

Mercury Detection and Response



Mercury flask



Mercury recovered from residential spill

Mercury “bullets” used for amalgamation in dental offices



Instructors and Handouts

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Handouts are located at
www.epaosc.org/Hgresponseresources

Course Agenda

- ❖ **Introduction**
- ❖ Mercury Basics
- ❖ Health Effects of Mercury
- ❖ Using Personal Protective Equipment
- ❖ Intro to Mercury Responses
- ❖ Cleanup Techniques and Response Issues
- ❖ Mercury Vapor Analyzers and Other Instrumentation

What Number Do I Call?

National Response Center: 800-424-8802

EPA Region IX Spill Phone: 800-300-2193



Introduction

Mercury Experience

EPA's Mercury Website:

<http://www.epa.gov/mercury/>

(2009 public service announcement geared toward children can be found on this page)

Course and Mercury Guidebook:

www.epaossc.org/mercury_guidebook

(look under the “documents” section of this page)

EPA National Mercury Task Force

- ❖ Representatives from all 10 EPA Regions
- ❖ Highlights of topics and changes coming from the task force:
 - **Changes to action levels**
 - SOP for using Lumex for confirmation of cleanup
 - Evaluation of available mercury detection instruments
 - National guidance for restoration of properties (internal EPA)

Continued Highlights – Hg Task Force

- National guidance for demolition vs. cleanup of residential properties (internal EPA, but made public)
- Updated, consistent national guidebook
- Updated, consistent training slides (differences will only be regional case studies)
- National policy on relocation of residents
- Discussion of when EPA will become involved in residential cleanups

Saylor Way Mercury

Residential Mercury Nightmare

Las Vegas, NV

Jan. – Feb. 2004



Summary

- ❖ Mercury spill over several months at a single family residence.
- ❖ 17 year old male played with the mercury contaminating the house, backyard, pool and sidewalk
- ❖ 17 year old victim hospitalized with severe acute mercury poisoning.
- ❖ Site discovered as the result of a 911 call.
- ❖ Visible elemental mercury spread throughout the house.
- ❖ Ambient concentrations $>50,000 \text{ ng/m}^3$.
- ❖ USEPA notified via the NRC and assumes responsibility for the site.
- ❖ USEPA conducts removal action pursuant to Superfund.
- ❖ Interior of residence gutted to remove mercury below $1,000 \text{ ng/m}^3$ action level (ATSDR).
- ❖ Backyard demolished to remove contaminated pool.



Decontamination of doggy contaminated with mercury



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ASSESSMENT

- ❖ Monitoring with real-time instruments
 - Jerome Mercury Meter
 - Nippon Mercury Meter
 - Lumex Mercury Meter
 - Ambient air
 - Soil
- ❖ Confirmation with air sampling



RESIDENCE DECONTAMINATION

- ❖ Removal of free elemental mercury via vacuuming
- ❖ Removal of contaminated personal effects
- ❖ Demolition
- ❖ Heat and filtering of air
- ❖ Amalgamation of mercury
- ❖ Sealing with epoxy of contaminated areas



BACKYARD DECONTAMINATION

- ❖ Remove pool water
- ❖ Vacuum up free mercury in pool
- ❖ Remove contaminated concrete cracks
- ❖ Remove Contaminated Soil
- ❖ Pressure wash
- ❖ Amalgamation of mercury
- ❖ Not Successful – Pool Contaminated.



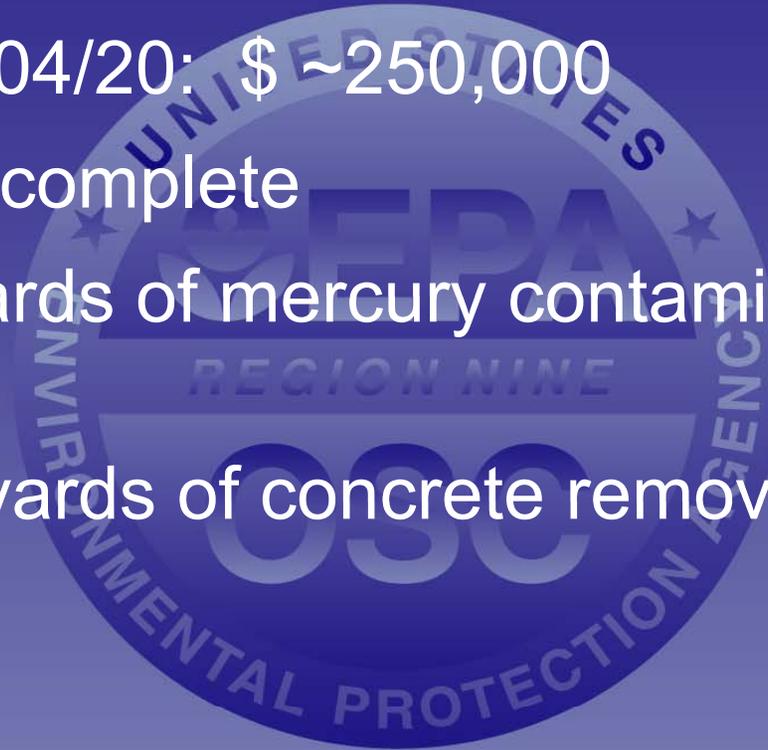
Pool Demolition

- ❖ Remove concrete patio
- ❖ Assess soil using Lumex
- ❖ Confirmation samples
- ❖ Demolish pool
- ❖ Rehab Backyard



Removal Summary

- ❖ Cost as of 04/20: \$ ~250,000
- ❖ 21 days to complete
- ❖ 80 cubic yards of mercury contaminated debris removed
- ❖ 120 cubic yards of concrete removed



Course Agenda

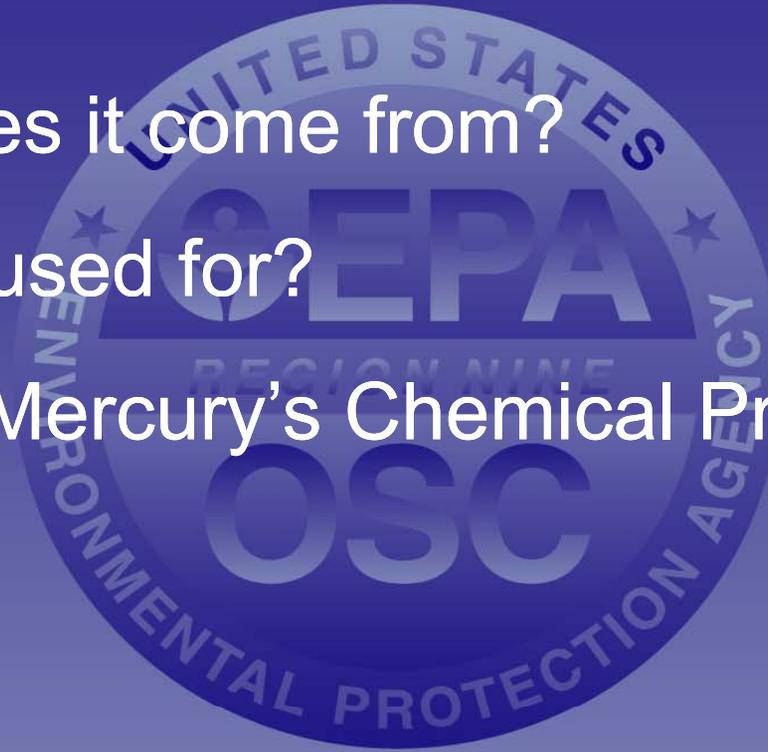
- ❖ Introduction and Recent Responses
- ❖ **Mercury Basics**
- ❖ Health Effects of Mercury
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Elemental Mercury



Introduction to Mercury

- ❖ Where does it come from?
- ❖ What is it used for?
- ❖ What are Mercury's Chemical Properties?



Naturally Occurring

Mercury mined as cinnabar ore (mercuric sulfide)



Vaporized from ore then captured and cooled to form the liquid metal mercury

Forms of Mercury

- ❖ Mercury comes in three forms:
- ❖ Elemental
 - Most residential mercury responses
- ❖ Inorganic
- ❖ Organic
 - Most common type is methyl mercury

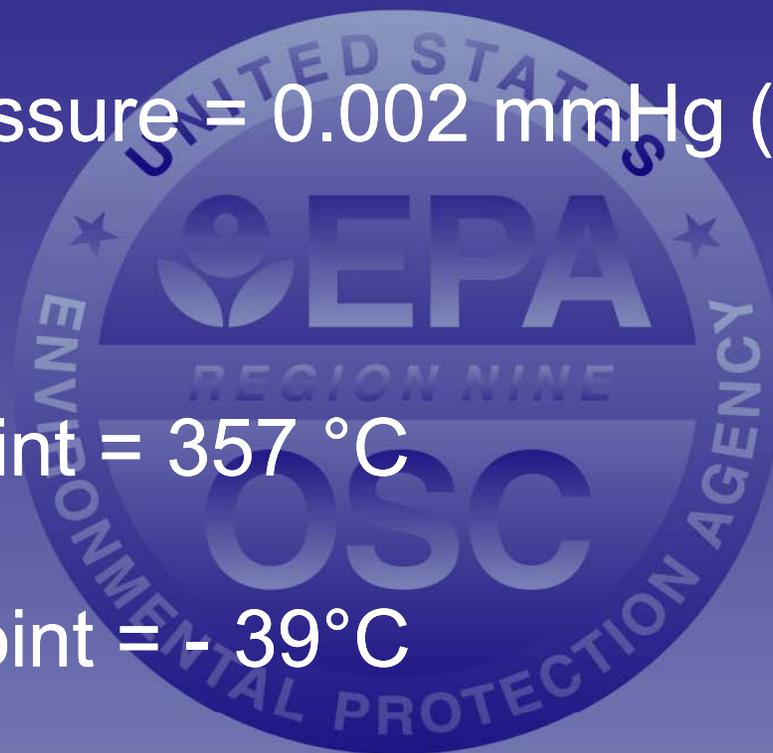


Physical/Chemical Properties

- ❖ Chemical Symbol = Hg
- ❖ Elemental Mercury is...
 - Shiny, silver-white odorless liquid at room temperature
 - Extremely volatile
 - Easily converted to a colorless, odorless gas

Physical/Chemical Properties

- ❖ Vapor Pressure = 0.002 mmHg (at “room temp)
- ❖ Boiling Point = 357 °C
- ❖ Melting Point = -39°C



Surface Tension

Mercury has the highest surface tension of any liquid. Mercury does not flow, it fractures into small “beads”



Mercury beads that were behind baseboard

Mercury Vapor Video

MERCURY VAPOR EXPERIMENT
BOWLING GREEN STATE UNIVERSITY (OHIO)
VIDEO



Mercury “Fun Facts”

Mercury (elemental) has many uses:

- Thermometers, barometers, batteries, electrical devices and dental fillings
 - Home thermometer: 500 mg Hg
 - CFL: 4 mg Hg
- A silver-colored mercury amalgam filling normally contains 52 percent mercury.
- On average, amalgam fillings weigh 1 gram and contain $\frac{1}{2}$ gram of mercury.
- The typical adult carries 10 amalgam fillings containing 5 grams of mercury.

Mercury Facts

- Half a gram of mercury (the amt in a typical dental filling) released in a 10-acre lake would warrant issuance of a fish advisory for the lake.
- One gallon of mercury weighs 128 Lbs.



Mercury Facts Continued

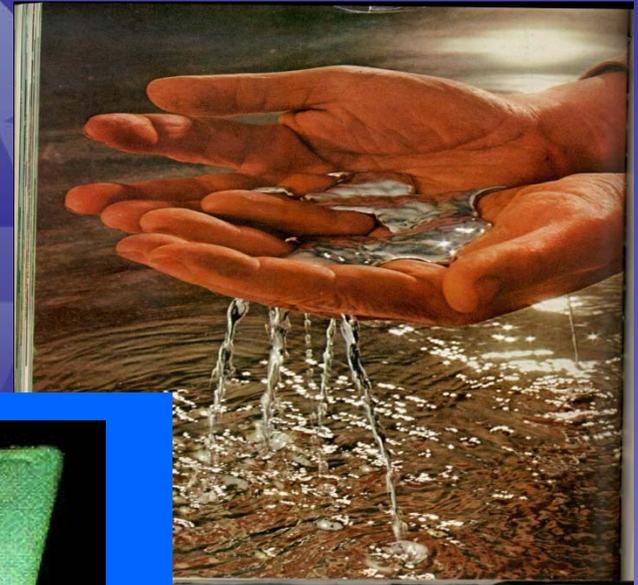
Solid



These people are idiots...

Please do not attempt these stunts at home.

Liquid



Gas



Mercury Mines

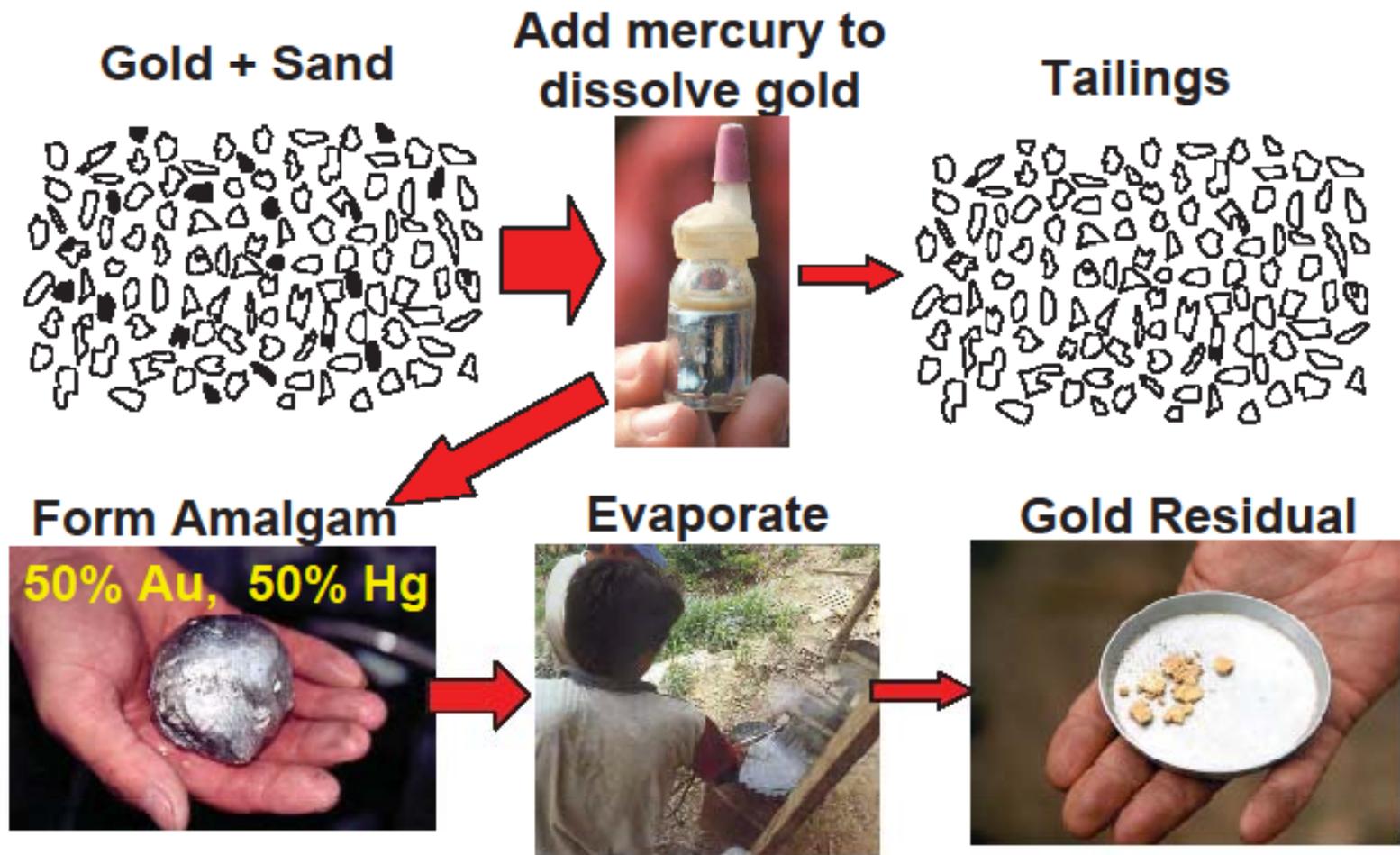
- ❖ EPA has assessed & cleaned up several mercury mines in Region 9 in the past 8 years.
- ❖ Inefficient mining operations left behind waste rock/ tailings piles that contain levels of mercury that are harmful to people/ fish – which drives cleanup
- ❖ XRF/ Lumex with soil attachment have been key in cost effective assessment and removal



Gold Mining and Mercury

- ❖ Mercury is used at gold mines to extract gold from ore
- ❖ Mercury (and use in Gold Mining) has created hazardous waste sites. (e.g. Carson River Area/ Comstock, NV)
- ❖ Barrick Goldstrike produced ~140,000 lbs. of mercury and ~ 130,000 lbs. of gold in 2005 – **Not very efficient**

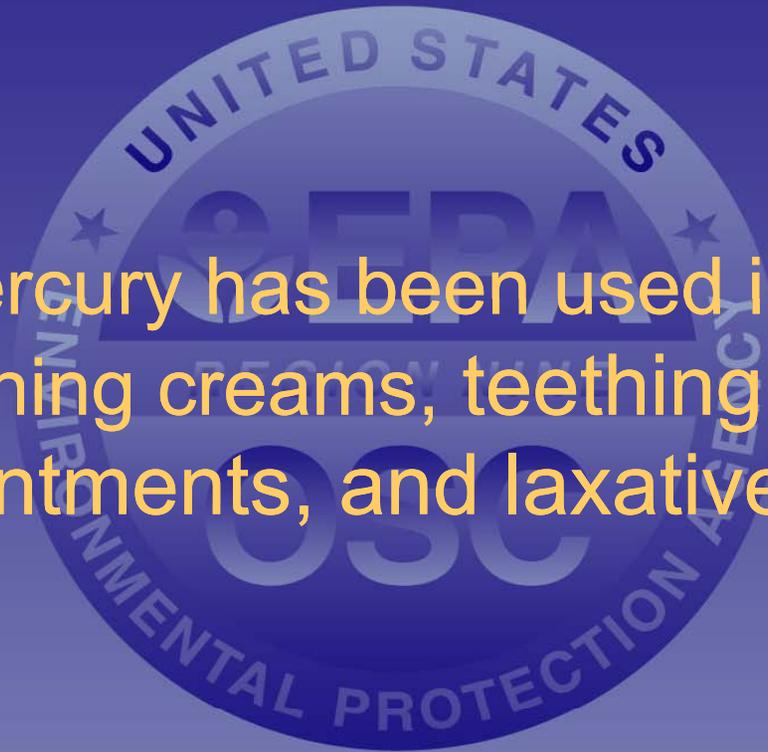
How Is Mercury Used?





Inorganic Mercury Uses

Inorganic mercury has been used in fungicides, skin-lightening creams, teething powders, ointments, and laxatives





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Uses of Inorganic Mercury

- Thermometers
- Thermostats
- Some household switches (silent switches) manufactured before 1991
- Fluorescent and high intensity discharge (HID) lamps
- Some alkaline batteries manufactured before 1994
- Some button batteries
- Latex paints manufactured before 1992
- Dental amalgam
- Old chemistry sets, mercury maze toys, and jewelry with liquid mercury
- Lighted athletic shoes (L.A. Gear's My Lil'Lights and L.A. lights purchased before June 1994 contain mercury. Other brands may contain button batteries)
- Some pesticides manufactured before 1994
- Some skin lightening creams illegally imported into the United States
- Some Asian medicinals
- Azogue (elemental mercury) used for Santeria or Esperitismo religious rituals and folk medicine
- Some septic tank and sump pump control switches
- Some dairy barn manometers

Organic Mercury

Bacteria in soil and water convert elemental mercury to methyl mercury (organic) which is soluble in water, and bioaccumulates



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Health Effects of Mercury

- ❖ Acute
- ❖ Chronic
- ❖ Fetal



Acute Health Effects

- ❖ High exposures to mercury vapor can cause short-term (acute) poisoning
 - Symptoms include cough, chest tightness, trouble breathing and upset stomach
 - Symptoms can lead to pneumonia, which can be fatal
- ❖ When inorganic mercury compounds are swallowed nausea, vomiting, diarrhea and severe kidney damage can occur

Chronic Health Effects

Chronic mercury poisoning includes three primary symptoms

- ❖ Gum problems: soft, spongy gums, loose teeth, sores may develop, and possibly increased saliva
- ❖ Mood and mental changes: wide swings of mood, irritable, frightened, depressed or excited very quickly for no apparent reason
 - Hallucinations, memory loss and inability to concentrate can occur

Chronic Health Effects (continued...)

- ❖ Nervous system: most frequent symptom is shaking hands
 - A tremor may also occur in the tongue and eyelids
 - Eventually this can progress to trouble balancing and walking

Developing Fetus

- ❖ Elemental and methyl mercury can cross the placental barrier
 - Mercury levels that wouldn't normally affect the adult, cross into the brain during neonatal development stages and transform mercury to its ionic form
 - The mercury remains where it has been transformed

Elemental mercury elimination

- ❖ Kidney excretion through urine
- ❖ Ingested mercury passes through feces
- ❖ Mercury in blood volatilized from skin and lungs
- ❖ Physiological half life: 30-60 days

Mercury Levels

- ❖ Background levels
 - ❖ $\leq 10 \mu\text{g/L}$ in whole blood
 - ❖ $\leq 20 \mu\text{g/L}$ in urine
- ❖ Non-Specific symptoms
 - ❖ $35 \mu\text{g/L}$ in blood
 - ❖ $150 \mu\text{g/L}$ in urine
 - ❖ Blood mercury should be $<5.8 \mu\text{g/L}$ for women who are or intend to become pregnant

ATSDR Suggested Action levels – Hg Vapor

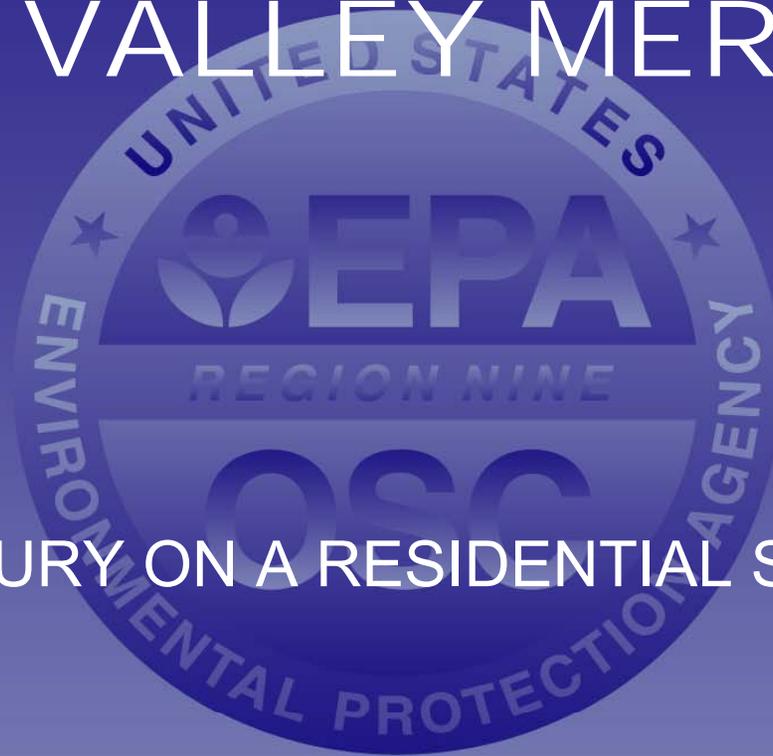
- ❖ Residential occupancy $< 1 \mu\text{g}/\text{m}^3$ *
- ❖ Commercial / schools $< 1 - 3 \mu\text{g}/\text{m}^3$ *
- ❖ Isolation of personal effects $3-6 \mu\text{g}/\text{m}^3$ **

* source of mercury has been eliminated

** Personal effects action level adjusted down from $10 \mu\text{g}/\text{m}^3$ by EPA National Mercury Taskforce and ATSDR.

APPLE VALLEY MERCURY

MERCURY ON A RESIDENTIAL STREET





CONTAMINATED
AREA

6:14:37

SUMMARY

- ❖ Spilled on three residential streets probably on December 28, 2002
- ❖ Spill discovered on January 1
- ❖ Initial Response by AVFD, SBCoFD and DTSC
- ❖ EPA response January 2 – Federalized on January 3
- ❖ Mercury amalgamation used to mitigate spill
- ❖ Monitoring with Lumex Mercury Meter of streets and adjacent homes
- ❖ Number of Homes Screened: 20

Approximately 8,000 pounds of sulfur was put down and collected to amalgamate the mercury













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H&S Action Levels for Mercury Vapor

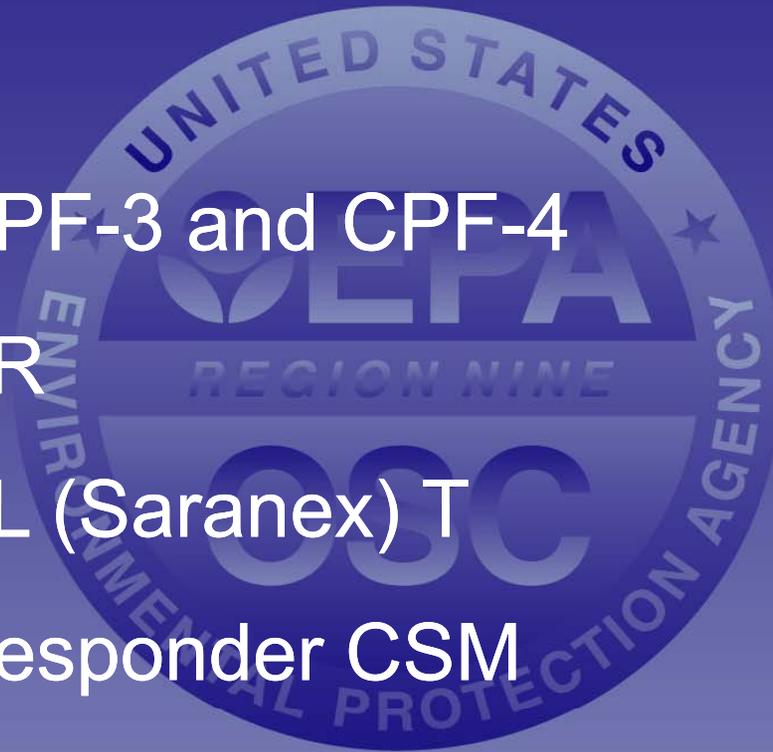
- ❖ $< 1,000 \text{ ng/m}^3$ (residential) – ATSDR
- ❖ $25,000 \text{ ng/m}^3$ (ACGIH – TLV based on 8-hr day)
- ❖ 0.1 mg/m^3 (OSHA – PEL, ceiling)
- ❖ 0.05 mg/m^3 (NIOSH – REL, skin based on 10-hr day)

Personal Protective Equipment – Respirator Cartridges

- ❖ All cartridges used for mercury vapor must have end-of-service-life indicators (ESLI)
- ❖ Examples
 - Mersorb[®] P100 Indicator Type Combination Cartridges should be used with MSA respirators
 - Mercury Vapor/ Chlorine with P100 should be used with the Scott respirators

Personal Protective Equipment – Suits

- ❖ Tychem-F
- ❖ Tychem CPF-3 and CPF-4
- ❖ Tychem BR
- ❖ Tychem SL (Saranex) T
- ❖ Tychem Responder CSM
- ❖ Tychem TK



Personal Protective Equipment – Gloves and Booties

❖ GLOVES

- Silver Shield
- PVC
- Latex
- Nitrile
- Neoprene

❖ Booties

- Latex



On Monday, June 4, 2007 a mercury spill was discovered in an alley in a residential neighborhood of Wilmington (Los Angeles), CA. Children playing in the alley, acquired the mercury (approximately 15 pounds) and released the material (estimated 20% of the contents of the container) onto the concrete and exposed soil in the alley.



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Mercury in Schools

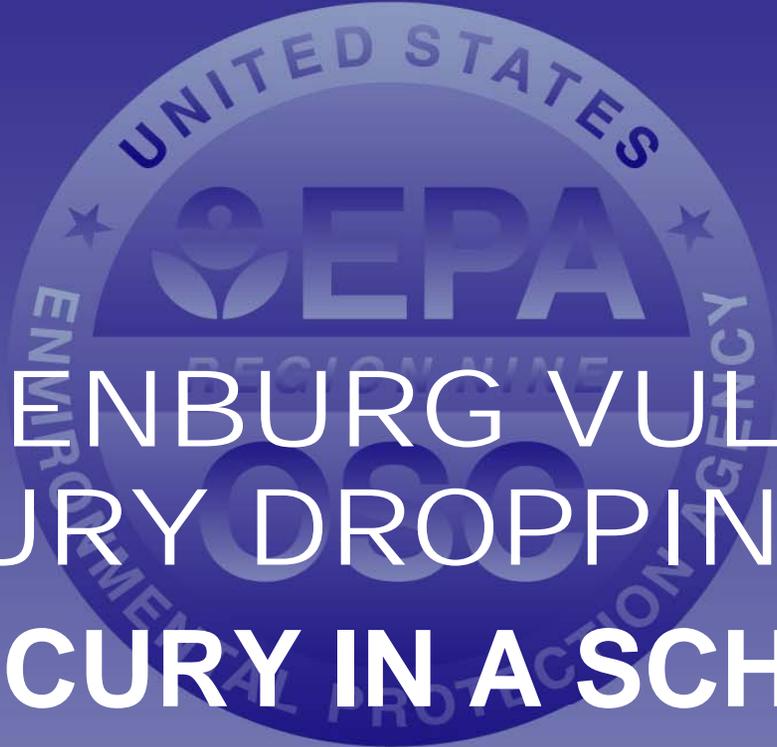
- ❖ Dependent on how long it has been released
- ❖ If it has been more than one day that the kids have been playing with it, entire school might have to be surveyed
- ❖ Survey kids prior to leaving school
 - **Keep all contaminated items at school**
- ❖ If multiple classrooms are contaminated, close school

Mercury in Schools

- ❖ Survey the homes of all kids exposed if mercury may have been brought home
- ❖ If the mercury is spread throughout the school, all kids homes may need to be surveyed
- ❖ Action Levels 1- 3 ug/m³
- ❖ **CALL EPA FOR ASSISTANCE**
 - **800-300-2193**

Response: Most Important

- ❖ Turn off ventilation
- ❖ Use only a vacuum designed specifically for mercury
- ❖ Conduct constant air monitoring
- ❖ No mercury spill is ever fully assessed without a MERCURY VAPOR ANALYZER

A large, semi-transparent watermark of the EPA logo is centered in the background. It features the text "UNITED STATES" at the top, "EPA" in the center, and "ENVIRONMENTAL PROTECTION AGENCY" at the bottom, with a stylized flower icon in the middle.

WICKENBURG VULTURE
MERCURY DROPPING SITE
MERCURY IN A SCHOOL

SUMMARY

- ❖ Gym, locker room, cafeteria, and music room contaminated
- ❖ 10 homes surveyed
- ❖ Mercury amalgamation used
- ❖ Fact sheet sent out to community
- ❖ Agencies: EPA, ADEQ, ADH





STATES
PA
NINE
VCY

OS
IRONMENTAL PR







Course Agenda

- ❖ Introduction and Case Study
- ❖ Mercury Basics
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- ❖ **Cleanup Techniques and Response Issues**
- ❖ Mercury Vapor Analyzers and Other Instrumentation

Techniques and Response Issues

- ❖ Action Levels
- ❖ Source Removal
- ❖ Sulfur Amalgamation
- ❖ Decontamination
- ❖ Disposal Considerations
- ❖ Documentation



Units of Measure

- ❖ $1 \text{ mg} = 1,000 \text{ } \mu\text{g}$
- ❖ $1 \text{ } \mu\text{g} = 1000 \text{ ng}$
- ❖ $1.0 \text{ ng} = 0.001 \text{ } \mu\text{g}$
- ❖ $1.0 \text{ } \mu\text{g} = 0.001 \text{ mg}$
- ❖ Old Jerome reads in mg
- ❖ Lumex usually set to read in ng
- ❖ $1000 \text{ ng} = 1.0 \text{ } \mu\text{g} = 0.001 \text{ mg}$

Action Levels for Mercury in Air

- ❖ $< 1,000 \text{ ng/m}^3$ (residential) – ATSDR
- ❖ $25,000 \text{ ng/m}^3$ (ACGIH – TLV based on 8-hr day)
- ❖ 0.1 mg/m^3 (OSHA – PEL, ceiling)
- ❖ 0.05 mg/m^3 (NIOSH – REL, skin based on 10-hr day)

Where does 1,000 ng/m³ come from?

- ❖ ATSDR
- ❖ Based on risk to human health
- ❖ Review ATSDR Toxicological Profile (1999) available on internet
- ❖ First publication of this AL for residential indoor air came out of Nicor Gas response in Region 5 (Chicago)
- ❖ Chemical-Specific Health Consultation for Joint EPA/ATSDR National Mercury Cleanup Policy Workgroup, 3/22/12

Action Levels for Mercury in Soil and Waste

- ❖ For Waste Disposal
 - ❖ 20 mg/kg (CA TTLC)
 - ❖ 0.2 mg/L (TCLP/ STLC)
 - ❖ 260 mg/kg (LDR)
- ❖ In Soil (elemental Hg)
 - ❖ 6.7 mg/kg (residential soil RSL)
 - ❖ 28 mg/kg (industrial soil RSL)

Action Levels for Mercury in Water

- ❖ In Water (elemental Hg):
 - ❖ Surface Water – 1.2 ng/L
 - ❖ Drinking Water (MCL) – 2 µg/L
 - ❖ Tap Water (PRG) – 0.63 µg/L
 - ❖ Tap Water (PRG for methyl mercury) – 3.7 µg/L
 - ❖ CA RWQCB RBSL (drinking water) – 0.012 µg/L

After Detection - Isolation

❖ Isolation

- Limit the number of people entering the house until a clean-up plan is in-place
- Mercury contamination is spread easily into cracks in floor tiles, sink drains, and cracks/treads in your work boots!!!
- Fire Departments beware...consider booties and tyvek instead of turnouts.

Source Removal

Before decontamination ensure **VISIBLE** mercury has been removed – use a **mercury – specific vacuum**



Sulfur Amalgamation

The process: add elemental mercury to an inorganic reagent (copper, gold, nickel, zinc or sulfur) to form a semi-solid substance (AMALGAMATION)



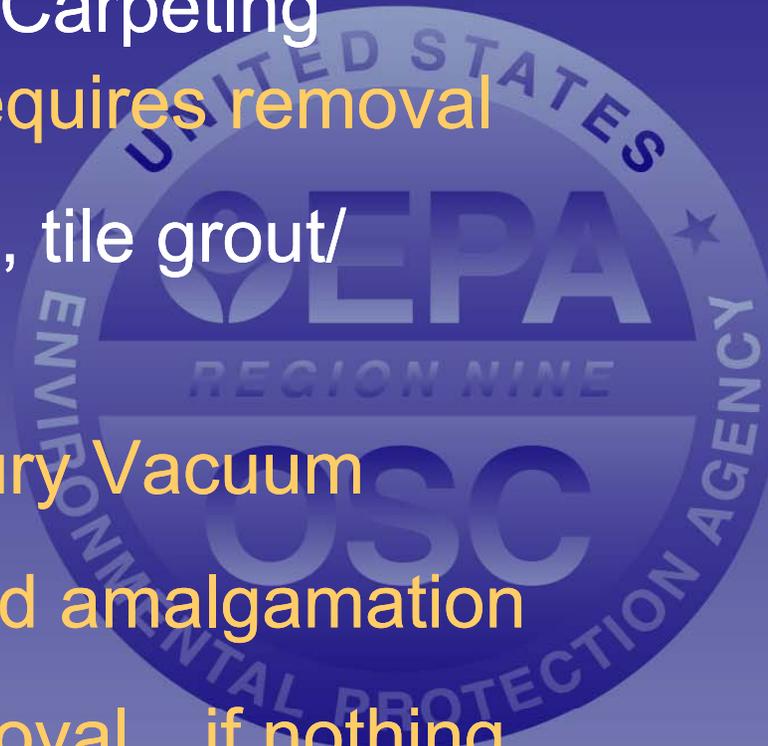
Sulfur Amalgamation

Use it after all visible mercury has been removed



Decontamination

- ❖ Upholstery/ Carpeting
 - Usually requires removal
- ❖ Baseboards, tile grout/ mastic
 - Try Mercury Vacuum
 - Then liquid amalgamation
 - Then removal...if nothing works...use epoxy (encapsulate as last resort)



Decontamination

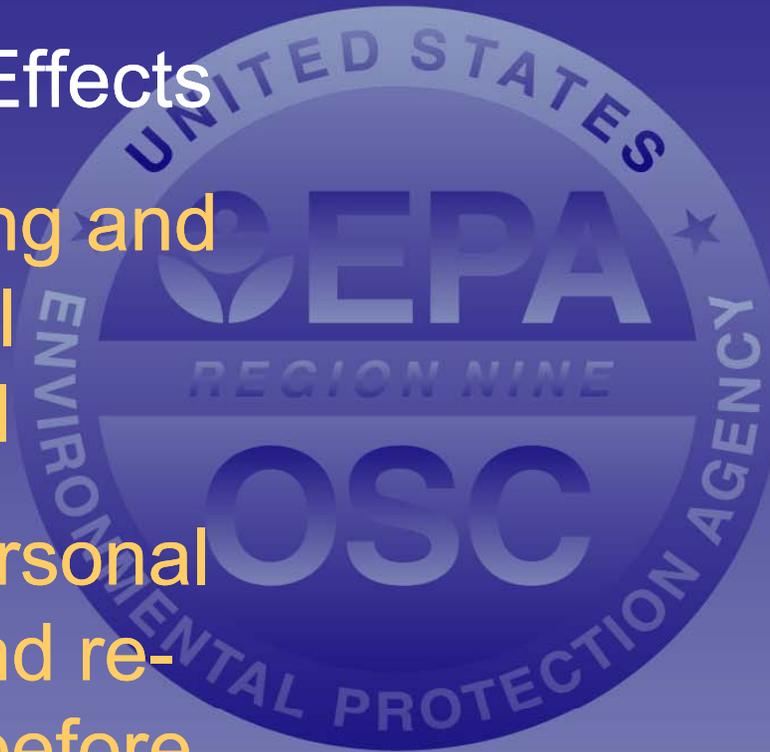
- ❖ Drains (p-trap) and Garbage Disposals
 - Removal



Decontamination

❖ Personal Effects

- Screening and Potential Disposal
- Heat Personal Items and re-screen before disposal



Heating and Ventilating

- ❖ Try to use existing HVAC*
- ❖ Monitor with thermometers
- ❖ Check for sprinkler system
- ❖ Use activated carbon filter when venting



If contamination is widespread (e.g. whole house); otherwise you can also use space heaters and sealing off of rooms to use this technique on larger buildings

Special Disposal Considerations

- ❖ Waste Sulfur (Mercury)
- ❖ Carbon Filters
- ❖ Soil and Debris
 - Appliances – additional issues
 - Contaminated HHW
- ❖ RQ, NA3077, Hazardous waste solid (D009), 9, III
- ❖ Waste Management in Wisconsin will recycle elemental mercury

Documentation

- ❖ Keep a log of personal items
- ❖ Home Screening Forms in Guidebook
- ❖ Community Fact Sheet
 - ❖ PR person — there will be Press
- ❖ EPA has generic fact sheets available (see website)

Mission Viejo Mercury

- ❖ Spill from a blood pressure cuff in a residence
- ❖ Spill cleanup by contractor to the PRP with oversight and assistance from EPA.









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Mercury Response Equipment



Mercury Vapor Analyzers – First Response

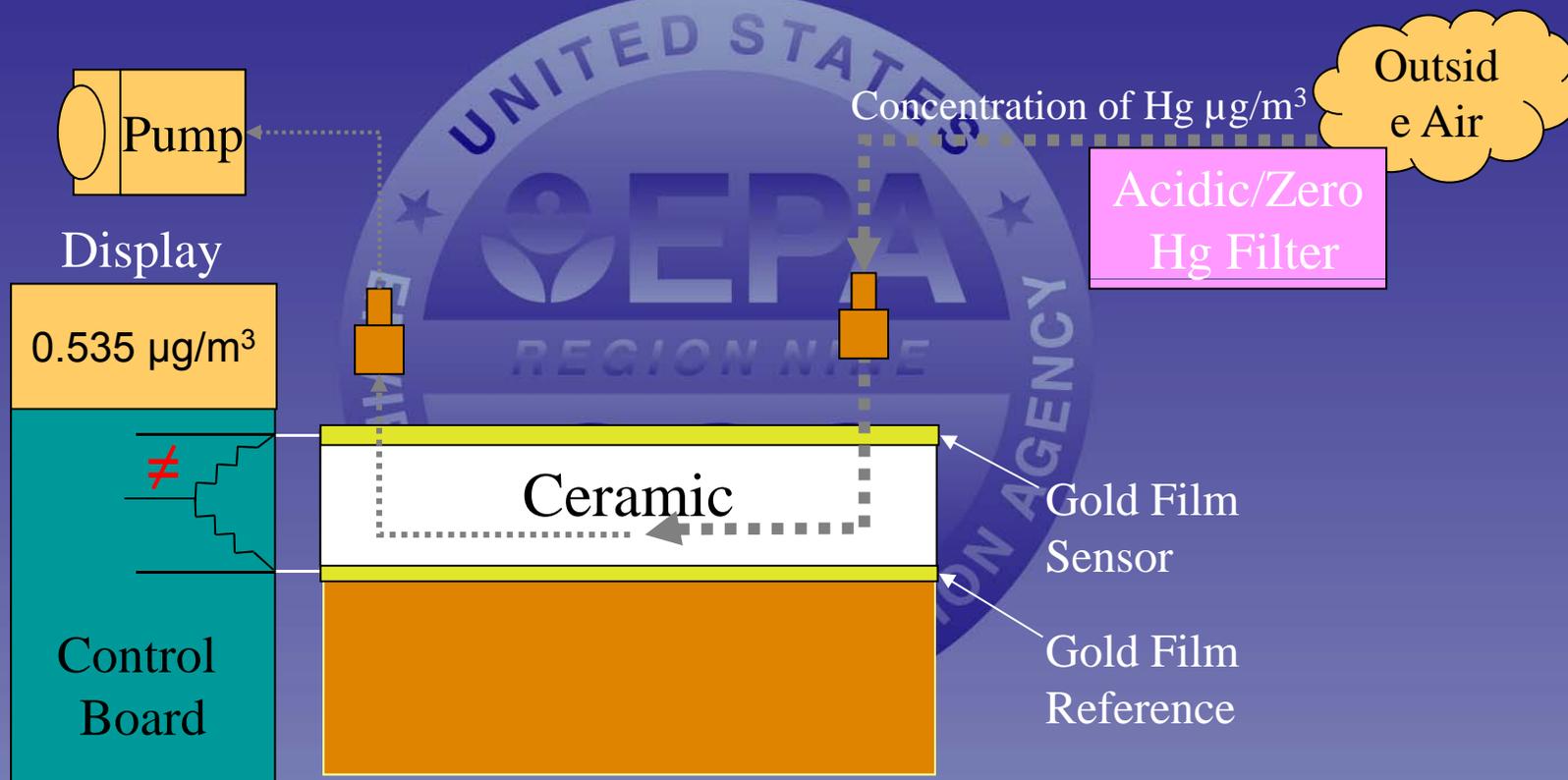


Most commonly used: Jerome
431-X (Gold Film Technology)

Better Detection Technology:
Atomic Spectroscopy

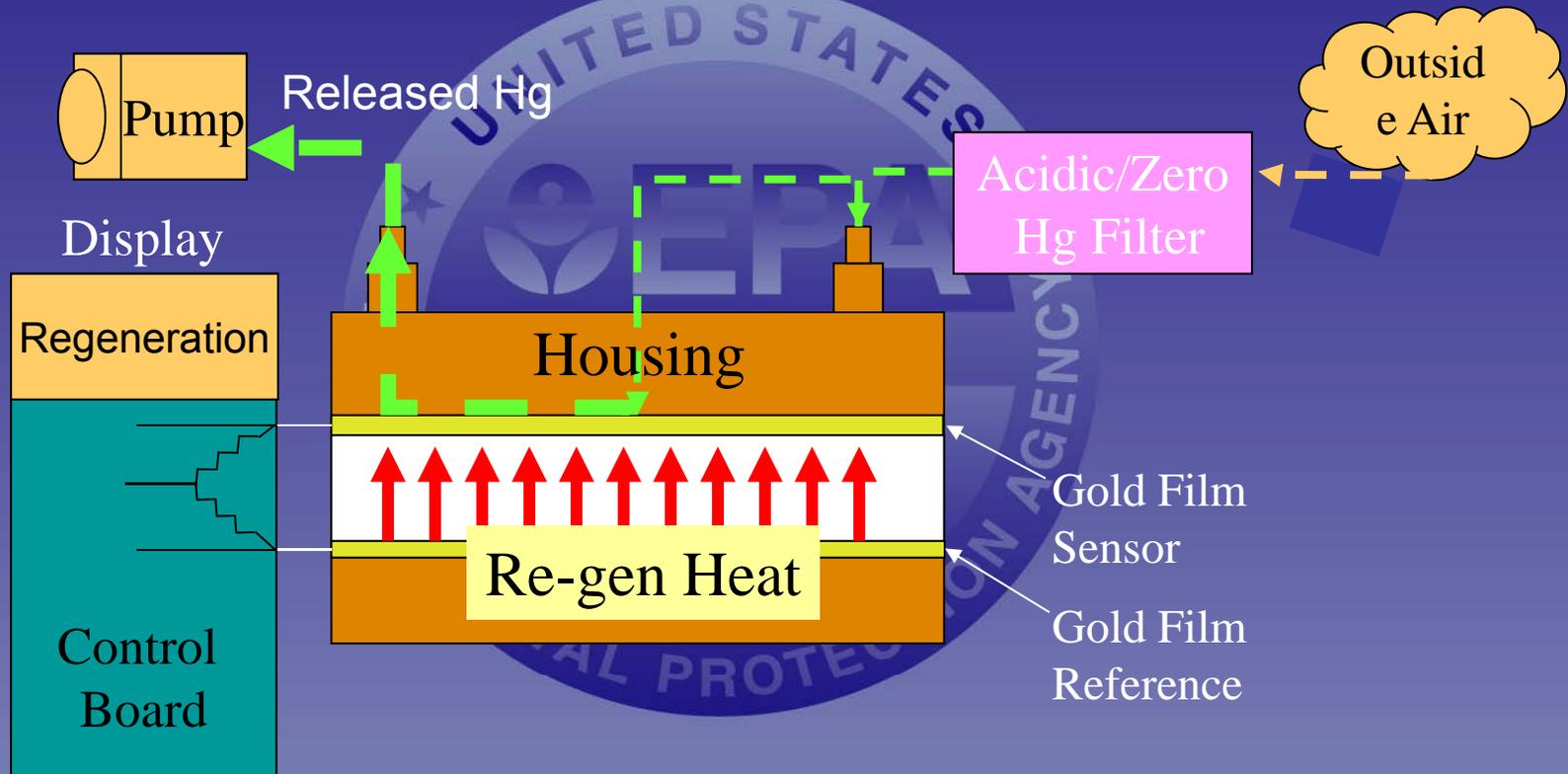


General Gold Film Technology Sampling Flow



***Slide graphic courtesy of Arizona Instruments

General Gold Film Technology Regeneration Flow



***Slide graphic courtesy of Arizona Instruments

JEROME 431-X: Least Sensitive



Jerome 431-X Uses



- ❖ Most useful for gross mercury contamination assessment
- ❖ At EPA Region 9 ERS sites, the Jerome is mostly used for health and safety monitoring (instrument detection limit of approximately 5,000 nanograms per cubic meter (ng/m^3) ($0.005 \text{ mg}/\text{m}^3$))

Jerome 431-X Limitations



- ❖ Sensitivity of the Jerome = $3,000 \text{ ng/m}^3$
(0.003 mg/m^3)
- ❖ Detection Range = $3,000 \text{ ng/m}^3$ to $999,000 \text{ ng/m}^3$
(0.003 mg/m^3 to 0.999 mg/m^3)
- ❖ Accuracy is $\pm 5\%$ at $100,000 \text{ ng/m}^3 \text{ Hg}$
($0.100 \text{ mg/m}^3 \text{ Hg}$)

Jerome 431-X Costs



❖ Made by Arizona Instruments

Arizona Instruments
1912 West 4th Street
Tempe, Arizona 85281
(800) 390-1414

❖ Purchase Price Approximately \$5,500

❖ Rental Price Approximately \$540/week
or \$1620/month

JEROME J 405: More Sensitive, Still Gold Film Technology



Jerome J 405



- ❖ 1st units out in the field July 2006
 - Side-by-side comparison at Vineyard Mercury Response was less than perfect
 - San Bernardino Co. Fire has 2 units
- ❖ May be a potentially-good middle-of-the road instrument (middle price and middle level of sensitivity range)
- ❖ Have to regenerate. Need to practice with it.

Jerome J 405 Attributes



- ❖ Sensitivity of the J405 = 500 ng/m^3 (0.0005 mg/m^3)
- ❖ Detection Range = 500 ng/m^3 to $3,000,000 \text{ ng/m}^3$ (0.0005 mg/m^3 to 3 mg/m^3)
- ❖ Accuracy is $\pm 10\text{-}20\%$ (survey mode is 20%)
- ❖ These are manufacturer's published values

Jerome J 405 Manufacturer and Cost



- ❖ Made by Arizona Instruments

Arizona Instruments
1912 West 4th Street
Tempe, Arizona 85281
(800) 390-1414

- ❖ Purchase Price — Approximately \$8,500
(without data logging)

Detection Instruments

JEROME J405 & 431-X Comparison

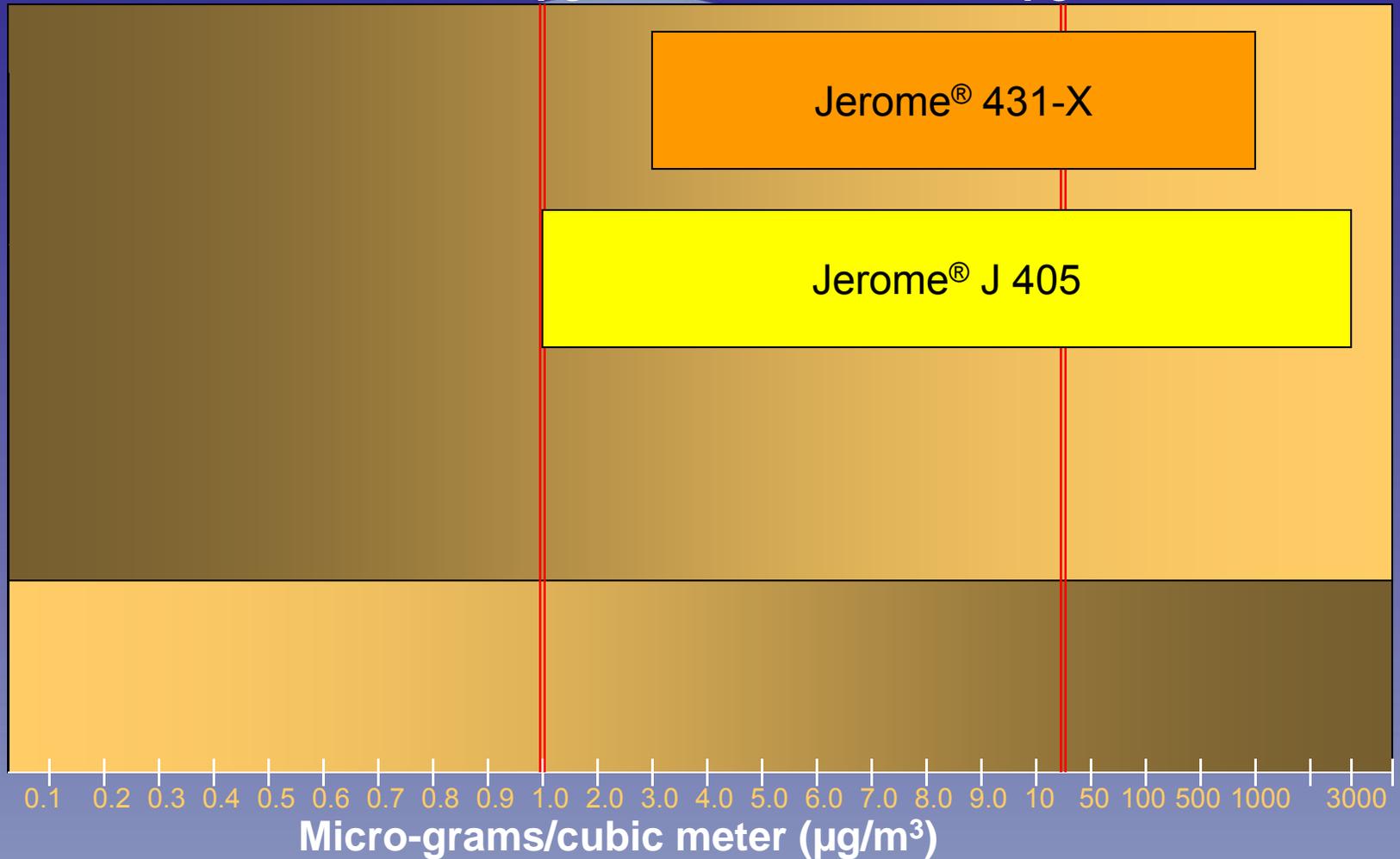
Residential Limit 1.0

Industrial Limit 25.0

$\mu\text{g}/\text{m}^3$

$\mu\text{g}/\text{m}^3$

Gold Film
Technology



***Slide graphic courtesy of Arizona Instruments

After Detection – Isolation Equipment

Atomic Absorption



Lumex 915+

Most Sensitive and Most Versatile



Lumex RA-915+ Basics

- ❖ Designed to determine the mercury vapor content in ambient air, water, soil, natural and stack gases, etc.
- ❖ Detects low level mercury vapors using portable atomic absorption spectrometer technology
- ❖ Built-in compressor
- ❖ Internal rechargeable source
- ❖ Capability to use an external rechargeable battery for field monitoring in remote areas



Lumex RA-915+ Detection Limitations



- ❖ Sensitivity is 2 ng/m^3 (0.000002 mg/m^3)
- ❖ Range of detection is 2 ng/m^3 to $50,000 \text{ ng/m}^3$
 - In “high concentration” mode, the range is 500 ng/m^3 to $200,000 \text{ ng/m}^3$
- ❖ Accuracy is $\pm 20\%$ in both the regular and high concentration modes
- ❖ Potential hydrocarbons interference issues

Lumex RA-915+ Other Features



- ❖ Sample volume = 20 liters per minute (L/min)
- ❖ Data collection and data logging are done in real time and stored as a separate file
- ❖ Two attachments: mercury in soil and mercury in water

Lumex RA-915+ Costs

❖ Manufacturer

Ohio Lumex Company
9263 Ravenna Road, Unit A-3
Twinsburg, Ohio 44087
(888) 876-2611
<http://www.OhioLumex.com>

- ❖ Purchase price – Approximately \$25,000
\$18,000 for air mode only
- ❖ Rental price – Approximately 1,000/week
or \$2,900/month



Instruments for Isolation



Attribute	Lumex 915+	Jerome J405
Detection Range	0.002-25 $\mu\text{g}/\text{m}^3$	0.5-3000 $\mu\text{g}/\text{m}^3$
Precision	< 25% R* @ baseline	20% RSD @ 0.50 $\mu\text{g}/\text{m}^3$ 15% RSD @ 1.0 $\mu\text{g}/\text{m}^3$ 3% RSD >25 $\mu\text{g}/\text{m}^3$
Accuracy		+/-20% @ 0.5 $\mu\text{g}/\text{m}^3$ +/-10% @ 1.0 $\mu\text{g}/\text{m}^3$
Calibration		4 point 106,25,1,0.5 $\mu\text{g}/\text{m}^3$

* %D is not the same as %RSD. See Calculations.

Instruments for Isolation and Cleanup



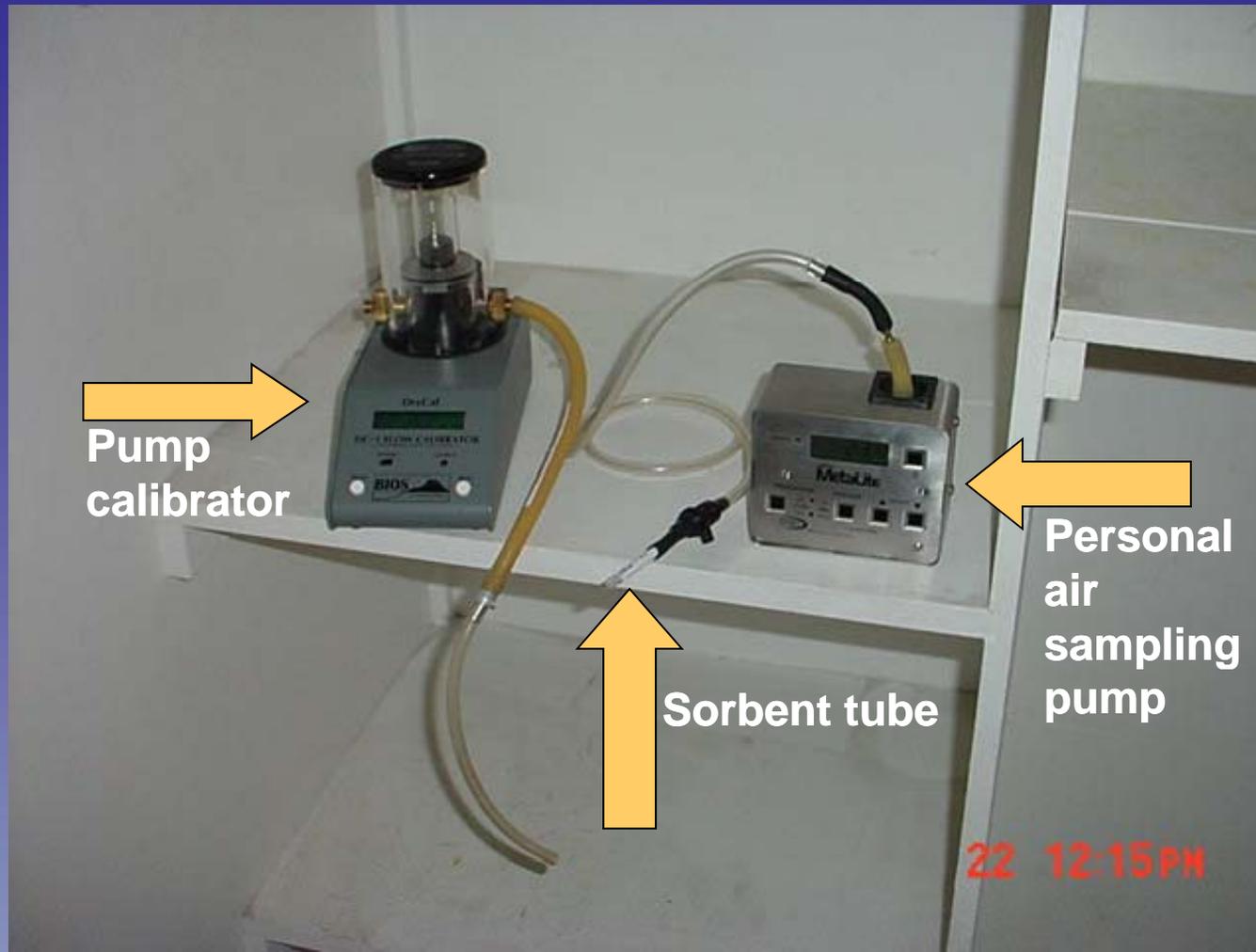
Attribute	Lumex 915+	Jerome J405
Warm up time	20 Min	0-5 Min**
Reference Cell	No	Yes
Zero (Baseline)	Manual	Automatic at begin of sample
Flow Volume	20 L/min	0.750 L/min closed loop
Size	460x210x110mm	280x160x170mm
Weight	7.58kg	2.5kg

** Special warm-up for reading $<1.0 \mu\text{g}/\text{m}^3$

After Mercury Cleanup – Air Sampling



Air Sampling – Set-up



Air Sampling – Laboratory Methods

- ❖ National Institute of Occupational Safety and Health (NIOSH) Method 6009
- ❖ Detection Limit – 3,000 ng/m³
- ❖ Cold vapor, atomic absorption spectrometry for measurement of elemental mercury
- ❖ Pump flow rate: 0.15 to 0.25 L/min
- ❖ Total Volume of air collected: 100–200 liters (larger volume = lower detection limit)
- ❖ Sample media = sorbent tubes (example: SKC tube #226-17-A @ www.skcinc.com)
- ❖ Sample Cost ~ \$40–\$70 per sample

EQUIPMENT HANDS - ON

