



Toxicological Profile for Mercury

Draft for Public Comment

April 2022



U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

DISCLAIMER

Use of trade names is for identification only and does not imply endorsement by the Agency for Toxic Substances and Disease Registry, the Public Health Service, or the U.S. Department of Health and Human Services.

This information is distributed solely for the purpose of pre dissemination public comment under applicable information quality guidelines. It has not been formally disseminated by the Agency for Toxic Substances and Disease Registry. It does not represent and should not be construed to represent any agency determination or policy.

FOREWORD

This toxicological profile is prepared in accordance with guidelines developed by the Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA). The original guidelines were published in the *Federal Register* on April 17, 1987. Each profile will be revised and republished as necessary.

The ATSDR toxicological profile succinctly characterizes the toxicologic and adverse health effects information for these toxic substances described therein. Each peer-reviewed profile identifies and reviews the key literature that describes a substance's toxicologic properties. Other pertinent literature is also presented, but is described in less detail than the key studies. The profile is not intended to be an exhaustive document; however, more comprehensive sources of specialty information are referenced.

The focus of the profiles is on health and toxicologic information; therefore, each toxicological profile begins with a relevance to public health discussion which would allow a public health professional to make a real-time determination of whether the presence of a particular substance in the environment poses a potential threat to human health. The adequacy of information to determine a substance's health effects is described in a health effects summary. Data needs that are of significance to the protection of public health are identified by ATSDR and EPA.

Each profile includes the following:

- (A) The examination, summary, and interpretation of available toxicologic information and epidemiologic evaluations on a toxic substance to ascertain the levels of significant human exposure for the substance and the associated acute, intermediate, and chronic health effects;
- (B) A determination of whether adequate information on the health effects of each substance is available or in the process of development to determine the levels of exposure that present a significant risk to human health due to acute, intermediate, and chronic duration exposures; and
- (C) Where appropriate, identification of toxicologic testing needed to identify the types or levels of exposure that may present significant risk of adverse health effects in humans.

The principal audiences for the toxicological profiles are health professionals at the Federal, State, and local levels; interested private sector organizations and groups; and members of the public. ATSDR plans to revise these documents in response to public comments and as additional data become available. Therefore, we encourage comments that will make the toxicological profile series of the greatest use.

Electronic comments may be submitted via: www.regulations.gov. Follow the on-line instructions for submitting comments.

Written comments may also be sent to: Agency for Toxic Substances and Disease Registry
Office of Innovation and Analytics
Toxicology Section
1600 Clifton Road, N.E.
Mail Stop S102-1
Atlanta, Georgia 30329-4027

The toxicological profiles are developed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA or Superfund). CERCLA section 104(i)(1) directs the Administrator of ATSDR to "...effectuate and implement the health related authorities" of the statute. This includes the preparation of toxicological profiles for hazardous substances most commonly found at facilities on the CERCLA National Priorities List (NPL) and that pose the most significant potential threat to human health, as determined by ATSDR and the EPA. Section 104(i)(3) of CERCLA, as amended, directs the Administrator of ATSDR to prepare a toxicological profile for each substance on the list. In addition, ATSDR has the authority to prepare toxicological profiles for substances not found at sites on the NPL, in an effort to "...establish and maintain inventory of literature, research, and studies on the health effects of toxic substances" under CERCLA Section 104(i)(1)(B), to respond to requests for consultation under section 104(i)(4), and as otherwise necessary to support the site-specific response actions conducted by ATSDR.

This profile reflects ATSDR's assessment of all relevant toxicologic testing and information that has been peer-reviewed. Staffs of the Centers for Disease Control and Prevention and other Federal scientists have also reviewed the profile. In addition, this profile has been peer-reviewed by a nongovernmental panel and is being made available for public review. Final responsibility for the contents and views expressed in this toxicological profile resides with ATSDR.



Patrick N. Breyse, Ph.D., CIH
Director, National Center for Environmental Health and
Agency for Toxic Substances and Disease Registry
Centers for Disease Control and Prevention



Christopher M. Reh, Ph.D.
Associate Director
Agency for Toxic Substances and Disease Registry
Centers for Disease Control and Prevention

VERSION HISTORY

Date	Description
April 2022	Final toxicological profile released
March 2013	Draft for public comment toxicological profile released
March 1999	Addendum to the toxicological profile released
May 1994	Final toxicological profile released
December 1989	Final toxicological profile released

CONTRIBUTORS & REVIEWERS

CHEMICAL MANAGER TEAM

Rae T. Benedict, Ph.D. (Lead)
Breanna Alman, M.P.H
Franco Scinicariello, M.D., M.P.H.

Julie M. Klotzbach, Ph.D.
Mario Citra, Ph.D.
Gary L. Diamond, Ph.D.
Deborah Herber, Ph.D.
Lisa Ingerman, Ph.D., D.A.B.T.
Sara Nieman, M.S.
Sabah Tariq, M.S,
Kimberly Zaccaria, Ph.D., D.A.B.T.

ATSDR, Office of Innovation and Analytics,
Toxicology Section, Atlanta, GA

SRC, Inc., North Syracuse, NY

REVIEWERS

Interagency Minimal Risk Level Workgroup:

Includes ATSDR; National Center for Environmental Health (NCEH); National Institute for Occupational Safety and Health (NIOSH); U.S. Environmental Protection Agency (EPA), Center for Public Health and environmental Assessment; EPA, Office of Water; National Toxicology Program (NTP).

Additional reviews for science and/or policy:

ATSDR, Office of Community Health and Hazard Assessment; ATSDR, Office of Capacity Development and Applied Prevention Science; ATSDR, Office of Science; EPA Office of Air and Radiation, Office of Air Quality and Planning Standards (Air Toxics Program); NCEH, Division of Laboratory Science; NCEH, Division of Environmental Health Science and Practice.

PEER REVIEWERS

1. Harvey Clewell, Ph.D.; Principal Consultant; Ramboll US Consulting, Inc.; Monroe, Louisiana
2. William Pan, Ph.D.; The Elizabeth Brooks Reid and Whitelaw; Reid Associate Professor of Population Studies; Durham, North Carolina
3. Kristine Vejrup, Ph.D.; Associate Professor; Norwegian Institute of Public Health; Division of Occupational and Environmental Medicine; Lund University; Lund, Sweden

These experts collectively have knowledge of toxicology, chemistry, and/or health effects. All reviewers were selected in conformity with Section 104(I)(13) of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended.

ATSDR scientists review peer reviewers' comments and determine whether changes will be made to the profile based on comments. The peer reviewers' comments and responses to these comments are part of the administrative record for this compound.

The listing of peer reviewers should not be understood to imply their approval of the profile's final content. The responsibility for the content of this profile lies with ATSDR.

CONTENTS

DISCLAIMER	ii
FOREWORD	iii
VERSION HISTORY	v
CONTRIBUTORS & REVIEWERS	vi
CONTENTS.....	vii
LIST OF FIGURES	ix
LIST OF TABLES	x
CHAPTER 1. RELEVANCE TO PUBLIC HEALTH	1
1.1 OVERVIEW AND U.S. EXPOSURES	1
1.2 SUMMARY OF HEALTH EFFECTS.....	2
1.3 MINIMAL RISK LEVELS (MRLs)	12
CHAPTER 2. HEALTH EFFECTS.....	18
2.1 INTRODUCTION.....	18
2.2 ACUTE POISONING IN HUMANS.....	139
2.3 DEATH	140
2.4 BODY WEIGHT.....	145
2.5 RESPIRATORY	153
2.6 CARDIOVASCULAR.....	159
2.7 GASTROINTESTINAL.....	185
2.8 HEMATOLOGICAL	188
2.9 MUSCULOSKELETAL	195
2.10 HEPATIC.....	200
2.11 RENAL	208
2.12 DERMAL.....	236
2.13 OCULAR	239
2.14 ENDOCRINE.....	241
2.15 IMMUNOLOGICAL	254
2.16 NEUROLOGICAL.....	276
2.16.1 Neurodevelopmental Effects.....	280
2.16.2 Neurological Effects in Adults	338
2.17 REPRODUCTIVE	372
2.18 DEVELOPMENTAL.....	398
2.19 CANCER.....	425
2.20 GENOTOXICITY	428
2.21 GENERAL MECHANISMS OF ACTION	442
CHAPTER 3. TOXICOKINETICS, SUSCEPTIBLE POPULATIONS, BIOMARKERS, CHEMICAL INTERACTIONS.....	446
3.1 TOXICOKINETICS.....	446
3.1.1 Absorption.....	449
3.1.2 Distribution	459
3.1.3 Metabolism.....	474
3.1.4 Excretion	476
3.1.5 Physiologically Based Pharmacokinetic (PBPK)/Pharmacodynamic (PD) Models	481
3.2 CHILDREN AND OTHER POPULATIONS THAT ARE UNUSUALLY SUSCEPTIBLE... 498	498
3.3 BIOMARKERS OF EXPOSURE AND EFFECT	503
3.3.1 Biomarkers of Exposure.....	504

3.3.2	Biomarkers of Effect	509
3.4	INTERACTIONS WITH OTHER CHEMICALS	509
CHAPTER 4. CHEMICAL AND PHYSICAL INFORMATION		511
4.1	CHEMICAL IDENTITY	511
4.2	PHYSICAL AND CHEMICAL PROPERTIES	513
CHAPTER 5. POTENTIAL FOR HUMAN EXPOSURE		518
5.1	OVERVIEW	518
5.2	PRODUCTION, IMPORT/EXPORT, USE, AND DISPOSAL	520
5.2.1	Production	520
5.2.2	Import/Export	525
5.2.3	Use	526
5.2.4	Disposal	527
5.3	RELEASES TO THE ENVIRONMENT	528
5.3.1	Air	530
5.3.2	Water	537
5.3.3	Soil	538
5.4	ENVIRONMENTAL FATE	540
5.4.1	Transport and Partitioning	542
5.4.2	Transformation and Degradation	550
5.5	LEVELS IN THE ENVIRONMENT	554
5.5.1	Air	556
5.5.2	Water	559
5.5.3	Sediment and Soil	561
5.5.4	Other Media	564
5.6	GENERAL POPULATION EXPOSURE	585
5.7	POPULATIONS WITH POTENTIALLY HIGH EXPOSURES	587
CHAPTER 6. ADEQUACY OF THE DATABASE		608
6.1	INFORMATION ON HEALTH EFFECTS	608
6.2	IDENTIFICATION OF DATA NEEDS	608
CHAPTER 7. REGULATIONS AND GUIDELINES		626
CHAPTER 8. REFERENCES		630
APPENDICES		
APPENDIX A. ATSDR MINIMAL RISK LEVEL WORKSHEETS		A-1
APPENDIX B. LITERATURE SEARCH FRAMEWORK FOR MERCURY		B-1
APPENDIX C. USER'S GUIDE		C-1
APPENDIX D. QUICK REFERENCE FOR HEALTH CARE PROVIDERS		D-1
APPENDIX E. GLOSSARY		E-1
APPENDIX F. ACRONYMS, ABBREVIATIONS, AND SYMBOLS		F-1

LIST OF FIGURES

1-1. Health Effects Found in Animals Following Inhalation Exposure to Elemental Mercury	9
1-2. Health Effects Found in Animals Following Oral Exposure to Inorganic Mercuric Salts	10
1-3. Health Effects Found in Animals Following Oral Exposure to Organic Mercury	11
1-4. Summary of Sensitive Targets of Elemental Mercury – Inhalation	12
1-5. Summary of Sensitive Targets of Inorganic Mercuric Salts – Oral.....	13
1-6. Summary of Sensitive Targets of Organic Mercury – Oral.....	14
2-1. Overview of the Number of Studies Examining Elemental Mercury Health Effects in Chapter 2	33
2-2. Overview of the Number of Studies Examining Inorganic Mercuric Salts Health Effects in Chapter 2	34
2-3. Overview of the Number of Studies Examining Organic Mercury Health Effects in Chapter 2	35
2-4. Overview of the Number of Studies Examining Mercury Health Effects—Unspecified General Population Exposure in Chapter 2	36
2-5. Levels of Significant Exposure to Elemental Mercury – Inhalation.....	43
2-6. Levels of Significant Exposure to Mercuric Oxide – Inhalation	48
2-7. Levels of Significant Exposure to Inorganic Mercuric Salts – Oral	75
2-8. Levels of Significant Exposure to Organic Mercury – Oral	127
5-1. Number of NPL Sites with Mercury or Mercury Compound Contamination	518
5-2. Temporal Atmospheric Emissions of Mercury from Facilities Required to Report to the Toxics Release Inventory	535
5-3. Global Mercury Budget: Impact of Human Activities on the Mercury Cycle and the Resulting Increase in Mercury Accumulated in Soils and Oceans	541
5-4. Transformation of Mercury in Air, Water, and Sediment	550
6-1. Summary of Existing Health Effects Studies on Elemental Mercury by Route and Endpoint.....	609
6-2. Summary of Existing Health Effects Studies on Inorganic Mercuric Salts by Route and Endpoint	610
6-3. Summary of Existing Health Effects Studies on Organic Mercury by Route and Endpoint	611
6-4. Summary of Existing Health Effects Studies on General Population Exposure to Mercury (Unspecified Route and Form)	612

LIST OF TABLES

1-1. Minimal Risk Levels (MRLs) for Elemental Mercury	15
1-2. Minimal Risk Levels (MRLs) for Inorganic Mercury Salts	16
1-3. Minimal Risk Levels (MRLs) for Methylmercury	17
2-1. Levels of Significant Exposure to Elemental Mercury – Inhalation.....	37
2-2. Levels of Significant Exposure to Mercuric Oxide – Inhalation.....	47
2-3. Levels of Significant Exposure to Inorganic Mercuric Salts – Oral.....	49
2-4. Levels of Significant Exposure to Organic Mercury – Oral.....	85
2-5. Results of Epidemiological Studies Evaluating Exposure to Mercury (Predominant Mercury Form Unknown) and Death in General Populations.....	145
2-6. Results of Epidemiological Studies Evaluating Body Weight Effects of Mercury Exposure (Predominant Mercury Form Unknown) in General Populations	152
2-7. Results of Epidemiological Studies Evaluating Exposure to Mercury (Predominant Mercury Form Unknown) and Respiratory Effects in General Populations	158
2-8. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Effects on Cardiovascular Outcomes.....	162
2-9. Effects on Blood Pressure in Rats Exposed to Mercuric Chloride via Drinking Water Exposure	165
2-10. Epidemiological Studies Evaluating Associations between Mercury and Blood Pressure and Cardiac Function in Populations with High Fish Diets	168
2-11. Effects on Blood Pressure in Rats Exposed to Methylmercuric Chloride via Oral Exposure	174
2-12. Overview of Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Blood Pressure in General Populations	177
2-13. Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Cardiovascular Disease and Mortality due to Cardiovascular Disease in General Populations	181
2-14. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Hematological Effects	191
2-15. Hematological Effects in Rodents Orally Exposed to Mercuric Chloride.....	192
2-16. Results of Epidemiological Studies Evaluating Exposure to Mercury (Predominant Mercury Form Unknown) and Musculoskeletal Effects in General Populations.....	198
2-17. Hepatic Clinical Chemistry in Rodents Orally Exposed to Mercuric Chloride.....	204

2-18. Results of Epidemiological Studies Evaluating Exposure to Mercury (Predominant Mercury Form Unknown) and Hepatic Effects in General Populations.....	207
2-19. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Renal Effects	212
2-20. Kidney Lesions in Rats Orally Exposed to Mercuric Chloride	219
2-21. Kidney Lesions in Mice Orally Exposed to Mercuric Chloride	221
2-22. Kidney Weight and Clinical Chemistry in Rats Orally Exposed to Mercuric Chloride	222
2-23. Kidney Weight and Clinical Chemistry in Mice Orally Exposed to Mercuric Chloride.....	226
2-24. Urinalysis in Rats Orally Exposed to Mercuric Chloride	228
2-25. Kidney Lesions in Animals Orally Exposed to Organic Mercury	231
2-26. Results of Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Renal Effects in General Populations	233
2-27. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Effects on Thyroid Hormones	244
2-28. Thyroid Function and Hormone Levels in Female Rats and Mice Orally Exposed to Inorganic Mercury Salts	246
2-29. Corticosterone levels and Adrenal Gland Weight in Rodents Orally Exposed to Mercuric Chloride	247
2-30. Overview of Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Thyroid Hormones in General Populations	251
2-31. Overview of Epidemiological Studies Evaluating Associations between Mercury Exposure (Predominant Mercury Form Unknown) Glucose Homeostasis in General Populations	252
2-32. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Immunological Effects	257
2-33. Results of Epidemiological Studies Evaluating Immunological Effects in Populations with High Fish Diets.....	260
2-34. Functional Immune Assays in Rodents Orally Exposed to Methylmercury During Development.....	264
2-35. Functional Immune Assays in Laboratory Animals Orally Exposed to Methylmercury During Adulthood.....	266
2-36. Immune Organ Weight and Cellularity in Rodents Orally Exposed to Methylmercury	269
2-37. Results of Epidemiological Studies Evaluating Exposure to Mercury (Predominant Mercury Form Unknown) and Immunological Effects in General Populations.....	271

2-38. Results of Skin Patch Tests to Mercury Compounds in General Populations	275
2-39. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) in Populations with Mercury Amalgam Dental Restorations and Neurodevelopmental Effects.....	282
2-40. Results of Epidemiological Studies Evaluating Exposure to Methylmercury and Neurodevelopmental Effects—Prospective Birth Cohorts in the Seychelle Islands	292
2-41. Results of Epidemiological Studies Evaluating Exposure to Methylmercury and Neurodevelopmental Effects—Prospective Birth Cohort in the Faroe Islands	302
2-42. Results of Epidemiological Studies Evaluating Exposure to Methylmercury and Neurodevelopmental Effects—Prospective Birth Cohort in the Nunavik Region of Arctic Canada	310
2-43. Results of Epidemiological Studies Evaluating Exposure to Methylmercury and Neurodevelopmental Effects—Amazonian River Basin Studies	313
2-44. Neurodevelopmental Effects in Male and Female Primates Following Oral Exposure to Methylmercury Compounds.....	318
2-45. Neurobehavioral Effects in Rodents Following Acute Oral Exposure to Methylmercury Compounds During Development	320
2-46. Neurobehavioral Effects in Rodents Following Intermediate Oral Exposure to Methylmercury Compounds During Development	322
2-47. Neurological Effects in Primates Following Oral Exposure to Methylmercury Compounds	324
2-48. Results of Epidemiological Studies Evaluating General Population Exposure to Mercury (Predominant Mercury Form Unknown) and Neurodevelopmental Effects	327
2-49. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Neurological Effects.....	339
2-50. Results of Epidemiological Studies Evaluating Exposure to Methylmercury and Neurological Effects.....	358
2-51. Neurological Effects in Primates Following Oral Exposure to Methylmercury Compounds	363
2-52. Neurobehavioral and Neurophysiological Effects in Rodents Following Adult Oral Exposure to Methylmercury Compounds.....	364
2-53. Dose-Response Data for Sensitive Neurobehavioral Effects in Mice following Acute Oral Exposure to Methylmercury	367
2-54. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Reproductive Effects	375
2-55. Reproductive Function in Rodents Orally Exposed to Mercuric Chloride when Both Sexes are Exposed	378

2-56. Reproductive Function in Male Rodents Orally Exposed to Mercuric Chloride Prior to Mating to Unexposed Females	379
2-57. Reproductive Function in Female Rodents Orally Exposed to Mercuric Chloride Prior to Mating to Unexposed Males.....	380
2-58. Sperm Parameters and Male Reproductive Hormones in Male Rodents Orally Exposed to Mercuric Chloride	381
2-59. Epidemiological Studies Evaluating Associations between Mercury and Reproductive Effects in Populations with High Fish Diets	385
2-60. Reproductive Function in Male Rodents Orally Exposed to Methylmercuric Chloride via Gavage Prior to Mating to Unexposed Females	386
2-61. Reproductive Function in Female Laboratory Animals Orally Exposed to Methylmercury Compounds.....	388
2-62. Sperm Parameters in Male Laboratory Animals Orally Exposed to Methylmercury Compounds.....	390
2-63. Overview of Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Reproductive Effects in General Populations.....	393
2-64. Results of Epidemiological Studies Evaluating Exposure to Elemental Mercury (Hg ⁰) and Developmental Effects	401
2-65. Epidemiological Studies Evaluating Associations between Mercury and Developmental Effects in Populations with High Maternal Fish Diets	404
2-66. Pre- and Postnatal Survival in Rats Following Gestation-Only Exposure to Methylmercury Compounds.....	407
2-67. Pre- and Postnatal Survival in Mice Following Gestation-Only or Gestation plus Lactation Exposure to Methylmercury Compounds.....	409
2-68. Malformations and Variations in Rats Following Gestation-Only Exposure to Methylmercury Compounds.....	411
2-69. Malformations and Variations in Mice Following Gestation-Only Exposure to Methylmercury Compounds.....	413
2-70. Body Weight and Length Effects in Rats Following Gestation or Gestation Plus Lactation Exposure to Methylmercury Compounds.....	415
2-71. Body Weight Effects in Mice Following Gestation-Only Exposure to Methylmercury Compounds.....	418
2-72. Overview of Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Anthropometric Measures in Newborns in General Populations.....	420

2-73. Overview of Epidemiological Studies Evaluating Associations between Mercury (Predominant Mercury Form Unknown) and Postnatal Growth in General Populations.....	424
2-74. Genotoxicity of Elemental Mercury in Epidemiological Studies.....	430
2-75. Genotoxicity of Inorganic Mercury Salts <i>In Vitro</i> Studies.....	432
2-76. Genotoxicity of Inorganic Mercury Salts <i>In Vivo</i> Animal Studies.....	434
2-77. Genotoxicity of Organic Mercury <i>In Vitro</i>	436
2-78. Genotoxicity of Organic Mercury <i>In Vivo</i> Animal Studies.....	438
3-1. Whole-Body Retention and Excretion of Mercuric Chloride in Human Subjects.....	453
3-2. Summary of Estimates of Gastrointestinal Absorption in Mice and Rats.....	456
4-1. Chemical Identity of Selected Inorganic and Organic Mercury Compounds.....	511
4-2. Physical and Chemical Properties of Selected Inorganic and Organic Mercury Compounds.....	514
5-1. Facilities that Produce, Process, or Use Mercury.....	522
5-2. Facilities that Produce, Process, or Use Mercury Compounds.....	523
5-3. Cumulative Worldwide Man-made Releases of Mercury to Air, Land, and Water Until 2010.....	529
5-4. Releases to the Environment from Facilities that Produce, Process, or Use Elemental Mercury.....	530
5-5. Releases to the Environment from Facilities that Produce, Process, or Use Mercury Compounds.....	532
5-6. Global Anthropogenic Emissions of Mercury to the Atmosphere by Sector.....	536
5-7. Mercury Deposition Data from the Mercury Deposition Network for North America.....	538
5-8. Estimated Discards of Mercury in Products in Municipal Solid Waste.....	539
5-9. Bioconcentration of Various Mercury Compounds by Freshwater and Saltwater Organisms.....	545
5-10. Mercury Concentrations Found in Fish.....	546
5-11. Comparison of the Biomagnification of Methylmercury and Inorganic Mercury in a Freshwater Food Chain (Little Rock Lake).....	548
5-12. Lowest Limit of Detection Based on Standards.....	555
5-13. Summary of Environmental Levels of Mercury Worldwide.....	555
5-14. Mercury Levels in Water, Soil, and Air at National Priorities List (NPL) Sites.....	556
5-15. Atmospheric Mercury Network (AMN) Average Gaseous Elemental Mercury Concentrations, 2008–2018.....	557

5-16. Mercury Concentrations in Food from the FDA Total Diet Study 2006–2013	566
5-17. Trends in Mercury Concentrations Based on Fish Data Aggregated by State from 1988 to 2005	569
5-18. Mercury Levels in 50 Species of Fish Obtained at Two Sites Along the Florida Reef Tract from April 2012 to December 2013	571
5-19. Mercury Concentrations (mg/kg) for Largemouth Bass Collected in Various States Throughout the United States (1990–1995)	575
5-20. Mercury Concentrations (mg/kg) for Channel Catfish Collected in Various States Throughout the United States (1990–1995)	576
5-21. Combined Data on Mercury Concentrations in Selected Fish Species Sampled in the Northeast.....	577
5-22. Total Mercury Concentrations in Tissues of Marine Mammals in Alaska and Canada (mg/kg, Wet Weight).....	580
5-23. Geometric Mean and Selected Percentiles of Total Mercury Blood Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2003–2010.....	588
5-24. Geometric Mean and Selected Percentiles of Total Mercury Blood Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2011–2016.....	590
5-25. Geometric Mean and Selected Percentiles of Inorganic Mercury Blood Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2003–2010.....	592
5-26. Geometric Mean and Selected Percentiles of Inorganic Mercury Blood Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2011–2016.....	594
5-27. Geometric Mean and Selected Percentiles of Ethyl Mercury Blood Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2011–2016.....	596
5-28. Geometric Mean and Selected Percentiles of Methylmercury Blood Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2011–2016.....	598
5-29. Geometric Mean and Selected Percentiles of Total Mercury Urinary Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2003–2010.....	600
5-30. Geometric Mean and Selected Percentiles of Total Mercury Urinary Concentrations (in $\mu\text{g/L}$) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2011–2016.....	602

5-31. Geometric Mean and Selected Percentiles of Total Mercury Creatinine Corrected Urinary Concentrations ($\mu\text{g/g}$ of Creatinine) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2003–2010.....	604
5-32. Geometric Mean and Selected Percentiles of Total Mercury Creatinine Corrected Urinary Concentrations ($\mu\text{g/g}$ of Creatinine) for the U.S. Population from the National Health and Nutrition Examination Survey (NHANES) 2011–2016.....	606
6-1. Ongoing Studies on Mercury Sponsored by the National Institutes of Health (NIH)	623
7-1. Regulations and Guidelines Applicable to Mercury (Hg)	626