

Integrated Risk Information System (IRIS) Screening-Level Literature Review

Chemical Name: Mercury, elemental CASRN: 7439-97-6

Date of screening-level review: 1/1/2002

Summary of Available Toxicity Information

IRIS

RfD (mg/kg-day):

Date of Last Significant Revision:

Availability: Not available

Critical Effect:

UF:

MF:

Was an UF assigned based on lack of supporting data?

What was the data gap?

Study Animal/Species:

Principal Study Description:

Principal Study Reference:

RfC (mg/m³): 0.0003

Date of Last Significant Revision: 04/19/90

Availability:

Critical Effect: Hand tremor; increases in memory disturbance; slight subjective and objective evidence of autonomic dysfunction

UF: 30

MF: 1

Was an UF assigned based on lack of supporting data? Yes

What was the data gap? Lack of data base, particularly developmental and reproductive studies

Study Animal/Species: Human

Principal Study Description: Occupational inhalation studies

Principal Study Reference: Fawer et al., 1983; Piikivi and Tolonen, 1989; Piikivi and Hanninen, 1989; Piikivi, 1989; Ngim et al., 1992; Liang et al., 1993

CSF (mg/kg-day)⁻¹:

Date of Last Significant Revision:

Availability: Not available

Tumor Type:

Study Animal/Species:

Principal Study Reference:

IUR (µg/m³)⁻¹:

Date of Last Significant Revision:

Availability: Not available

Tumor Type:

Study Animal/Species:

Principal Study Reference:

WOE Classification: D

Date of Last Significant Revision: 03/03/94

Information Available through the IRIS Submission Desk

Comments: Not available

ATSDR

Toxicological Profile (date of most recent update): 1999

Oral MRL (mg/kg-day):

Duration:
Critical Organ/Effect:
Study Animal/Species:
Principal Study Reference:

Inhalation MRL (mg/m³): 0.0002

Duration: Chronic
Critical Organ/Effect: Nervous system
Study Animal/Species: Human
Principal Study Reference: Fawer et al., 1983

ATSDR Supplemental Document:

Health Canada

Health Canada Assessment (date of assessment): Not available

TDI (mg/kg-day):

Critical Organ/Effect:
Study Animal/Species:
Principal Study Reference:

TC (mg/m³):

Critical Organ/Effect:
Study Animal/Species:
Principal Study Reference:

TD05 (mg/kg-day):

Tumor Type:
Study Animal/Species:
Principal Study Reference:

TC05 (mg/m³):

Tumor Type:
Study Animal/Species:
Principal Study Reference:

Cancer classification:

IARC

Date of Most Recent Monograph: 1993

Classification: 3

WHO

Publication Date: 1991
Publication Type: WHO

NTP Cancer Bioassay (published since 1986)

Publication Date: Not available
Route of exposure:
Result:

NTP Report on Carcinogens

Date Listed: Not available
Classification:

Re-registration Eligibility Decisions (RED)

Publication Date: Not available

RfD (mg/kg-day):

Critical Effect:
UF:
MF:
Study Animal/Species:
Principal Study Description:
Principal Study Reference:

RfC (mg/m³):

Critical Effect:
UF:
MF:
Study Animal/Species:
Principal Study Description:
Principal Study Reference:

CSF (mg/kg-day)⁻¹:

Tumor Type:
Study Animal/Species:
Principal Study Reference:

IUR (µg/m³)⁻¹:

Tumor Type:
Study Animal/Species:
Principal Study Reference:

NCEA Provisional Assessments

Publication Date: Not available

RfD (mg/kg-day):

Critical Effect:
UF:
MF:
Study Animal/Species:
Principal Study Description:
Principal Study Reference:

RfC (mg/m³):

Critical Effect:
UF:
MF:
Study Animal/Species:
Principal Study Description:
Principal Study Reference:

CSF (mg/kg-day)⁻¹:

Tumor Type:
Study Animal/Species:
Principal Study Reference:

IUR (µg/m³)⁻¹:

Tumor Type:
Study Animal/Species:
Principal Study Reference:

WOE Classification:

Literature Search Strategy and Screening

RfC: Conduct literature search from 1998 to January, 2002 (ATSDR, 1999).
Carcinogenicity: Conduct literature search from 1998 to January, 2002 (ATSDR, 1999).

Revision History

Evaluation of the Recent Literature and Determination of Currency

Oral Reference Dose (RfD):

No assessment of the RfD is included in IRIS.

Inhalation Reference Concentration (RfC):

The literature published since the inhalation RfC for elemental mercury was derived (1990) contains study data that could potentially produce a change in the RfC.

The IRIS RfC for elemental mercury was derived based on human occupational studies published between 1983 and 1993. In the 1999 Toxicological Profile, ATSDR derived a chronic inhalation minimal risk level (MRL) for mercury vapor based on one of the studies on which the IRIS RfC is based. A literature search conducted for the years 1998 to 2002, however, identified additional human study data, including several studies of chloralkali workers: studies comparing urinary mercury concentration to effects on thyroid function (2000), renal and immunologic markers (2000), and neuropsychological effects (1999, 2001), as well as an additional study of a variety of long-term health effects in workers whose exposure was assessed with historical measurements and personnel records (2001). Other human studies identified include: a study of reversible color vision loss in workers (1998); a follow-up study of neurological effects to workers who had past occupational exposures (2000); a study of mercury exposures and microdamage to kidneys in Venezuelan workers (2001); a study of changes in the monocyte-macrophage system in workers with low-level exposures (2001); two studies of auditory neurosensory responses (1998) and neuro-otological effects (2002) in adults and children in gold mining areas of Ecuador; a study of the effects on the activity of red cell enzymes and peripheral blood indices in workers with chronic exposure (7 months to 32 years) to mercury vapors (2000); and a study of neurobehavioral effects in Zulu chemical workers (2000). The extent to which useful exposure/dose-response data are available for a number of these studies is uncertain based on the information provided in the abstracts.

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A review of the ATSDR Toxicological Profile (1999) and a literature search conducted for the years 1998 to 2002 also identified developmental toxicity studies (a noted data gap in the IRIS assessment) in rats (1992, 2001), in addition to the two studies of Ecuadorian children noted above.

¹The IRIS RfC verification date is listed in the IRIS summary as 4/19/90. A note is also provided indicating that the IRIS summary was included in the Mercury Study Report to Congress and that peer

review and public comments (1995) were evaluated and considered in the revision and finalization of the IRIS summary.

Oral Slope Factor (CSF):

No assessment of the CSF is included in IRIS.

Inhalation Unit Risk (IUR):

No assessment of the IUR is included in IRIS.

Cancer Weight-of-Evidence (WOE) Classification:

The literature published since the WOE classification (D—not classifiable as to human carcinogenicity) was derived (1994) does not appear to contain study data that could produce a change in the WOE classification. A review of the ATSDR Toxicological Profile (1999) and a literature search conducted for the years 1998 to 2002 identified three genotoxicity studies: a positive micronuclei study in mercury-exposed workers (1999); a study of chromosomal aberrations (positive) and sister-chromatid exchanges (inconclusive) in individuals exposed to mercury and other chemical contaminants (1999); and a positive mutagenicity study that also examined the mechanism by which mutations were induced (1999). The abstracts of the latter two studies do not reveal the form of mercury investigated.

Unknown Relevance:

Thirty-three documents were categorized as being of unknown relevance, including 21 records from the Computer Retrieval of Information on Scientific Projects (CRISP) database (a biomedical database of research projects supported by the Department of Health and Human Services) and a study entitled “Influence of prenatal mercury exposure upon scholastic and psychological test performance: benchmark analysis of a New Zealand cohort.” The documents listed in the CRISP database include descriptions of proposed or ongoing studies of mercury’s immunotoxicity, a study of exposure to dentists entitled “Chronic Disease Risks Associated with Mercury Vapor Exposure,” and “Cellular and Molecular Toxicity in Human Mammary Cells.”

Note: A literature search conducted for the years 1998 to 2002 identified one study carried out to develop, apply, and validate a physiologically-based pharmacokinetic (PBPK) model for inhaled mercury vapor (2001).

Note: Because of the large number of references found in the literature search (approximately 2,050), search results were limited with a secondary search in EndNote to identify references containing terms related to human studies and carcinogenicity assessments, including: human, worker, subject, patient, occupa*, epidemiol*, genotox*, mutat*, and mutag*. Any references not containing one of these search terms were coded as N/A. In addition, references containing the CAS number for mercuric chloride and/or methylmercury, but not the CAS number for elemental mercury were coded N/A. Studies containing the terms phytox*, ecotox*, aquatic, sediment, ocean, watershed, ecosystem, patch, or allergy were also coded as N/A.