

Health Issues Associated with Exposure to Elemental Mercury from Compact Fluorescent Bulbs

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Magic number of 300 ng/m³ ... EPA RfC

- ◆ Based on occupational studies
- ◆ Principal study: hand tremor in 26 men, LOAEL 9000 ng/m³
- ◆ Historical levels may have been higher
- ◆ Other studies:
 - EEG changes
 - subjective changes in memory, sleep, psychological effects
 - autonomic effects
 - finger tapping, visual scanning, visuomotor coordination, visual memory, concentration (dentists)
 - finger tapping, mental arithmetic, two tests of executive function, visual reaction time (fluorescent lamp factory worker for at least 2 years)

Magic number of 300 ng/m³ ... EPA RfC

- ◆ All small studies
- ◆ Based on chronic exposure in adults
- ◆ No information on infants and children
- ◆ Total UF of 30
 - 10X LOAEL to NOAEL, sensitive populations, 3X database insufficiency
 - no justification provided to go from default of 10 to 3
 - mercury vapor produces reproductive and developmental effects in animals, but small database

Long versus short term exposure

- ◆ The EPA RfC is designed to protect against chronic exposure
- ◆ Acute exposure toxicity values (CT, IN, LA, MT, NC, ND, OK, SC, TX, VA)
 - 15 or 30 minutes, 8 or 24 hours
 - values range from 24 to 4000 ng/m³
 - all below levels found in Maine study
 - effect of spikes on vulnerable populations is unclear
- ◆ What about a peak followed by lower-level exposure?
 - may or may not be protective for infants, children, or other vulnerable populations

Signs of acute elemental mercury poisoning by inhalation

- ◆ metallic taste
- ◆ difficulty breathing/lung damage
- ◆ vomiting/diarrhea
- ◆ swollen gums
- ◆ acrodynia
 - children especially susceptible
 - red and swollen hands and feet, peeling skin
 - pink cheeks, photophobia, irritability, loss of appetite
 - signs may be delayed

Comparison of urine mercury levels in workers vs. children

- ◆ Urinary mercury levels in workers averaged 17 to 20 ug/L in various studies in which neuropsychological effects were found
- ◆ Two studies of effects of dental amalgams in 6-10 year-old children followed for 5 or 7 years
 - no adverse effects identified
 - urinary mercury levels averaged 1.5-3.0 ug/L and about 1.5 ug/L in the two studies
 - same form of mercury, same route of exposure
- ◆ Not prenatal, infant, or early childhood exposure, no spikes
- ◆ Unclear how to interpret this comparison

Concern about vulnerable populations

◆ Infants and toddlers

- brains much more vulnerable
- we know that neurotoxicants identified in adults may have different and more severe effects in developing organisms
- higher respiration rate than adults, so higher exposure
- closer to the source of exposure

◆ Fetuses

- elemental mercury can cross the placenta
- converted to inorganic in the mother's blood which does not cross
- but there could be acute peaks, particularly problematic during pregnancy

◆ Diseases

- kidney disease: mercury causes kidney damage
- diabetes: mercury produces peripheral neuropathy
- degenerative nervous system diseases?

◆ Elderly ???

Issues specific to the Maine study

- ◆ High peak levels – in the thousands ng/m³
 - above acute values for other states
 - what is the contribution of peak vs. longer-term lower levels to potential toxicity
- ◆ Length of exposure to > 300 ng/m³
 - some scenarios resulted in elevated level or spikes for (at least) hours, especially at 1 foot
 - agitation days or weeks later produced levels in the thousands or greater
 - vacuuming could produce high levels days later and vacuum could become contaminated
 - unlikely that area would never be vacuumed again
 - the length of time to decrease below 300 ng/m³ is unknown
- ◆ High levels at 1 foot and directly above source is of particular concern for toddlers and children