

Thank You for Attending Today's Webinar:

Measuring Mercury Vapor in Safety Critical Applications



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Measuring Mercury Vapor in Safety Critical Applications

Joe Pecha

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The dangers of mercury led to more strict government regulations

▶ Industries/Applications

- ▶ Power Plants
- ▶ Industrial Hygiene
- ▶ Mining (Coal and Gold)
- ▶ HAZMAT
- ▶ Dental

Regulatory Agency	Exposure Limit
OSHA	100 $\mu\text{g}/\text{m}^3$ or 0.1 mg/m^3
NIOSH & MSHA	50 $\mu\text{g}/\text{m}^3$ or 0.05 mg/m^3
ACGIH	25 $\mu\text{g}/\text{m}^3$ or 0.025 mg/m^3
EPA & ATSDR	1.0 $\mu\text{g}/\text{m}^3$ or 0.001 mg/m^3

▶ Dangers

- ▶ Invisible, odorless gas attacks nervous system and major organs - brain, liver, kidney
- ▶ Mercury exposure linked to autism

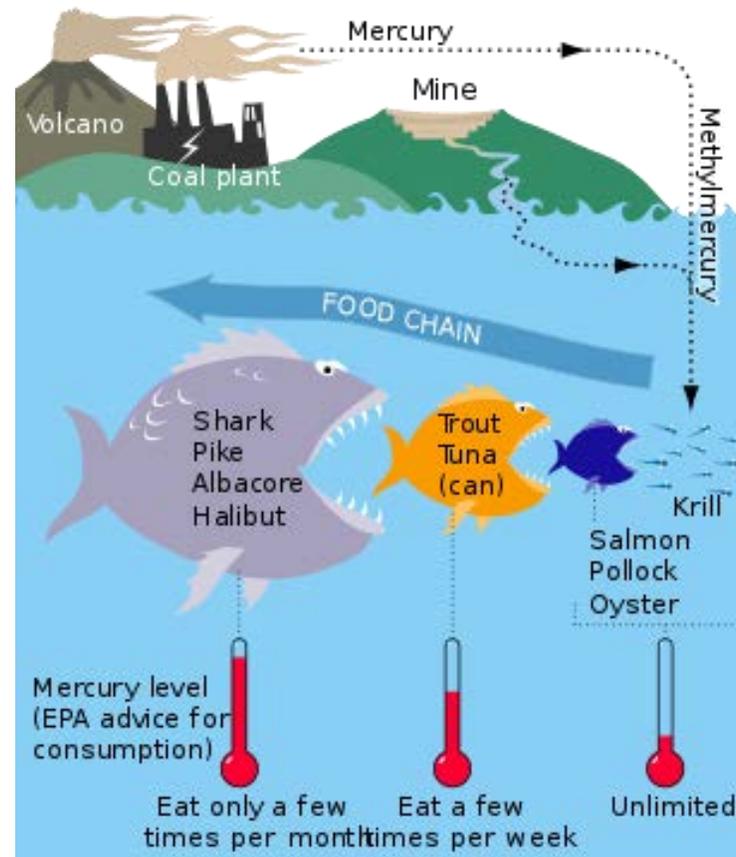
▶ Regulations Regarding Mercury



Common Industry & Public Issues

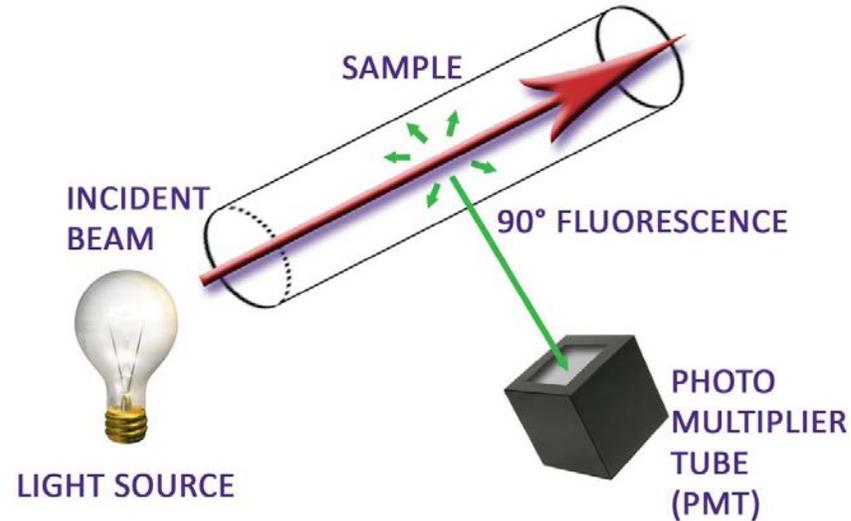
- ▶ Workplace Health & Safety (IH)
 - ▶ Dental offices, recycling facilities, first response
- ▶ Biomagnification
- ▶ Emissions

Ultimately, to prevent these issues, customers must make sure the amount of mercury is lower than the regulations set by the EPA.



Atomic Fluorescence Spectroscopy

- ▶ The mercury bulb flashes light onto the sample, which excites the atoms. When the atoms fall back into ground state, light is released and is detected by the photo multiplier tube. The instrument will only detect wavelengths that are selected, which allows only fluoresced mercury atoms to be picked up.



Jerome® J505 Features

Features

- ▶ Atomic Fluorescence Spectroscopy
- ▶ Portable
- ▶ Zero Regenerations
- ▶ Durable
- ▶ Data Logging
- ▶ Intuitive Interface
- ▶ Minimal Interferences

Specifications	
Detection Range	0.05 $\mu\text{g}/\text{m}^3$ to 500 $\mu\text{g}/\text{m}^3$
Resolution	Standard Mode: 0.01 $\mu\text{g}/\text{m}^3$ Quick Mode: 0.1 $\mu\text{g}/\text{m}^3$ Search Mode: 0.1 $\mu\text{g}/\text{m}^3$
Precision	15% RDS at 1 $\mu\text{g}/\text{m}^3$
Accuracy	$\pm 15\%$ at 0.3 $\mu\text{g}/\text{m}^3$ $\pm 10\%$ at 1 $\mu\text{g}/\text{m}^3$ $\pm 10\%$ at 25 $\mu\text{g}/\text{m}^3$ $\pm 10\%$ at 100 $\mu\text{g}/\text{m}^3$
Response Time	Standard Mode: 28 seconds Quick Mode: 16 seconds Search Mode: 8 seconds, then updates in 1 second intervals
Battery	10+ hour life, charges in 3 hours
Weight	6.5 lbs

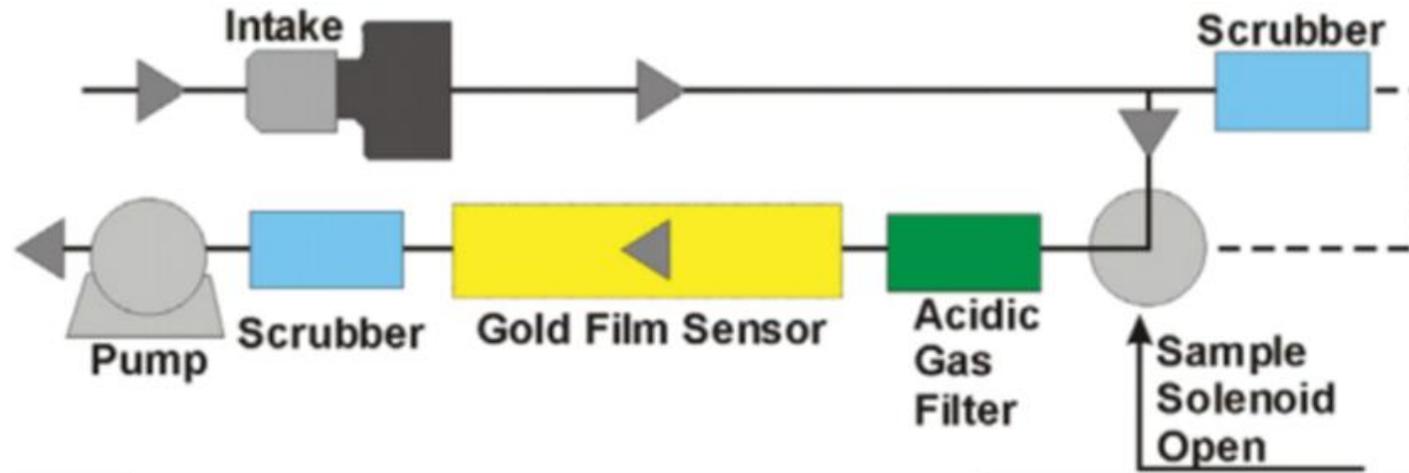


Jerome® J505 Operations

- ▶ Main Screen Functionality
 - ▶ Testing Modes: Standard, Quick, Search
 - ▶ Result Units: Nanograms, micrograms, milligrams
 - ▶ Multiple Sites: Reading paired with location
- ▶ USB port: Data Download or USB Keyboard



Gold Film Sensor



- ▶ Mercury rich sample passes over a thin gold film and deposits on the gold and changes the electrical resistance of the foil.
- ▶ This change in resistance is directly proportional to the mass of mercury vapor taken from a known volume of air, which can be calculated in $\mu\text{g}/\text{m}^3$.



Jerome® J405 Features

Features

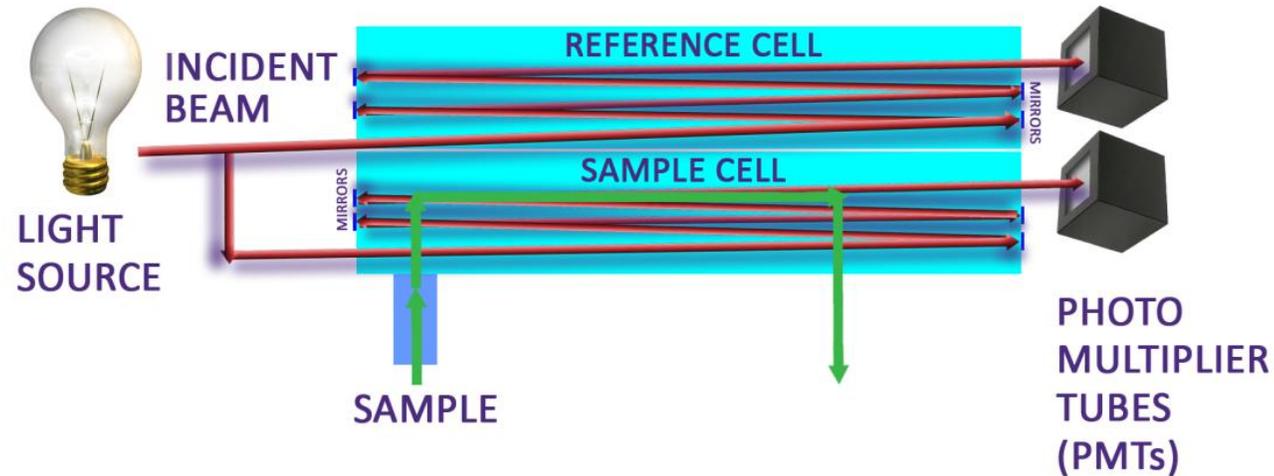
- ▶ Gold Film Sensor
- ▶ Optional Data Logging
- ▶ Field Regeneration
- ▶ Durable
- ▶ Intuitive Interface

Specifications	
Detection Range	0.5 $\mu\text{g}/\text{m}^3$ to 999 $\mu\text{g}/\text{m}^3$
Resolution	0.01 $\mu\text{g}/\text{m}^3$
Precision	15% RSD at 1 $\mu\text{g}/\text{m}^3$
Accuracy	$\pm 10\%$ at 1.0 $\mu\text{g}/\text{m}^3$ $\pm 5\%$ at 25 $\mu\text{g}/\text{m}^3$ $\pm 5\%$ at 100 $\mu\text{g}/\text{m}^3$
Response Time	Sample Mode: 16 seconds Survey Mode: 2 seconds
Battery	24 hour life, charges in 3 hours
Weight	5.3 lbs



Atomic Absorption Spectroscopy

- ▶ Beam of electromagnetic radiation from excited mercury atoms is passed through the sample. Some of the radiation is absorbed by the mercury atoms in the sample. The greater the number of atoms there is in the sample, the more radiation is absorbed, which is proportional to the number of mercury atoms. A calibration curve is constructed by running several samples of known lead concentration under the same conditions as the unknown. The amount the standard absorbs is compared with the calibration curve and this enables the calculation of the lead concentration in the unknown sample



Comparison

	Atomic Fluorescence	Gold Film Sensor	Atomic Absorption
Interferences	Acetone *When present in high concentrations	Chlorine, NO ₂ , H ₂ S, Mercaptans	Sulfides, chlorides, organic compounds that have broad band UV absorbance
Regeneration	None	45 minutes	None
Design	Durable	Durable	Mirror fragility
Detection Limits	0.05 µg/m ³ - 500 µg/m ³	0.5 µg/m ³ - 999 µg/m ³	0.0005 µg/m ³ - 50 µg/m ³
Weight	6.5 lbs	5.3 lbs	15.4 lbs



Thank you! Questions?

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