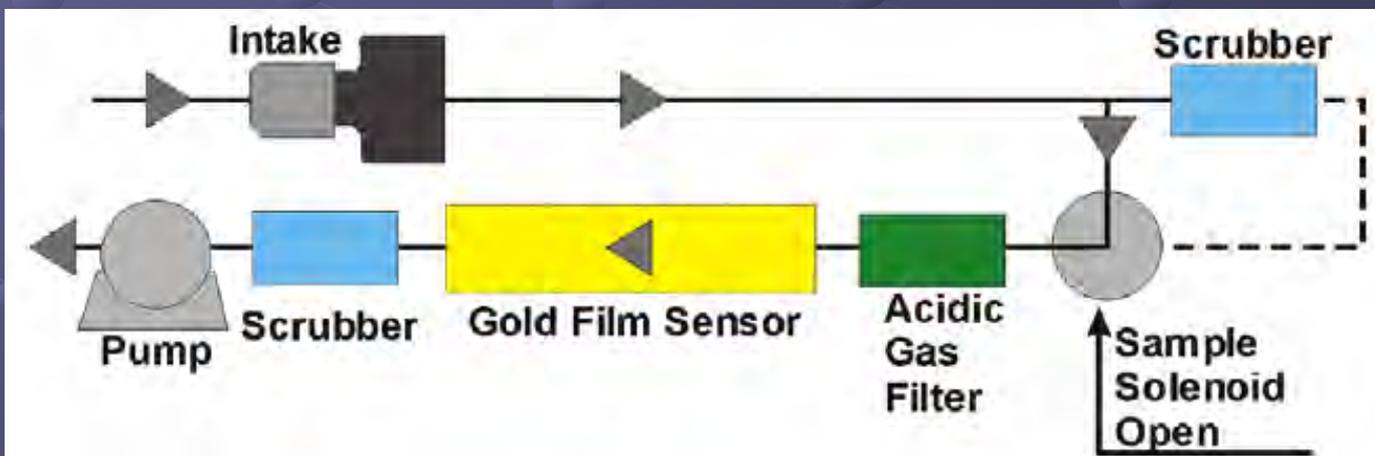
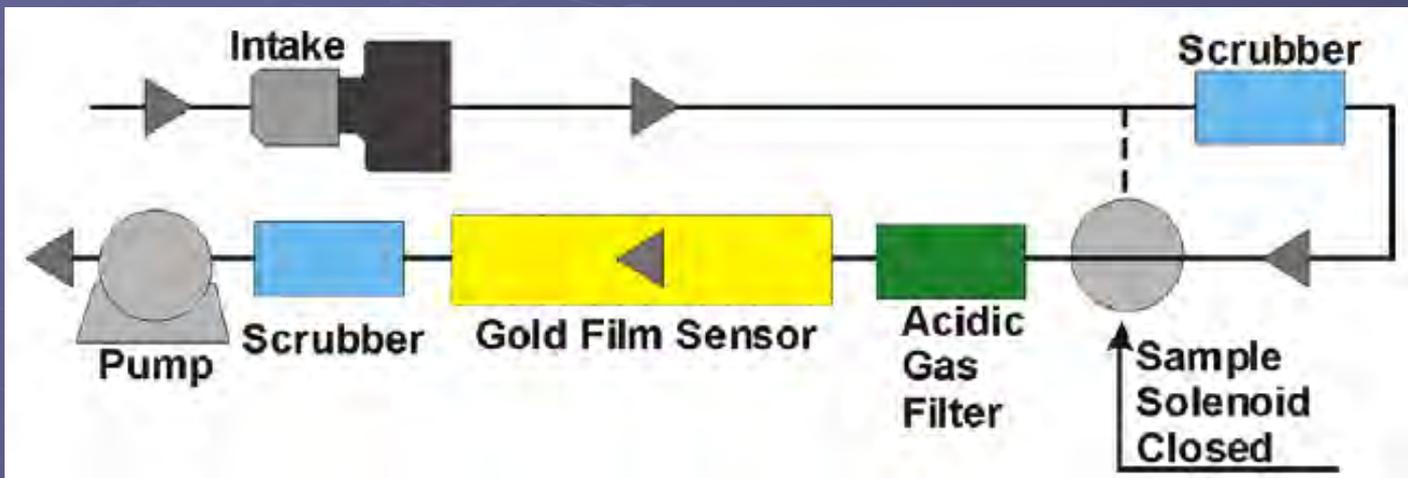


Jerome Internal Operations



Lumex 915+ Mercury Vapor Analyzer with RP-91 and RP-91C Attachments

Capabilities:

- Portable Atomic Absorption (AA) Spectrometer
- Instant NIOSH 6009 indoor air Hg concentrations
- 2 - 50K ng/m³ (0.002 µg/m³) multi-path cell
- 5K – 200K ng/m³ single path

Limitations:

- Soil and liquid attachments require field lab setup
- Standards are expensive and difficult to ship quickly (DG)
- 16 pounds



- Direct analysis of soil and complex mixtures (EPA 7473)
- Hg determination in aqueous samples (EPA 1631)

Analytical characteristics

Samples	Detection limit	Sample volume or weight	Atomization technique	Number of analyses per hour
Ambient air	2 ng/m ³	20 l/min	without atomization	*)
Natural and other gases	2-500 ng/m ³	5 - 20 l/min	without atomization	*)
Water	0.5 ng/l	20 ml	cold vapor	15
Oil and condensate	50 µg/kg	10 mg	pyrolysis	15
Solid and sediments	0.5 µg/kg	200 mg	pyrolysis	15
Urine	5 ng/l	1 ml	cold vapor	15
Tissues	5 µg/kg	10 mg	pyrolysis	15
Hair	20 µg/kg	10 mg	pyrolysis	15
Blood	0,5 µg/l	0.2 ml	cold vapor	15
Plants	2 µg/kg	50 mg	pyrolysis	15
Foodstuff	2 - 10 µg/kg	5 - 50 mg	pyrolysis	15

*) Real-time assaying with a response time of 1 sec.



Water and Soil Attachments



Chips & Tubes



- Draeger tubes
 - 0.05-2.0 mg/m³
- Gastec tubes
 - 0.05-13.2 mg/m³
- Draeger CMS
 - n/a

Innov-X Systems XRF

- Scans soils and surfaces for RCRA metals, including mercury
- Down to ppm



Air Sampling



- Confirmatory sampling
- NIOSH 6009 Method
- Detection Level
 - 0.03 $\mu\text{g}/\text{m}^3$ for 4 hours (48 liters at 0.2ml/min)
 - Greatly dependant on “Blank” sample
- New Tube for Coal Burning Power Plants
 - Thermal desorbtion with lower detection limit coming out sometime soon
 - ChemTest – 4.0 μg surface

Site Assessment

Hunting it down

Exposure Response Limits

- OSHA Permissible Exposure Limits –
 - 0.1 mg/m³ Ceiling (100 µg/m³)
- NIOSH Recommended Exposure Limit–
 - 0.05 mg/m³ for 10 hour worker
 - 0.1 mg/m³ for 15 min.
- ACGIH Threshold Limit Value
 - 0.025 mg/m³ 8-hour work shift

Cleanup Level Guidelines

● ATSDR Limits

- $<1.0 \text{ ug/m}^3$ - Residential occupancy level
- $<10 \text{ } \mu\text{g/m}^3$ – Acceptable personal effects level
- $>10 \text{ } \mu\text{g/m}^3$ - Residential isolation
- $3 \text{ } \mu\text{g/m}^3$ - Re-occupancy after spill
- $25 \text{ } \mu\text{g/m}^3$ – Occupational setting where mercury is handled (1/4 PEL). ER worker PPE upgrade.
- $10,000 \text{ } \mu\text{g/m}^3$ – PPE upgrade

Systematic Approach

- Set up zones, Identify “Hot Spots”
- Other suspect areas
- Complete reconnaissance of facility
- Outdoor check
- Minimize cross contamination/decon

- Vehicles
- Residence (s)

The Spill

- When mercury escapes its container, it will:
 - Form beads – which roll until they run into an object and then break into smaller beads which roll....over and over.
 - Attaches to metals through amalgamation or lodges in a crevice – then it moves with the object
 - Mercury beads give off mercury vapor – which is the real hazard

Example



The Tactics of a Response

- When a spill first occurs, to contain/limit the vapors given off, the HVAC system should be turned off ASAP.
 - This will keep vapors from spreading throughout the building
 - In the winter, this also cools the building so less vapors are given off.
- Do not be a cause of cross-contamination

Basic Removal

- Determine ambient air concentrations in each room of a building
 - Find hotspots in contaminated rooms
- Remove gross contamination
 - Use a mercury vacuum to remove visible mercury beads
 - Remove contaminated carpet and items immediately

Basic Removal continued

- Remove deposited mercury
 - Use sorbent liquids to wipe surfaces
 - Heat/Vent cycles
- Confirm ambient air concentrations are below the 1,000 ng/m³ action level



The Hunt

Ways to find Mercury

How to find it

- Screening with instrument
- Flashlight in dark room
- Ask questions about what was done before your arrival.
 - Personnel traffic pattern?
 - Attempts to clean it up?
 - Use of a vacuum to clean up Hg?
 - Used dishwasher on contaminated items?

Spikes

- When using Lumex and a high reading occurs, remove instrument to outside or away from area to clear.
- Change pre-filters on daily basis, or more frequent.

Clean Up



- **Dynamic Situation**
 - Identify source(s) and clean up as you go
 - Unlike other types of spills
- **Remove contaminated debris**
- **Remove contaminated flooring**







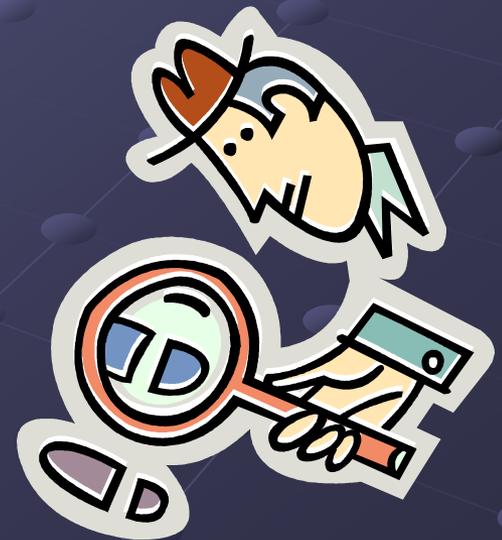
Must Check

- Drains/sinks/traps
- HVAC filters
- Janitors closet
 - Cleaning supplies
- Vehicles
- Vacuums
- Dishwasher
- Personal items
 - Clothing
 - Backpacks
 - Shoes



Chasing it down

- Screen each room for ambient air concentrations
- Locate hot spots within rooms where ambient concentrations are elevated
- Hot spots usually occur:
 - Near the spill site
 - In high traffic areas
 - Near metal objects
 - The weirdest places



At a hotspot









Or alone



EPA Region 10

Screening personal items

- When possible, bag the items and wait 15 minutes with the bag closed
- Open the bag and take a headspace reading for 5 – 10 seconds
- If readings are below $10 \mu\text{g}/\text{m}^3$, the items do not necessarily need to be decontaminated, but can be at the discretion of the OSC
- Write the headspace reading on the outside of the bag

The Removal

- Sorbents - Mercury spill kits
 - Zinc or sulfur powder
 - Spray Solutions – HgX or HgCS102
- Mercury Vacuum



Deposited Mercury and Mercury Vapor Removal

● Heat Building/Room (90°F+)

- Portable heaters
- Building heating system

● Ventilation

- Floor fans, carpet driers, blowers, etc.

Cleaning Personal Items



“The Heat Shack”

- This is a way to heat many personal items to a warm temperature even in the winter
- Start with the least contaminated items and move up

Making the Call

- After heating and venting overnight, close up the room/building and let them sit stagnant for 30-60 mins
- Rescreen each room individually, noting ambient air concentrations
- If there are ambient concentrations above the action level, you must reevaluate, likely have to perform more removal action

Time to Air Sample

- An air sample is collected over approximately 8 hours.
- A sorbent tube absorbs mercury vapor out of the 100 L of air that passes over it during that 8 hours
- The sorbent tube is then shipped to an off-site laboratory for analysis
- The detection limit is between 100 and 200 ng/m³

Wait a minute

- The Lumex is a real time detection instrument that is calibrated annually by the manufacturer, has a testing function, and a detection limit of 2 ng/m^3



EPA ERT did a study

- Raj Singhvi of the ERT based in Edison, NJ Completed a study comparing the real time data of the Lumex to the off-site analysis for NIOSH 6009
- He found:

“In order to meet final clean-up action levels (0.3-1.0 $\mu\text{g}/\text{m}^3$) for indoor mercury spills, time averaged Lumex and Tracker results may be used instead of the NIOSH method under certain circumstances, such as during emergency responses, depending on site requirements.”

Region 9 for example

- Region 9 uses the Lumex instead of sorbent tubes to confirm when ambient concentrations no longer present a hazard
- During two mercury responses earlier this year no sorbent tubes were collected.

Protocol Mode

- Normally does a 10 second average
- This mode averages 3 of the 10 second averages
- Also provides a standard deviation value
- The 10 seconds is adjustable
- Re-Check after a period of time



Picking Up the Mercury

- Sorbents - Mercury spill kits
 - Sulfur-based compounds
 - Lime
 - Fast acting visual indicator
- Vacuums



Vapor Removal

● Heat

- Portable heaters
- HVAC

● Ventilation

- Using building HVAC system
- Floor fans, carpet driers, blowers, etc.

Mercuryaction.org

- EPA scientists have estimated that over 600,000 infants are born each year overexposed to unhealthy mercury levels *in utero*.

