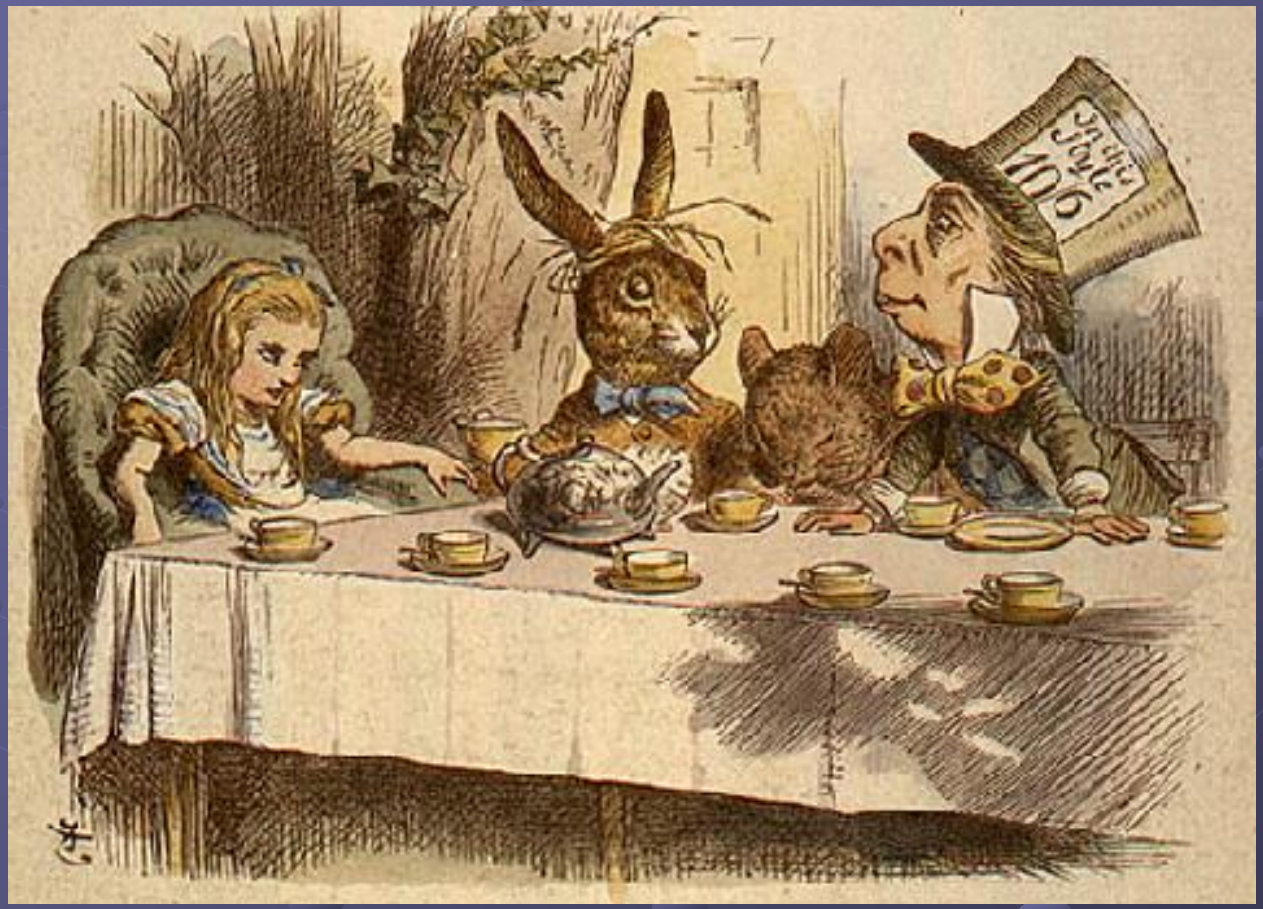
Mercury Response



What have we learned?

Objectives

- Mercury – physical properties
- Uses
- Health effects
- Interaction with other materials

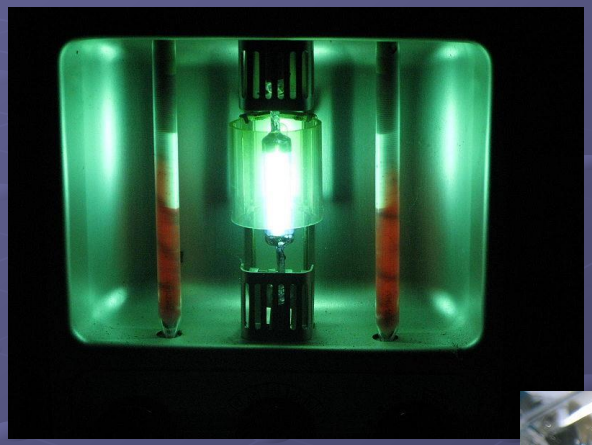
Where does Mercury come from?

- Mineral – Cinnabar
  - Mercuric sulfide (HgS) – red
- Latinized Greek - Hygrargaria
- History –
  - Chinese - medicines (prolongs life, heal fractures, maintain good health)
  - Greeks - ointments
  - Egyptians and Romans – cosmetics
  - Lewis & Clark – Mercurous Chloride(Calomel)-Benjamin Rush
  - Milliners – Mad Hatter Disease

Collecting elemental mercury from gas condensation in Sierra Nevada range, CA.

Not So Ancient History

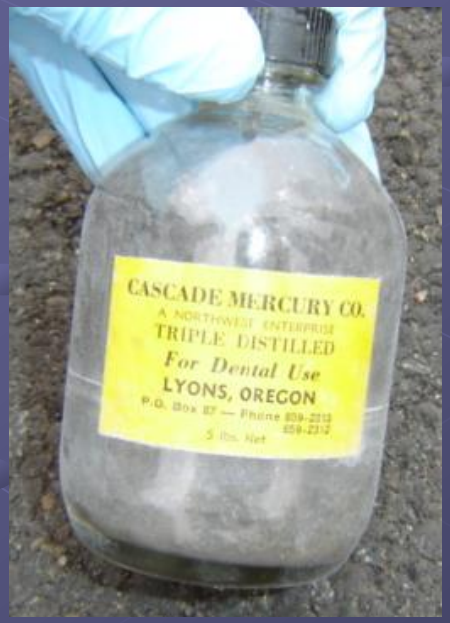
- Switches
- Lamps
- Lab equipment
- Thermometers
- Barometers
- Manometers
- Sphygmomanometers
- Float valves
- Thermostats
- Computers
- Batteries
- Vaccines



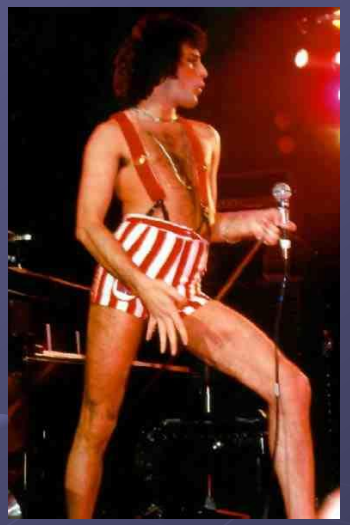
Examples of some products that contain mercury.

It was just sitting there and …

- Gold and silver mining
- Metal recycling
- Storage



Don’t Get Confused!



- Other types of mercury
  - Inorganic salts
    - Mixes with sulfur, chloride or oxygen
  - Organic compounds
    - Methyl mercury
    - Phenyl mercury
    - Thimerosal (sodium ethylmercurithiosalicylate)
- We are ONLY discussing ELEMENTAL MERCURY

Periodic Table

1A	2A	3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A
1 H 1.008																	2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 23.00	12 Mg 24.31											13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Rf (261)	105 Ha (262)	106 Unh (263)	107 Uns (262)		109 Une (267)									

Mercury

Lanthanides	58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
Actinides	90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np 237.0	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

NIOSH Pocket Guide

Mercury compounds [except (organo) alkyls] (as Hg)

CAS 7439-97-6 (metal)

Hg (metal)

RTECS OV4550000 (metal)

Synonyms & Trade Names
Mercury metal: Colloidal mercury, Metallic mercury, Quicksilver
Synonyms of "other" Hg compounds vary depending upon the specific compound.

DOT ID & Guide
2809 172 (metal)

Exposure Limits

NIOSH REL: Hg Vapor: TWA 0.05 mg/m^3 [skin]
Other: C 0.1 mg/m^3 [skin]

OSHA PEL†: C 0.1 mg/m^3

IDLH 10 mg/m^3 (as Hg) See: 7439976

Conversion

Physical Description
Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]

MW: 200.6	BP: 674°F	FRZ: -38°F	Sol: Insoluble
VP: 0.0012 mmHg	IP: ?		Sp.Gr: 13.6 (metal)
Fl.P: NA	UEL: NA	LEL: NA	

Metal: Noncombustible Liquid

Critical Conversions

- ppm = $(mg/m^3)(24.45) / MW$
  - MW for Hg = 200.6
- $mg/m^3 = (ppm)(MW) / 24.45$
- 1 g =

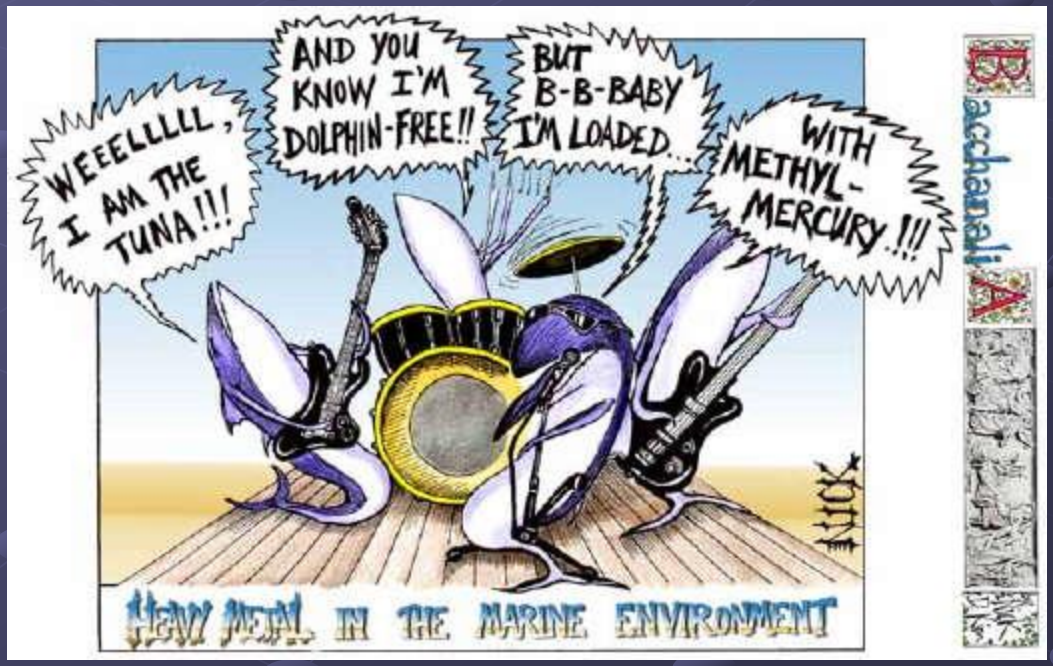
  1,000 mg

  1,000,000 µg

  1,000,000,000 ng

Routes of Exposure

- Nonpolar, monatomic (one atom), Lipid-soluble
- Inhalation
  - Most common route
  - 90% of Hg inhaled is absorbed into bloodstream
- Ingestion
  - Less than 0.1% will be absorbed into bloodstream
  - (Note: 85% of metabolized mercury comes from fish)
- Skin/eye absorption
  - Very low, little risk of toxicity



http://www.webelements.com/webelements/elements/text/Hg/key.html

Mercury–Clinical Description (CDC) Chronic Exposure

- Neurologic, dermatologic and renal manifestations.
- Neuropsychiatric disturbances (e.g., memory loss, irritability, or depression)
- Pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria

So What Is Too High

- Exposure limits - Occupational
  - OSHA PEL – Ceiling 0.1 mg/m^3 (100 µg/m^3 or 100,000 ng/m^3)
  - NIOSH REL - 0.05 mg/m^3 (8-hour TWA)
  - ACGIH TVL – 0.025 mg/m^3
  - Skin notation
    - Corrosive

ATSDR Recommended Limits

- Residential
  - <1.0 µg/m^3 Breathing zone level - Acceptable
  - >10.0 µg/m^3 – Isolate residents from exposure
  - 3.0 – 6.0 µg/m^3 - Acceptable level in head space of bagged personal items

Why so low?

- Occupational vs Residential
  - 8 hour TWA for 40 hour work week
  - 24 hours for 365 days for 70 years
  - Susceptible populations
    - Children under 6 years old
    - Pregnant woman

Mercury Interaction with Other Materials

Chemistry of Mercury

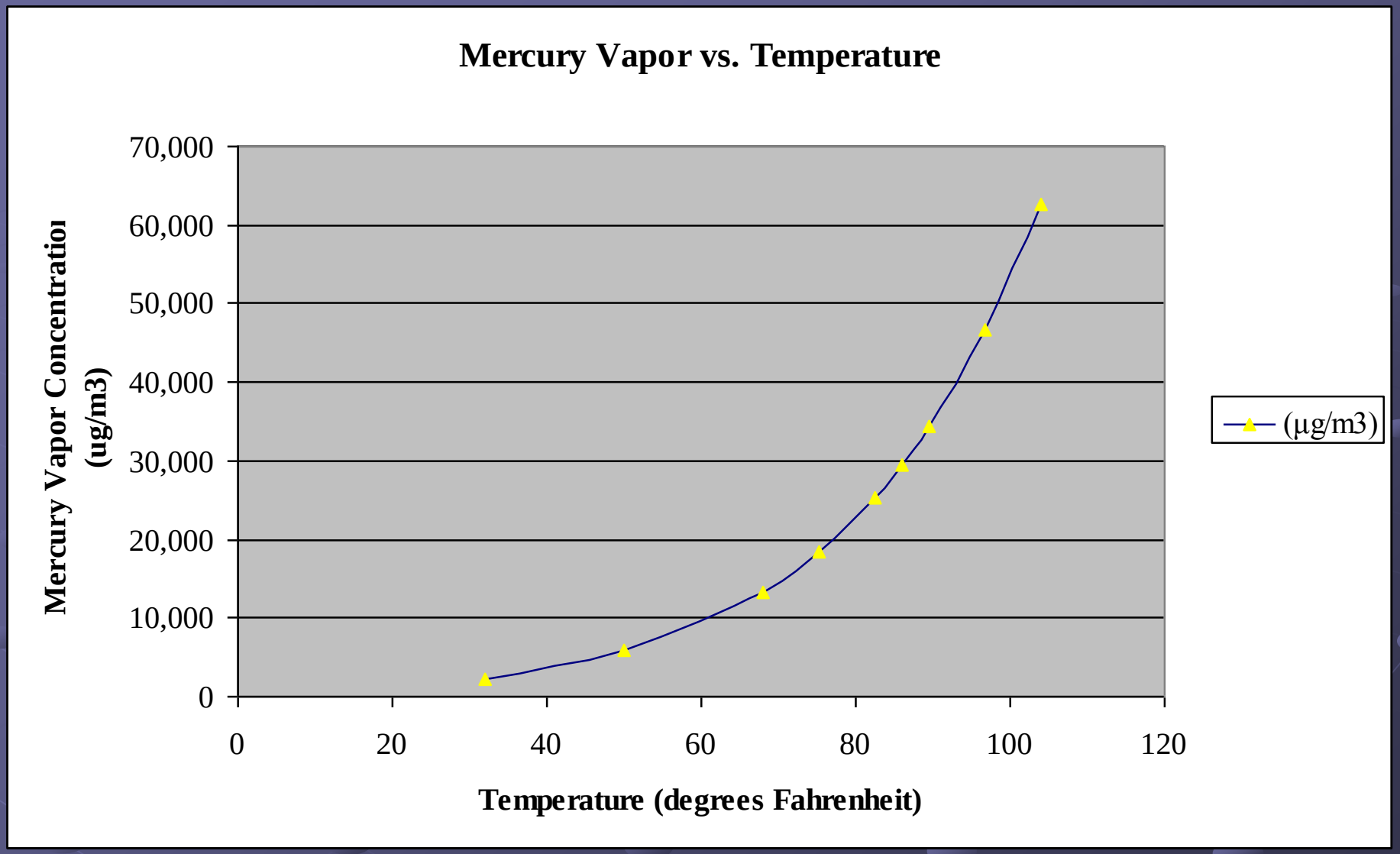
- Molecular weight – 200.6
- Vapor pressure – 0.0012 mmHg
- Forms covalent bonds
  - Weaker bonds (share electrons)
  - Not ionic bonds like other metals (take electrons)

Chemistry of Mercury

- Like likes like
  - Amalgamation with other metals
    - Zinc
    - Silver
    - Gold
    - Copper
    - Uranium
    - Sulfur, etc.

Vapor vs Beads

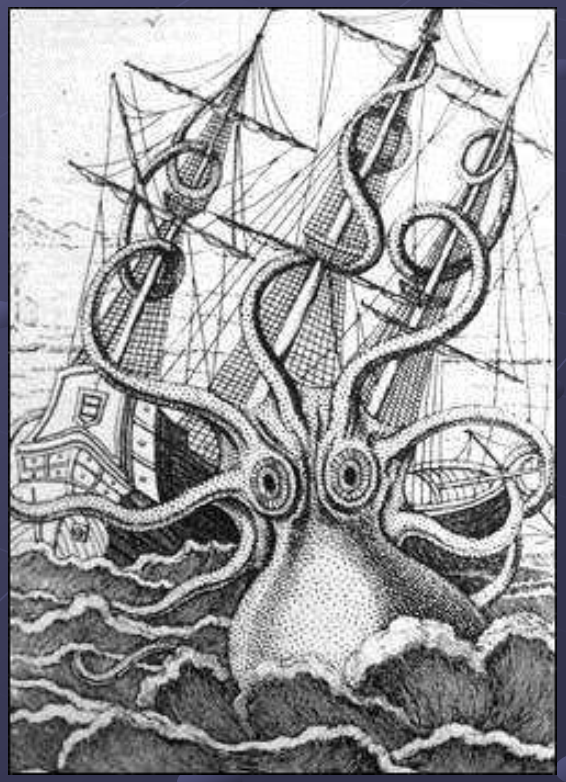
- Over 2-3 µg/m^3
  - Liquid mercury beads present
  - Will never volitilize away



Data from OSHA web site Hazards of Mercury

Mercury Interactions with Building Materials

- Mercury breaks up into smaller beads
- Sealed, Non-porous surfaces – OK for cleanup
  - Paints
  - Metals
  - Walls
- Porous surfaces – Bad!
  - Concrete, wood, carpet, tiles, asphalt, etc.
- More later on clean up



PPE for Response

- Mercury Vapor Cartridges
  - ESLI
  - Breakthrough time -
- Tychem F
- Nitrile
- Booties
- Optional
  - Hardhat
- Levels <10,000 µg/m^3

Next Mercury Subject

Questions?