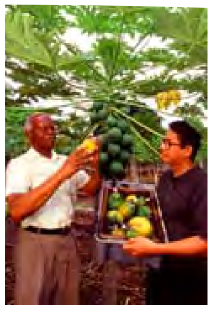
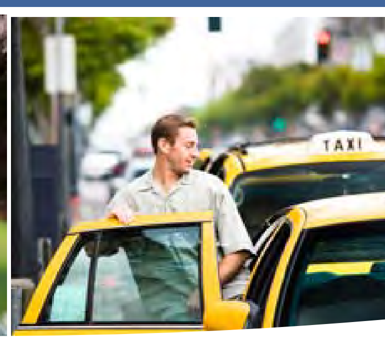
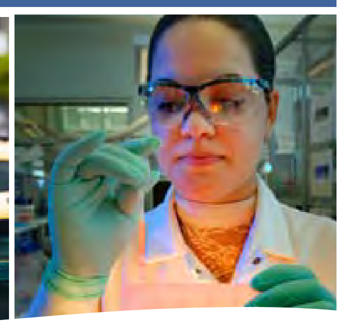



2009

Fourth National Report on Human Exposure to Environmental Chemicals







Fourth National Report on Human Exposure to Environmental Chemicals

2009

Department of Health and Human Services
Centers for Disease Control and Prevention

Contents

Antimony

CAS No. 7440-36-0

General Information

Antimony is found in ores or other minerals, often combined with oxygen to form antimony trioxide or with sulfur to form stibnite. Antimony can exist in one of four valences in its various chemical and physical forms: -3, 0, +3, and +5. It is used in metal alloys, storage batteries, solder, sheet and pipe metal, ammunition, metal bearings, castings, and pewter. It is also used in paints, ceramics, fireworks, enamels, and glass, and as a fire-retardant in textiles and plastics. Stibine is a metal hydride form of antimony used in the semiconductor industry. Two antimony compounds (sodium stibogluconate and antimony potassium tartrate) have been used as antiparasitic medications.

Antimony enters the environment from natural sources and from its use in industry. People are exposed to antimony primarily through food and, to a lesser extent, from air and drinking water. Workplace exposures can occur at smelters, coal-fired plants, and refuse incinerators that process or release antimony. Dermal contact with soil, water, or other substances containing antimony is another means of exposure. The absorption, distribution, and excretion of antimony vary depending on its oxidation state. Urinary excretion appears to be greater for pentavalent antimony

Urinary Antimony

Geometric mean and selected percentiles of urine concentrations (in µg/L) for the U.S. population from the National Health and Nutrition Examination Survey.

	Survey years	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval) 50th	75th	90th	95th	Sample size
Total	99-00	**.132** (.120-.145)	**.130** (.120-.150)	**.220** (.200-.230)	**.330** (.300-.350)	**.430** (.390-.470)	2276
	01-02	**.134** (.126-.142)	**.130** (.130-.140)	**.190** (.180-.200)	**.270** (.250-.310)	**.350** (.320-.400)	2690
	03-04	*	**.080** (<LOD-.090)	**.130** (.120-.150)	**.200** (.190-.220)	**.280** (.250-.320)	2558
Age group							
6-11 years	99-00	**.176** (.154-.200)	**.190** (.160-.210)	**.260** (.230-.280)	**.350** (.300-.400)	**.440** (.320-.600)	316
	01-02	**.146** (.134-.160)	**.150** (.130-.160)	**.200** (.180-.210)	**.270** (.240-.330)	**.340** (.280-.440)	368
	03-04	**.099** (.087-.114)	**.100** (.070-.120)	**.160** (.120-.200)	**.240** (.190-.310)	**.310** (.230-.330)	290
12-19 years	99-00	**.158** (.141-.178)	**.170** (.150-.180)	**.240** (.210-.270)	**.350** (.290-.420)	**.460** (.350-.510)	663
	01-02	**.169** (.156-.184)	**.160** (.150-.180)	**.240** (.220-.260)	**.350** (.320-.410)	**.460** (.400-.500)	762
	03-04	**.105** (.095-.115)	**.100** (.090-.120)	**.150** (.140-.160)	**.230** (.200-.270)	**.290** (.250-.370)	725
20 years and older	99-00	**.123** (.112-.137)	**.120** (.110-.130)	**.200** (.180-.220)	**.310** (.290-.350)	**.430** (.390-.470)	1297
	01-02	**.128** (.119-.136)	**.130** (.120-.130)	**.180** (.170-.190)	**.250** (.220-.300)	**.330** (.280-.390)	1560
	03-04	*	**.070** (<LOD-.080)	**.120** (.100-.140)	**.190** (.170-.210)	**.270** (.220-.320)	1543
Gender							
Males	99-00	**.143** (.131-.157)	**.150** (.130-.160)	**.240** (.220-.260)	**.350** (.330-.390)	**.470** (.390-.570)	1132
	01-02	**.145** (.136-.154)	**.140** (.130-.150)	**.200** (.190-.210)	**.310** (.280-.330)	**.390** (.350-.440)	1335
	03-04	**.095** (.088-.103)	**.090** (.080-.100)	**.140** (.130-.160)	**.220** (.200-.250)	**.320** (.270-.350)	1281
Females	99-00	**.122** (.109-.137)	**.120** (.110-.140)	**.200** (.180-.220)	**.300** (.280-.340)	**.400** (.350-.460)	1144
	01-02	**.125** (.117-.133)	**.120** (.120-.130)	**.180** (.160-.190)	**.240** (.220-.280)	**.320** (.260-.360)	1355
	03-04	*	**< LOD**	**.120** (.090-.140)	**.180** (.150-.220)	**.230** (.190-.330)	1277
Race/ethnicity							
Mexican Americans	99-00	**.132** (.108-.161)	**.140** (.120-.170)	**.210** (.180-.240)	**.300** (.260-.390)	**.430** (.330-.560)	787
	01-02	**.142** (.130-.154)	**.130** (.130-.150)	**.200** (.170-.230)	**.260** (.240-.320)	**.360** (.300-.400)	683
	03-04	**.093** (.079-.110)	**.090** (<LOD-.120)	**.140** (.120-.160)	**.190** (.160-.260)	**.270** (.210-.330)	618
Non-Hispanic blacks	99-00	**.175** (.148-.207)	**.180** (.150-.200)	**.260** (.230-.300)	**.400** (.310-.490)	**.490** (.410-.710)	554
	01-02	**.180** (.164-.197)	**.170** (.160-.190)	**.250** (.220-.280)	**.360** (.320-.410)	**.460** (.370-.530)	667
	03-04	**.108** (.098-.119)	**.110** (.100-.120)	**.160** (.150-.190)	**.230** (.200-.280)	**.310** (.250-.360)	723
Non-Hispanic whites	99-00	**.128** (.115-.144)	**.130** (.110-.140)	**.210** (.190-.230)	**.330** (.280-.350)	**.400** (.360-.500)	768
	01-02	**.126** (.117-.135)	**.130** (.120-.130)	**.180** (.170-.190)	**.250** (.230-.300)	**.340** (.310-.390)	1132
	03-04	*	**.070** (<LOD-.080)	**.130** (.110-.140)	**.190** (.170-.210)	**.280** (.230-.320)	1074

Limit of detection (LOD, see Data Analysis section) for Survey years 99-00, 01-02, and 03-04 are 0.04, 0.04, and 0.07, respectively.
< LOD means less than the limit of detection, which may vary for some chemicals by year and by individual sample.
* Not calculated: proportion of results below limit of detection was too high to provide a valid result.

than for trivalent compounds (Elinder and Friberg, 1986). An elimination half-life of approximately 95 hours has been estimated after occupational exposures (Kentner et al., 1995).

Human health effects from antimony at low environmental doses or at biomonitored levels from low environmental exposures are unknown. Inorganic antimony salts irritate the mucous membranes, skin, and eyes. Acute inhalation of antimony has been associated with irritation of the respiratory tract and impaired pulmonary function (Renes, 1953). Pulmonary edema may occur in severe cases of inhalation exposure (Cordasco et al., 1973). Dysrhythmias and T-wave changes on electrocardiogram have also been noted after both therapeutic (Berman, 1988; Ming-Hsin et al., 1958) and occupational exposures (Briegner et al., 1954). Histopathologic inflammatory and degenerative changes in the lung, myocardium, liver, and kidney have been demonstrated in high dose animal studies depending on the dose, species, and route of exposure (Elinder and Friberg, 1986). Acute antimony poisoning may cause a metallic taste, and gastrointestinal symptoms such as vomiting, diarrhea, abdominal pain, and ulcers (Werrin, 1962). The toxicity of stibine after acute inhalational exposure is similar to that of arsine, resulting in hemolysis with abdominal and back pain (Dernehl et al., 1944).

Workplace standards and recommendations for air exposure

Urinary Antimony (creatinine corrected)

Geometric mean and selected percentiles of urine concentrations (in µg/g of creatinine) for the U.S. population from the National Health and Nutrition Examination Survey.

	Survey years	Geometric mean (95% conf. interval)	Selected percentiles (95% confidence interval) 50th	75th	90th	95th	Sample size
Total	99-00	**.124** (.108-.143)	**.119** (.102-.143)	**.185** (.164-.214)	**.276** (.233-.333)	**.385** (.333-.430)	2276
	01-02	**.126** (.119-.134)	**.120** (.115-.126)	**.173** (.162-.188)	**.267** (.242-.300)	**.364** (.320-.414)	2689
	03-04	*	**.080** (<LOD-.086)	**.135** (.119-.143)	**.208** (.192-.230)	**.277** (.250-.294)	2558
Age group							
6-11 years	99-00	**.191** (.147-.248)	**.185** (.156-.220)	**.250** (.200-.417)	**.447** (.271-.741)	**.741** (.333-1.30)	316
	01-02	**.178** (.159-.200)	**.173** (.150-.193)	**.228** (.200-.272)	**.338** (.265-.480)	**.471** (.313-.727)	368
	03-04	**.116** (.103-.130)	**.118** (.098-.136)	**.167** (.146-.187)	**.256** (.194-.317)	**.333** (.250-.500)	290
12-19 years	99-00	**.121** (.104-.140)	**.120** (.095-.146)	**.176** (.146-.207)	**.259** (.206-.310)	**.310** (.228-.421)	663
	01-02	**.121** (.112-.131)	**.115** (.106-.127)	**.160** (.138-.186)	**.224** (.199-.245)	**.266** (.244-.310)	762
	03-04	**.075** (.068-.082)	**.068** (.061-.077)	**.100** (.092-.113)	**.156** (.126-.173)	**.193** (.172-.255)	725
20 years and older	99-00	**.118** (.104-.135)	**.111** (.097-.135)	**.175** (.149-.209)	**.263** (.227-.320)	**.352** (.320-.391)	1297
	01-02	**.122** (.115-.129)	**.115** (.108-.121)	**.167** (.153-.181)	**.265** (.241-.300)	**.364** (.318-.405)	1559
	03-04	*	**.079** (<LOD-.087)	**.135** (.116-.145)	**.209** (.195-.233)	**.278** (.250-.294)	1543
Gender							
Males	99-00	**.112** (.099-.127)	**.109** (.095-.127)	**.164** (.146-.181)	**.226** (.204-.268)	**.320** (.235-.391)	1132
	01-02	**.114** (.107-.123)	**.108** (.103-.115)	**.153** (.138-.171)	**.228** (.205-.250)	**.333** (.281-.438)	1334
	03-04	**.080** (.076-.084)	**.075** (.069-.081)	**.122** (.111-.132)	**.192** (.173-.209)	**.253** (.230-.278)	1281
Females	99-00	**.137** (.117-.161)	**.131** (.108-.164)	**.213** (.176-.247)	**.320** (.263-.417)	**.429** (.357-.485)	1144
	01-02	**.139** (.131-.148)	**.132** (.124-.140)	**.196** (.178-.211)	**.295** (.267-.317)	**.371** (.333-.444)	1355
	03-04	*	**< LOD**	**.143** (.125-.161)	**.225** (.188-.261)	**.288** (.250-.333)	1277
Race/ethnicity							
Mexican Americans	99-00	**.120** (.107-.135)	**.114** (.105-.129)	**.167** (.148-.203)	**.250** (.209-.315)	**.333** (.280-.357)	787
	01-02	**.138** (.128-.149)	**.130** (.117-.143)	**.182** (.159-.203)	**.269** (.229-.308)	**.338** (.308-.429)	682
	03-04	**.086** (.076-.098)	**.082** (<LOD-.092)	**.129** (.107-.151)	**.189** (.154-.238)	**.238** (.185-.321)	618
Non-Hispanic blacks	99-00	**.114** (.099-.133)	**.112** (.098-.130)	**.163** (.144-.183)	**.236** (.195-.338)	**.343** (.255-.425)	554
	01-02	**.123** (.113-.134)	**.115** (.106-.127)	**.163** (.150-.181)	**.233** (.208-.267)	**.300** (.248-.373)	667
	03-04	**.078** (.071-.085)	**.074** (.069-.082)	**.109** (.096-.124)	**.170** (.148-.192)	**.222** (.179-.257)	723
Non-Hispanic whites	99-00	**.129** (.109-.152)	**.125** (.102-.152)	**.195** (.167-.225)	**.298** (.239-.352)	**.400** (.333-.444)	768
	01-02	**.127** (.117-.138)	**.120** (.113-.130)	**.176** (.159-.198)	**.280** (.241-.317)	**.380** (.318-.471)	1132
	03-04	*	**.081** (<LOD-.089)	**.139** (.124-.147)	**.217** (.200-.238)	**.286** (.253-.333)	1074

< LOD means less than the limit of detection for the urine levels not corrected for creatinine.
* Not calculated: proportion of results below limit of detection was too high to provide a valid result.

to antimony have been established by OSHA and ACGIH, respectively, and a drinking water standard has been established by the U.S. EPA. Antimony trioxide is rated by IARC as a possible human carcinogen. Information about external exposure (i.e., environmental levels) and health effects is available from ATSDR at: http://www.atsdr.cdc.gov/toxpro2.html.

Biomonitoring Information

Levels of urinary antimony reflect recent exposure. Earlier measurements in general populations (Minoia et al., 1990; Paschal et al., 1998) or compiled reference ranges (Hamilton et al., 1994) have reported values slightly higher than those in this *Report*, which may be due to methodologic, population, or exposure differences. Levels of urinary antimony in infants appeared to be similar to those reported by CDC (2005) for young children (Cullen et al., 1998; Dezateux et al., 1997). Urinary antimony was not associated with locally elevated soil levels in a study of more than 200 German residents (Gebel et al., 1998). Several investigations of airborne antimony exposures in workers have found urinary levels that are many times higher than those seen in NHANES 1999-2000, 2001-2002, and 2003-2004, even when exposure levels were below workplace air standards (Bailly et al., 1991; Iavicoli et al., 2002; Kentner et al., 1995; Liao Y-H et al., 2004; Ludersdorf et al., 1987).

Finding a measurable amount of antimony in urine does not mean that the level of antimony causes an adverse health effect. Biomonitoring studies on levels of urinary antimony can provide physicians and public health officials with reference values so that they can determine whether people have been exposed to higher levels of antimony than are found in the general population. Biomonitoring data can also help scientists plan and conduct research on exposure and health effects.

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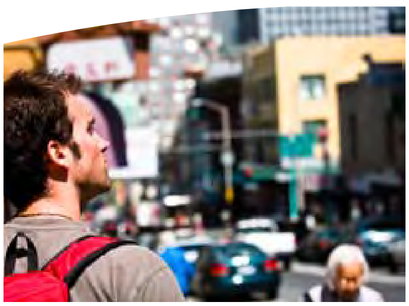
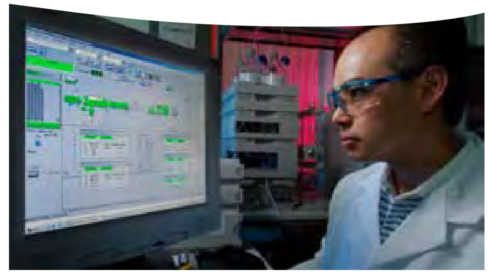
Appendix E. Abbreviations Used in Text

ACGIH	American Conference of Governmental Industrial Hygienists
ATSDR	Agency for Toxic Substances and Disease Registry
CDC	Centers for Disease Control and Prevention
DHHS	Department of Health and Human Services
FAO/WHO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
IARC	International Agency for Research on Cancer
IOM	Institute of Medicine
IPCS	International Programme on Chemical Safety
NAS	National Academy of Sciences
NCEH	National Center of Environmental Health
NCHS	National Center for Health Statistics
NHANES	National Health and Nutrition Examination Survey
NIOSH	National Institute of Occupational Safety and Health
NRC	National Research Council of the NAS
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
U.S.	United States
USDA	U.S. Department of Agriculture
U.S.EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WHO	World Health Organization








Centers for Disease Control and Prevention
National Center for Environmental Health
Division of Laboratory Sciences
Mail Stop F-20
4770 Buford Highway, NE
Atlanta, GA 30341-3724

Telephone: (toll free) 1-800-CDC-INFO (1-800-232-4636)
Email: CDCINFO@cdc.gov
Website: http://www.cdc.gov/exposurereport