trap



Heating



I05 method operation

After analysis

Blank

- Extra desorption cycle

Duplicate

- Recovery test
 - > 80% - 1st trap
 - < 80% - 2nd trap

