Elemental Mercury

TEACH Chemical Summary

Elemental mercury is one of three forms of mercury listed in TEACH. In addition to this Chemical Summary, there are separate Chemical Summaries for organic mercury (e. g. , methylmercury) and for inorganic mercury.

U.S. EPA, Toxicity and Exposure Assessment for Children's Health

This TEACH Chemical Summary is a compilation of information derived primarily from U.S. EPA and ATSDR resources, and the TEACH Database. The TEACH Database contains summaries of research studies pertaining to developmental exposure and/or health effects for each chemical or chemical group. TEACH does not perform any evaluation of the validity or quality of these research studies. Research studies that are specific for adults are not included in the TEACH Database, and typically are not described in the TEACH Chemical Summary.

I. INTRODUCTION

Mercury in elemental form is a silver-colored metal that exists as a thick liquid at room temperature, familiar to most people as the silver liquid inside mercury thermometers. Mercury can chemically combine with other elements to form organic (carbon-containing) and inorganic (not containing carbon) compounds. Mercury is a naturally-occurring metal that is also used in man-made products and processes, and is emitted into air from industrial sources (1-4). Human exposure to mercury occurs from a variety of sources, e. g. , breathing mercury-containing air, using commercial products that contain mercury, and ingesting fish that contain methylmercury (1, 2, 4). The U.S. EPA provides a Web site with information about mercury exposure and effects, with a portal at www.epa.gov/mercury (5). Report any spills of elemental mercury of 2 tablespoons or greater (2 tablespoons of elemental mercury weighs about 1 pound) to the U.S. EPA at 800-424-8802 (5).

There are three major forms of mercury, each of which is covered in a separate TEACH Chemical Summary: 1) organic mercury, predominantly methylmercury found in some foods such as fish, ethylmercury found in some vaccine preservatives and some antiseptics, and phenylmercuric acetate (PMA) formerly used in some indoor paint; 2) non-elemental forms of inorganic mercury, found primarily in batteries, some disinfectants, and some health remedies and creams; and 3) elemental mercury, found in thermometers, fluorescent bulbs, dental amalgam fillings, and other sources (1, 2, 4). This Chemical Summary focuses on elemental mercury. Additional information on inorganic and organic mercury is available in separate Chemical Summaries on this U.S. EPA TEACH Web site.

Elemental mercury is most often encountered as a silver-colored liquid, as described above, or as mercury vapor in air. Children are most likely to be exposed to elemental mercury after a spill from a broken object previously containing mercury, like a thermometer. Exposures have also been reported for children finding stored elemental mercury, or parents using mercury in ritualistic practices, particularly in the Hispanic and Haitian communities (1-4, 6, 7).

In children, reported symptoms following elemental mercury exposure include renal toxicity, skin rashes, hypertension, and pulmonary toxicity (1, 2, 8). Neurological symptoms include behavioral changes (irritability, shyness, nervousness), tremors, and reduced muscle coordination (1, 2, 8). Reports of death in children following acute elemental mercury exposure were related to respiratory failure (1, 8-10). Acrodynia, or "pink disease" (1, 8, 11-13) has been reported, and includes leg cramps, irritability, redness and peeling of the skin of hands, nose, and soles of the feet, itching, fever, sweating, salivating, rashes, sleeplessness, and/or weakness (1, 2, 8).

II. EXPOSURE MEDIA AND POTENTIAL FOR CHILDREN'S EXPOSURE[1]

Exposure Media	Relative Potential for Children's Exposure[2,3]	Basis[4]
Indoor Air	Higher	Elevated levels of elemental mercury or mercury vapor in indoor air can occur as a result of accidental spills and can be lethal to children. Spills have occurred in home and school environments. Attempted clean-up using a vacuum cleaner disperses elemental mercury into the air, and is likely to increase exposure. There have been reports of children finding elemental mercury in school science labs and abandoned cars or buildings, and playing with or transporting the mercury; these behaviors have resulted in mercury contamination of schools, homes, and buses where the children had been after the mercury exposure. Mercury contamination of carpeting can persist for long periods of time, and new owners of homes have discovered contamination of carpeting by previous owners.
Diet	Lower	Elemental mercury is not generally found at elevated levels in diet. *See the Organic Mercury Chemical Summary for information about methylmercury exposure from diet, particularly eating fish.*
Sediment	Lower	Elemental mercury is not generally found at elevated levels.
Medical	Lower	Elemental mercury is not generally found at elevated levels in medical applications. *See the Inorganic Mercury Chemical Summary for information about inorganic mercury exposure from some home/medicinal remedies; and see the Organic Mercury Chemical Summary for information about ethylmercury from some vaccine uses.*
Ambient Air	Lower	While elemental mercury can be present in ambient air, it is not likely to be a significant exposure pathway.
Drinking Water	Lower	Elemental mercury is not generally found at elevated levels.
Soil	Lower	Elemental mercury is not generally found at elevated levels.
Surface Water	Lower	Elemental mercury is not generally found at elevated levels.

[1] For more information about child-specific exposure factors, please refer to the Child-Specific Exposure Factors Handbook (http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=55145).

[2] The Relative Potential for Children's Exposure category reflects a judgment by the TEACH Workgroup, U.S. EPA, that incorporates potential exposure pathways, frequency of exposure, level of exposure, and current state of knowledge. Site-specific conditions may vary and influence the relative potential for exposure. For more information on how these determinations were made, go to http://www.epa.gov/teach/teachprotocols_chemsumm.html.

[3] Childhood represents a lifestage rather than a subpopulation, the distinction being that a subpopulation refers to a portion of the population, whereas a lifestage is inclusive of the entire population.

[4] Information described in this column was derived from several resources (e. g. , 1-5) including studies listed in the TEACH Database (http://www.epa.gov/teach).

III. TOXICITY SUMMARY[5, 6]

Mercury is a neurotoxicant, and may affect many areas of the brain (1, 2, 8). Different forms of mercury may not all have neurotoxic effects listed here, and many neurotoxic effects of mercury exposure have been attributed to methylmercury exposure (see TEACH Organic Mercury Chemical Summary). Reported neurotoxic symptoms of mercury exposure include poor performance on neurobehavioral tests, particularly on tests of attention, fine motor function, language, visual-spatial abilities (e. g. , drawing), and verbal memory (1, 2, 8). Similar neurological effects have been reported in children chronically exposed to elemental mercury (14-17).

Elemental mercury exposure of adults has also been associated with renal toxicity, hypertension, and pulmonary (lung) toxicity (1, 2, 8). Other reported health effects in children following acute elemental mercury exposure include headache (17-19), tics (involuntary muscle movements) (11), weight loss (13, 20), rashes (12, 13, 20-24), pulmonary (lung) toxicity (9, 25), hypertension (high blood pressure) (12, 20, 21, 26, 27), and heart rate variability (28). Reports of death in children following acute exposure to elemental mercury were related to respiratory failure (1, 8-10).

Children and adults exposed to mercury, including elemental mercury, have been reported to develop a disorder called acrodynia, or "pink disease" (1, 8, 13). Symptoms include leg cramps; irritability; and redness and peeling of the skin of hands, nose, and soles of the feet. Itching, fever, sweating, salivating, rashes, sleeplessness, and/or weakness have also been reported (1).

In experimental animal studies, offspring of pregnant rats exposed to elemental mercury experienced decreased birth weight at doses that also resulted in maternal toxicity (29). Adverse behavioral effects (e. g. , altered levels of spontaneous motor activity) were observed in adult rats whose mothers were exposed to mercury vapor during pregnancy into adulthood (30-32).

Carcinogenicity Weight-of-Evidence Classification[7]: Elemental mercury was classified by the U.S. EPA in 1994 as "not classifiable as to human carcinogenicity" due to lack of sufficient data (http://www.epa.gov/iris/subst/0370.htm, II. A. 1). The World Health Organization International Agency for Research on Cancer (IARC) in 1997 classified metallic (elemental) mercury as Group 3, "not classifiable as to their carcinogenicity in humans," with inadequate evidence for carcinogenicity in humans and in experimental animals (http://monographs.iarc.fr/ENG/Monographs/vol58/volume58.pdf).

[5] Please refer to research article summaries listed in the TEACH Database for details about study design considerations (e. g. , dose, sample size, exposure measurements).

[6] This toxicity summary is likely to include information from workplace or other studies of mature (adult) humans or experimental animals if child-specific information is lacking for the chemical of interest. Summaries of articles focusing solely on adults are not listed in the TEACH Database because the TEACH Database contains summaries of articles pertaining to developing organisms.

[7] For recent information pertaining to carcinogen risk assessment during development, consult "Guidelines for Carcinogen Risk Assessment and Supplemental Guidance on Risks from Early Life Exposure" at *http://www.epa.gov/cancerguidelines*.

IV. EXPOSURE AND TOXICITY STUDIES FROM THE TEACH DATABASE

This section provides a brief description of human and animal studies listed in the TEACH Database. For more details about study design parameters, e. g. , doses and exposure information, please refer to article summaries in the TEACH Database. Any consideration should include an understanding that exposure levels in animal studies, in many cases, are greater than exposure levels normally encountered by humans.

A. *HUMAN EXPOSURE AND EFFECTS*

Studies that measured total mercury, without distinguishing forms of mercury:

- Total mercury has been measured in many types of food (1, 4, 33-35), including infant and toddler foods (33) and children's diet (35). Another study estimated mercury exposure of children from diet in Canada (34). The largest proportion of mercury in diet was attributed to the presence of methylmercury in fish (see Organic Mercury Chemical Summary) (1).
- Total mercury concentrations have been measured in umbilical cord blood (36-42), placenta (37, 38), and fetal hair (38). One study in Tennessee measured total mercury in fetal blood, placenta, and maternal blood for over 650 pregnancies, and reported significant correlations between mercury concentrations in maternal blood and in fetal blood (38). In another study, mercury concentrations in cord blood were not correlated with the distance of these mother's homes from an industrial area (36).
- Total mercury concentrations have also been measured in blood, urine, fingernails, and hair of children (10, 40, 43-64), as well as in breast milk (37, 40, 65-73). Also, as part of a large ongoing national study (National Health and Nutrition Examination Survey, or NHANES; 1999-2002), total mercury concentrations were measured in blood of children 1-5 years old, and in blood and urine of women 16-49 years old were measured (47). Results indicated that 5. 7% of women 16-49 years old had mean total mercury concentrations in blood higher than 5. 8 μg/L (blood mercury levels below 5. 8 μg/L, the U.S. EPA reference blood level, were estimated to be without appreciable harm) (57).
- Possible effects of mercury exposure on pregnancy outcome have been studied. One study found a correlation between increased incidence of miscarriage and total mercury concentrations in well water (74). In a study of pregnant women in Iowa, increasing blood total mercury concentrations were correlated with the incidence of previous stillbirths, and separately with a history of having children with birth defects (75).
- Longitudinal studies of possible neurodevelopmental effects of mercury exposure have been performed, measuring total mercury concentrations in hair and blood of pregnant women and their children over time (1, 8). In studies from the Faroe Islands and elsewhere, poorer performance on neuropsychological tests in children was associated with higher concentrations of mercury in maternal hair during pregnancy or in cord blood (39, 58, 76-81). Similar correlations were found in another study in New Zealand (82). In contrast, other studies in the Seychelle Islands found few correlations between mercury concentrations in maternal hair and neurological impairments in children (83-93). Mercury exposures in these studies were largely attributed to methylmercury exposure from the consumption of fish in the diet (76-78, 83-92, 94-97). These large studies, in conjunction with other data, have been carefully evaluated and analyzed by the National Research Council and the U.S. EPA, and provide the basis for derivation of the current U.S. EPA oral reference dose (RfD) for methylmercury (96, 97).

- Children's total mercury blood concentrations were significantly associated with other health effects, including increased N-acetyl-beta-D-glucosaminidase (a measure of kidney function) and decreased serum prolactin (indicating a shift in neurobiochemical metabolism) (63). Total mercury concentrations in blood and in hair were significantly associated with decreased logical and spatial abilities (61). There were no significant impairments in cognitive testing of children with amalgam (mercury-containing) dental fillings, as compared to children with composite (mercury-free) fillings (98, 99). More information about mercury exposure from dental amalgam use is summarized in the next section (describing studies that measured elemental mercury).
- Possible associations between autism spectrum disorders (ASD) and environmental exposure to mercury have been explored. Increased incidence of ASD was associated with mercury air concentration at the census tract level (100), and with total reported environmental mercury releases (101). One study reported no significant difference in blood concentrations of total mercury between children with ASD, and children without ASD (102). More information about mercury exposure from vaccines is summarized in the TEACH Organic Mercury Chemical Summary.
- Some adverse effects on vision (e. g. , reduced contrast sensitivity, with difficulties sensing shades of gray) in children were significantly associated with increased total mercury concentrations in blood (103). In another study, there was no association between contrast sensitivity in 7-year-old children, and their cord blood total mercury concentrations at birth (104).
- Increases in blood pressure and decreases in heart rate variability in 7-year-old children were associated with increasing total mercury concentrations in cord blood at their birth (28). A follow-up of those children at 14 years of age revealed that there was no longer a significant increase in blood pressure associated with cord blood mercury concentrations, though a significant association with decreases in heart rate variability remained (27).
- Exploring possible thyroid effects, one study reported no significant association between cord blood total mercury concentrations and infant thyroid hormone concentrations (41). Another large study of children found no correlation between blood total mercury levels and blood thyroid hormone levels (105).

Studies that measured elemental mercury:

- Dental amalgam fillings contain elemental mercury combined with other metals, and mercury exposure for pregnant women and children who have amalgam fillings have been studied (98, 99, 106-111). The number of amalgam fillings in women during pregnancy was significantly associated with mercury concentrations in neonatal hair (109) but not in amniotic fluid (110) (see Considerations for Decision Making in this Chemical Summary). There was no significant difference in birth weight of infants born to mothers with increasing numbers of dental amalgam fillings (111).
- In children, the presence of amalgam fillings in children was significantly associated with urine mercury concentrations in one study of children (106), but not another study of adolescents (107). The presence of amalgam fillings in children's mouths did not affect the antibiotic resistance of bacteria in their mouths (108). Two large longitudinal studies reported no detectable neurological impairments in tests of children with amalgam dental fillings, as compared to children with composite dental fillings (98, 99).

- Acute exposures of children to elemental mercury most frequently occur via inhalation as a result of spills from thermometers or ritualistic use of mercury in the home (1, 6, 7, 9-12, 24-26, 112). In schools, spills continue to occur every year from thermometers, gauges, or stores of elemental mercury (1, 20-24, 112). Acute exposure from removal of gas regulators containing elemental mercury were recently reported (19).
- Ritualistic use of elemental mercury in homes puts children at risk of exposure, and elemental mercury was found in stores selling such supplies in New York, New Jersey, and Pennsylvania (6). One study reported that Latino and African-Caribbean families are at special risk because of the use of elemental mercury in certain rituals (7) (see Considerations for Decision Making in this Chemical Summary). Another study measured total mercury concentrations in urine of children in a population predisposed to ritualistic use of mercury, and 5% of the children tested had urine mercury concentrations above 5 μg/L (113).
- There are several case studies in the literature which describe acute toxicity in children following exposure to elemental mercury, often in the home (9-13, 18-26, 114). Reported health effects include neurological tics such as eye blinking and uncontrollable shoulder shrugs (11), weight loss (13, 20), acrodynia (a syndrome that includes small red pustule skin rash and other symptoms; see Toxicity Summary in this Chemical Summary) (12, 13), other skin rashes (12, 19-24), pulmonary toxicity (9, 25), residual neurological deficiencies (10), high blood pressure (12, 20, 21, 26), and death (9, 10).
- Neurological endpoints have been measured in children living near gold mining operations who were exposed to elemental mercury (14-17). Significant effects included decreased head circumference (16), impaired language development (16), reduced visual motor skills (16), headaches (17), memory loss (17), and decreased performance on neuropsychological tests (14). One of these studies found no measurable neurological or neurobehavioral effects in children with mean mercury blood concentrations of 25 μg/L (children of exposed workers), as compared to children with mercury blood concentrations of 5 μg/L or less (15).

B. *EXPERIMENTAL ANIMAL EXPOSURE AND EFFECTS*

Experimental animal studies summarized here involved elemental mercury exposure.

- Tissue distribution of mercury following elemental mercury vapor exposure of pregnant mice revealed mercury accumulated more in fetal kidney than in liver or brain (115). Fetal uptake of elemental mercury in mice was altered with co-exposure to other factors. Injection or inhalation of mercury resulted in an increased accumulation of mercury in fetuses whose pregnant mothers were co-exposed to alcohol or aminotriazol, and the tissue distribution of mercury in the fetuses was altered with co-exposure resulting in greater accumulation of mercury in liver (116).
- Dental amalgam fillings in pregnant rats early in the pregnancy resulted in significantly greater accumulation of mercury in rats who received 4 amalgams/rat as compared to rats who had no amalgams (117).
- Exposure of pregnant rats to elemental mercury by inhalation resulted in decreased birth weight of their offspring and decreased litter size, though only at doses of mercury that also caused maternal toxicity (29). Nerve conduction velocity, nerve action potentials, and other measures of nerve function were not significantly different between offspring exposed to elemental mercury during pregnancy, and unexposed offspring (118).

- Effects of prenatal exposure to mercury on behaviors when rats reach adulthood have been studied. Three studies showed that inhalation exposure of pregnant rats to elemental mercury resulted in adverse behavioral effects in their offspring when the offspring were 2-5 months of age (adulthood); effects included altered levels of spontaneous motor activity (depending on age tested) and decreased spatial learning abilities (30-32).
- The role of the protein metallothionein (a naturally-occurring protein that binds metals such as mercury) in protection from mercury toxicity has been studied in mice and rats. Following inhalation mercury exposure of pregnant mice, fetuses that lacked metallothionein showed higher levels of mercury accumulation than fetuses that had metallothionein (119). Deposition of mercury in placenta showed no significant difference in mouse strains with or without metallothionein (120). Prenatal inhalation exposure of pregnant rats to mercury vapor resulted in increased expression of metallothionein in fetal brain (121). Increased metallothionein expression was also induced in pregnant female kidney following inhalation exposure of pregnant rats but not in fetal kidney, even though mercury was detected in fetal kidney tissue (122).

V. CONSIDERATIONS FOR DECISION-MAKERS

This section contains information that may be useful to risk assessors, parents, caregivers, physicians, and other decision-makers who are interested in reducing the exposure and adverse health effects in children for this particular chemical. Information in this section focuses on ways to reduce exposure, assess possible exposure, and, for some chemicals, administer treatment.

Information about Reducing or Preventing Exposures

- If a mercury spill occurs in the home, the U.S. EPA recommends calling the local fire department for instructions. Vacuum cleaners or brooms should NOT be used in clean-up because they volatilize elemental mercury and spread it, making clean-up very difficult (123). If levels of mercury in indoor air may be elevated, such as after a spill of elemental mercury from anything larger than a home thermometer, residents should be evacuated from the house until more information is available from emergency personnel. In school spills, schools should likely be evacuated and emergency personnel contacted immediately (47, 121).
- Pregnant women and children are considered susceptible subpopulations (1). Special consideration should be given to these groups when emergency or other personnel consider situations in which to evacuate people from an area with a spill (1, 47, 121).
- The ATSDR encourages parents and teachers to teach children that playing with any silver-colored liquid they might find may be dangerous to them (2).

Other Exposure Information

- Some religious practices use elemental (or "metallic") mercury (also called "azogue"), resulting in exposure of children and families to mercury. The U.S. EPA Office of Pollution Prevention and Toxics has formed a Task Force on Ritualistic Uses of Mercury (124). Numerous documents are available through the Task Force, including reports on continued use of mercury in cultural and spiritual rituals, and public outreach educational materials printed in English, Spanish, and Portuguese.
- Methylmercury exposure may occur from eating fish, and some types of fish contain more mercury than others (1, 2, 4, 125); for more details see the TEACH Organic Mercury Chemical Summary. Ethyl mercury exposure via thimerosal use in vaccines is discussed in that document as well. Exposure to inorganic mercury compounds (e. g. , mercuric chloride) may occur from use of some homeopathic remedies or some skin-bleaching creams (1, 2, 4); for more details see the TEACH Inorganic Mercury Chemical Summary.
- Dental amalgam fillings that contain mercury are used by dentists for dental caries, although non-mercury alternatives are available (1, 126) The American Dental Association advocates use of amalgam fillings, citing safety evaluations by several U.S. agencies (126). Information about the safety of amalgam fillings has been reviewed and presented by the U.S. EPA (127), U.S. Centers for Disease Control (128), and the U.S. FDA (129). A U.S. FDA Advisory Panel in 2006 expressed concern about a lack of knowledge concerning effects of amalgam use in pregnant women and children (129). Consult your dentist for more information and to discuss treatment options.
- Concentrations of mercury in urine, blood, and hair of women 16-49 years old and children 1-5 years old were measured from 1999-2002 as part of the ongoing National Health and Nutrition Examination Survey (NHANES) (47). This comprehensive survey is administered on an ongoing basis by the U.S. Centers for Disease Control and Prevention National Center for Health Statistics, with results reported every two years (47).
- Mercury concentrations in hair were measured as part of the National Human Exposure Assessment Survey (NHEXAS), designed to evaluate human exposure to several chemicals on a regional scale in the U.S. in 1998 (130). Hair mercury concentrations for 182 people, including children, living in the Midwest were measured as part of this survey (45).
- The U.S. EPA used 1999 emissions data for mercury compounds for all 50 states to report county-level emissions, modeled ambient air concentration estimates, modeled human inhalation exposure, and estimated risk (131).

Other Information Resources

- The U.S. EPA provides a Web site portal at http://www.epa.gov/mercury (5) with a broad array of information resources pertaining to mercury exposure and health effects (5). Detailed compilations and analyses of information pertaining to exposure and health effects of inorganic mercury are presented in the Toxicological Profile for Mercury (1), and in the U.S. EPA "Mercury Study Report to Congress" (132). A Hazard Summary for Mercury Compounds is also available from the U.S. EPA which summarizes information derived from several sources (133).

- A health risk assessment for mercury and mercury compounds is available as a component of a comprehensive U.S. EPA "Mercury Study Report to Congress" which contains detailed information about mercury emissions, health and environmental implications of those emissions, and emission control technologies (132).
- Mercury and mercury compounds are listed as number 3 on the 2005 Priority List of Hazardous Substances for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 104 (i), as amended by the Superfund Amendments and Reauthorization Act (SARA). This is a prioritized list ranking chemicals in order of concern for those most commonly found at sites listed on the National Priorities List (NPL); there are currently 275 substances on this list (134). Mercury has been found in at least 714 of 1,467 current or former NPL sites (1).
- Consult the U.S. EPA "Child-Specific Exposure Factors Handbook" (EPA-600-P-00-002B) for factors to assess children's dermal absorption and inhalation rates (135). An updated External Draft of the 2006 version of this handbook is available (136).

VI. TOXICITY REFERENCE VALUES

A. Oral/Ingestion

There are no oral toxicity reference values available for elemental mercury; see the Organic and Inorganic Mercury Chemical Summaries.

B. Inhalation

U.S. EPA Reference Concentration (RfC) for Chronic Inhalation Exposure: 3E-4 (or 0. 0003) mg/m^3, based on human occupational exposure studies demonstrating hand tremor, memory disturbances, and autonomic dysfunction (subjective and objective evidence). (http://www.epa.gov/iris/subst/0370.htm, I. B. 1) (137). Last revised 6/1/95.

U.S. ATSDR Minimal Risk Level (MRL): 0. 0002 mg/kg/day (inhalation, chronic), based on neurological effects (http://www.atsdr.cdc.gov/mrls/index.html) (138). Last revised 3/99.

VII. U.S. FEDERAL REGULATORY INFORMATION

- Mercury is one of 188 hazardous air pollutants (HAPs) listed under section 112(b) of the 1990 Clean Air Act Amendments and is regulated from more than 170 industrial source categories (139).
- The U.S. EPA requires reporting of quantities of certain chemicals that exceed a defined reportable quantity, and that quantity varies for different chemicals (140). Under the Emergency Planning and Community Right-to-Know Act (EPCRA) Section 313 "Toxic Chemicals," mercury is classified as a persistent, bioaccumulative and toxic compound (PBT) and as such, quantities of mercury greater than 10 pounds manufactured or processed, or otherwise used, is required (140, 141). Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), reporting releases of any quantity exceeding 1 pound is required (140).
- For a comprehensive list of mercury regulations and standards, go to *http://www.epa.gov/mercury/regs.htm*.

VIII. BACKGROUND ON CHEMICAL

A. CAS Number: 7439-97-6

B. Physicochemical Properties: Elemental mercury is a silver-colored metal that is a thick liquid at room temperature. Go to the National Library of Medicine ChemID Web site (*http://chem.sis.nlm.nih.gov/chemidplus*) and search for mercury.

C. Production: Mercury is extracted or released primarily from mining (1, 142). Five percent of the world mercury production is a byproduct of gold mining, and most of the remaining mercury is produced from underground mines (142). Inorganic mercury is mined and processed to generate elemental mercury. Some mercury is salvaged from scrap materials. Most of the mercury found in the environment is elemental and inorganic mercury that was released into air from mercury mining processes, emissions of coal-fired power plants, emissions from some solid waste incinerators, and other industrial sources (1). U.S. production of total mercury in 1995 was estimated to be 158 tons, while world production of total mercury in 1995 was estimated to be 5,500 tons (142). A recent analysis estimated that U.S. production of total mercury from secondary facilities is approximately 430 tons/year (143).

D. Uses: Elemental mercury is used during chlorine gas production at chlor-alkali plants; in gold extraction from gold ore; and in thermometers, barometers and other pressure gauges, some switches (e. g. , car switches), dental fillings, and some medical devices (1, 144). Elemental mercury may be found in school laboratories (sometimes in large amounts in school science room storage closets) (1, 112). In 2004, the total amount of reported releases and disposals of mercury compounds in the U.S. was over 4. 7 million pounds (145); total releases are likely to be greater than this estimate because not all sources of mercury compound releases are required to report (1, 145).

E. Environmental Fate: Mercury is a naturally-occurring element. Mercury is present in the environment as a result of both natural and human activities, and persists in the environment, though the form in which it exists changes over time (1, 142, 144). Metallic mercury enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants (1, 142). It enters the water or soil from erosion of natural deposits, discharge from refineries and factories, and runoffs from landfills and crop lands. Mercury emissions are transported through ambient air, and deposited to water and land where humans and wildlife can be exposed. Concentrations of mercury in ambient air are usually low and of little direct concern (1, 142). Once mercury enters water, either through air deposition or soil runoff, microorganisms such as bacteria transform inorganic mercury in the environment to methylmercury, which can then bioaccumulate in fish and animal tissue (1). Higher levels of methylmercury are found in some types of fish (e. g. , shark, swordfish, and tile fish) than others (see the TEACH Organic Mercury Chemical Summary) (125, 146, 147). If elemental mercury is spilled or released indoors, it can volatilize into the air and be redeposited, remaining in homes for many years if not cleaned up properly (1, 148).

F. Synonyms: mercury metal, colloidal mercury, metallic mercury, quicksilver.

Additional information on elemental mercury is available in the TEACH Database for Elemental Mercury, and at the following Web sites:

www.epa.gov/glnpo/sediments.html
www.epa.gov/mercury/
http:///www.epa.gov/grtlakes/bnsdocs/hg/hgbrief.html

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