

Index

- Acetaldehyde, 78, 152, 159–161, 169, 170
- Acrodynia, 91, 92, 102, 164, 231
- Activated carbon injection, 129
- Adams, John, 90
- Adaptive capacity, 35, 248–250
- Air pollution
- atmospheric transport, 117, 121, 126–128, 146, 246, 275
 - control devices for, 121, 128–132, 136, 137, 221, 230, 231, 234, 259
- Alchemy, 151, 152
- Alliance for Responsible Mining (ARM), 201–203
- Alluvial deposits, 186, 187, 194, 206
- Almadén, Spain, 43, 46, 47, 65, 85, 97–100, 251, 272
- Ambient air quality standards, 132
- Anthropocene, 18, 36, 250–252, 269
- Arctic, 57, 82, 83, 93, 96, 127, 256, 265, 272, 278
- Artisanal and small-scale gold mining (ASGM)
- addressing mercury use in, 202–206
 - attempts to formalize, 199, 200, 210, 278
 - employment in, 190–193, 221
 - Global Mercury Partnership and, 187, 204, 207, 209, 210, 221, 237
 - health consequences of mercury use in, 195, 196
 - mercury prices and, 60, 61, 205
 - mercury use in, 9, 47, 59, 151, 193–195
 - methylmercury and, 83, 196, 207
 - Minamata Convention on Mercury and, 68, 208–210, 263
- Asclepius, 79
- Atmospheric mercury monitoring stations, 121, 122, 139
- Australia
- mercury emission controls in, 138
 - mercury treaty negotiations and, 63
 - opposition to Minamata Convention in, 138
- Autism, 104, 105
- Basel Convention, 173, 266
- Batteries, 151, 152, 158, 165, 166, 168, 178, 231, 236, 238
- Best available techniques (BAT), 132, 133, 137, 138, 237, 238
- Best environmental practices (BEP), 132, 137
- Bioaccumulation, 56, 58, 59, 71, 75
- Biogeochemical cycle analyses, 34, 43–45, 49–51, 54, 59, 62, 70, 71, 245–247, 274, 275
- Biomagnification, 56
- Caduceus, 78, 79
- Calomel, 48, 81, 90–92, 112

- Canada. *See also* Grassy Narrows, Ontario, Canada
 ban on mercury-added devices in, 166
 coal-fired power plants in, 141, 144, 233
 mercury emission controls in, 135
 mercury treaty negotiations and, 63
 Cap-and-trade approaches, 130, 134
 Carroll, Lewis, 81
 Carson, Rachel, 3
 Celsius scale, 148
 Chemicals industry, 152, 158, 159, 170, 176, 246
 China. *See also* Wanshan, China
 ASGM and, 185, 186, 193, 194
 coal and, 125, 136, 140, 141, 169
 historical/traditional mercury uses in, 81, 82, 89, 102, 151, 156, 168, 177
 lithium production and, 160
 mercury-added products and, 165–167
 mercury emission controls in, 129, 136, 137, 141, 142
 mercury mining in, 46, 60, 65, 85, 100, 194
 mercury treaty negotiations and, 63, 140, 168
 rice and mercury exposure in, 93
 VCM production in, 159, 169, 170
 Chisso, 1–3, 23, 33, 78, 79, 101, 159–161, 238, 277
 Chlor-alkali production, 65, 133, 158, 159, 161, 169–172, 178, 179, 233, 236, 254, 258–260
 Chlorofluorocarbons (CFCs), 10, 149
 Cinnabar, 46–48, 59, 81, 85, 86, 89, 92, 102, 151, 155, 156
 Circular economy, 37, 38, 254, 255
 Clean Air Act (US; 1970), 133, 134
 Clean Air Mercury Rule (US), 134
 Climate change, 59, 72, 75, 117, 140, 141, 144, 145, 233, 235, 245, 247, 258, 265, 278, 279, 282
 Coal burning, 115–121, 125, 134, 138, 140–146, 233, 279
 Commission for Environmental Cooperation, 136
 Compact fluorescent lights (CFLs), 157, 167, 168, 178, 232, 254, 258, 282
 Complex adaptive systems, 19, 35, 239, 241, 242, 245–248, 271
 Concentrate amalgamation, 193, 194, 206
 Consumption choices, 281, 282
 Contaminated sites, 50, 67, 153, 161, 174–176, 180, 229, 234, 256
 Convention for the Prevention of Marine Pollution from Land-Based Sources, 172
 Convention on Long-Range Transboundary Air Pollution (CLRTAP), 51, 122, 137, 168
 Cotton market, 190, 191
 CRAFT Code, 202, 203
 Danbury Shakes, 87
 Dental use of mercury, 66, 67, 82, 92, 102–104, 113, 114, 276
 Diamond mining, 191
 Diaphragm-cell process, 158, 159, 169, 170
 Dichlorodiphenyltrichloroethane (DDT), 3, 10, 149
 Dietary advice/recommendations, 84, 108, 109, 113, 237, 238, 248, 250, 256, 265, 279
 Dietary exposure to mercury, 82, 83, 93–96, 106–108, 111, 113, 114, 226, 237
 Dodd-Frank Act (US; 2010), 201
 Dryden Chemicals, 161
 Effectiveness evaluation and Minamata Convention, 74, 266–268, 281
 Electrostatic precipitator technology, 128, 129

- Emergent properties, 35
- Emission limit values (ELVs), 132, 135, 137
- End-of-pipe technologies, 121, 128–130, 137, 140–142, 144, 145, 249, 257, 264
- Endogeneity, 266
- Energy Independence and Security Act (US; 2007), 167
- Environmental Protection Agency (EPA) (US), 108, 116, 133–135, 164, 166, 171, 172, 175, 238
- Epigenetics, 95
- Erethism, 83
- European Union (EU)
- dental amalgams and, 104
 - mercury-added products and, 164–166, 172
 - mercury-containing food and, 106
 - mercury emission controls in, 135, 137, 142, 179
 - mercury emissions and, 125, 126, 129, 142
 - mercury export bans and, 60, 61, 66, 73, 155, 195
 - mercury-free economy in, 171
 - mercury treaty negotiations and, 63, 140
 - mercury waste and, 172–174
- Export bans on mercury, 60–62, 65, 66, 73, 155, 173, 195, 255
- Fahrenheit scale, 148
- Fairtrade International (FLO), 201–203
- Faraday, Michael, 88
- Faroe Islands, 4, 82, 93–96, 107, 108
- Fish. *See also* Seafood
- dietary advice on consuming, 84, 107, 108
 - mercury effects on, 57
 - mercury levels in, 54, 93, 100, 106–108, 230
- Flue gas desulfurization, 128, 129
- Fly ash, 130
- Food, mercury in, 82, 83, 93–96, 106–108, 113, 226, 237
- Food and Agricultural Organization (FAO), 54, 106, 107
- Food and Drug Administration (FDA) (US), 102, 106, 108
- Fossil fuels, efforts to reduce dependence on, 140, 141, 279
- Francis (pop), 183
- Galileo, 147, 148
- Gaseous oxidized mercury, 56
- Global Environment Facility (GEF), 68, 204
- Global Mercury Partnership, 51, 63, 65, 69, 122, 137, 144, 153, 171, 173, 187, 204, 207, 209, 210, 221, 236, 237, 260, 262
- Gold
- global demand for, 191, 221
 - global supply of, 185
 - historical mining of, 45, 47, 87, 100, 184, 191
 - price of, 191, 201–203
 - supply chain, 185, 191, 200, 201
 - use in dentistry, 102, 103
- Gonorrhea, 91
- Grassy Narrows, Ontario, Canada, 161, 177, 179, 256, 257, 265, 282, 283
- Hamilton, Alice, 98, 99, 282
- Hard-rock deposits, 186, 194
- Hat making, 81, 87, 99, 152, 156, 176
- Hermes/Mercury, 78, 79
- Hippocrates, 81
- Holocene, 18
- Huancavelica, Peru, 43, 46, 86, 87, 98, 99, 230, 272
- Idrija, Slovenia, 43, 46, 65, 85, 98–100, 251, 272

- Incremental versus fundamental transitions, 37, 38, 115, 143, 144, 257–260, 269
- India. *See also* Kodaikanal, Tamil Nadu, India
 coal and, 136, 140
 demand for gold in, 191
 mercury emission controls in, 129, 136, 142
 mercury treaty negotiations and, 63, 140
 mercury uses in, historical/traditional, 81, 156
- Indonesia
 coal use in, 140
 mercury emission controls in, 136
 mercury mining in, 60, 62, 100, 194, 206
- Industrial ecology, 224, 246, 247
- Industrial Emissions Directive (EU; 2010), 135
- Industrial Revolution, 17, 18, 44, 111, 118, 260
- Institutional Analysis Development framework, 20, 239
- Institutional fit, 39, 209, 261–264, 266
- Interdisciplinary research, 274–276
- Intergovernmental Platform on Biodiversity and Ecosystem Services, 225
- International Labour Organization (ILO), 68, 99, 112
- Interoceanic Highway, 192
- IQ damages, 9, 94–96
- Iraq, mercury poisoning incidents in, 159
- Italy. *See* Monte Amiata, Italy
- Japan. *See also* Minamata Bay; Minamata disease; Niigata, Japan
 chlor-alkali production in, 158, 169, 170, 178, 179
 controversy over Minamata disease in, 2, 3, 78
 mercury-added products and, 164, 165
 mercury emission control in, 136
 mercury treaty negotiations and, 63, 170
- Kimberley Process Certification Scheme, 191
- Kodaikanal, Tamil Nadu, India, 88, 174, 175, 179, 180, 238, 256, 257, 265, 282, 283
- Kyrgyz Republic, mercury mining in, 60, 65, 100
- Laws and regulations, on mercury emissions, 131–140, 221, 238, 239
- Lead, 10, 54, 149, 239, 256
- Legacy emissions, 55, 74
- Lewis and Clark expedition, 90
- Lighting technology, 157, 167, 178, 232, 254
- Mad Hatter, 81
- Madre de Dios, Peru, 181–183, 193, 200
- Malaria, 91, 192
- Maximum Achievable Control Technology approach, 133
- Measuring devices, mercury-added, 166, 167
- Medical uses of mercury, 81, 82, 89–93, 101–106, 109–112, 157, 224, 232, 254, 259, 277
- Mercuriferous belts, 46
- Mercurous chloride, 48, 81. *See also* Calomel
- Mercury (god), 7, 78, 79, 116, 146, 148, 180, 211
- Mercury, Freddie (Farrokh Bulsara), 8, 244, 272, 284
- Mercury and Air Toxics Standards (US), 134, 141, 231, 259
- Mercury-cell process, 158, 159, 169, 172. *See also* Chlor-alkali production

- Mercury-Containing and Rechargeable Battery Management Act (US; 1996), 165
- Mercury flasks, 47, 48
- Mercury markets, 47, 51, 61, 62, 153, 186, 187
- Mercury mining, 47, 53, 60–62, 65, 73, 85–87, 97–100, 110–113, 149, 150, 154–156, 230, 236, 237, 255
- Mercury trade, 59, 62, 65, 66, 69, 75, 194, 195, 205, 211, 236, 255, 278
- Methylmercury
 discharge of, 1, 79, 160, 277
 ecosystem production of, 56–59, 127, 161, 196
 effects of, 9, 57, 83, 84, 89, 92–96, 100, 101, 161
 exposure to, 82, 83
 reference dose, 107
 as seed treatment, 87, 164
- Minamata Bay
 clean-up of, 2, 78, 174, 175, 282
 contamination of, 1, 2, 77
- Minamata Convention on Mercury
 adoption of, 2, 3
 on ASGM, 68, 185, 187, 199, 203, 204, 208–210
 on contaminated sites, 67, 68, 174
 on dental amalgam, 67, 103
 effectiveness evaluation and, 69, 268, 281
 emissions and releases and, 67, 122, 137, 138
 end-of-pipe technologies and, 137, 145
 human health and, 66, 67, 84, 112
 lifecycle focus and, 221, 234
 mercury-added products and, 67, 68, 168
 mercury mining and, 65, 236
 negotiations of, 8, 51, 62, 63, 69, 105, 140, 145, 168, 263, 276
 phaseouts and, 67, 73, 102, 144, 153, 178, 179, 236, 260–262
 production processes and, 67, 68, 170
 on thimerosal, 105, 106
 on waste disposal, 67, 173
- Minamata disease, 1–4, 77–79, 100, 101, 238, 283, 284
- “Minamata’s Pledge,” 283, 284
- Monte Amiata, Italy, 46, 99
- Multi-pollutant control technology, 137, 145, 274
- Natural Resources Defense Council (NRDC), 134
- Network analysis, 222, 240
- New Mexico, mercury poisoning incident in, 159, 160
- Newton, Isaac, 88
- New Zealand
 coal burning in, 138
 impacts of methylmercury exposure in, 94
- Niigata, Japan, 94, 161, 177–179
- Nobel, Alfred, 157
- Occupational exposure to mercury, 9, 66, 81, 84–89, 97–100, 109–113, 195, 196, 205, 224, 236, 237, 258
- Ontario, Canada, 161
- Organisation for Economic Co-operation and Development (OECD), 51, 200, 202
- Our Common Future*, 5
- Outcome indicators, 267, 268, 281
- Paints, 9, 151, 152, 164, 261
- Panogen, 161–164, 231, 237
- Paracelsus, 80, 88
- Paris Agreement, 140, 141
- Pascal, Blaise, 88
- Patio process, 43
- Per- and polyfluoroalkyl substances (PFAS), 171, 258
- Persistent organic pollutants (POPs), 63, 240

- Peru. *See also* Huancavelica, Peru; Madre de Dios, Peru
 ASGM in, 182, 186, 193
 emergency declaration in, 181
 mercury mining in, 43, 86
- Philippines, mercury emission controls in, 135, 136
- Piven, Jeremy, 94
- Planetary boundaries, 36, 252, 253, 269
- Pliny the Elder, 151
- Polycentric governance structures, 39, 261, 262
- Polychlorinated biphenyls (PCBs), 10, 149
- Pregnant women
 dental use of mercury and, 104
 dietary advice for, 84, 107, 108, 110, 111, 113, 233, 237, 281
 impacts of mercury on, 79, 84, 94, 281
 mercury use for abortions by, 92
- Prior informed consent (PIC) scheme, 66
- Process indicators, 267, 268, 281
- Pulgar-Vidal, Manuel, 181
- Qin Shihuang, 89, 90
- Religious uses of mercury, 9, 151, 156, 168, 179, 283
- Resilience, 35, 36, 248–250
- Rotterdam Convention, 63, 266
- Russia, lack of mercury emission controls in, 136
- Sakamoto, Shinobu, 3
- Saprolites, 186, 194, 206
- Seafood. *See also* Fish
 bans on harvesting and sale of, 100, 106, 161, 181, 250
 human exposure from consuming, 4, 83, 84, 93–96, 196, 230, 256, 258
 industry, 111
 mercury in, 82, 93, 106–108
- Showa Denko, 161, 238
- Silent Spring* (Carson), 3
- Silver-plating industry, 152
- Silver production, 9, 43–45, 47, 87, 98, 251
- Slovenia. *See* Idrija, Slovenia
- South Africa, mercury emission controls in, 136
- South Korea, mercury emission controls in, 136
- Spain. *See* Almadén, Spain
- Sphygmomanometer, 157
- Steubenville, Ohio, 115–117, 128, 130, 134, 141
- Stockholm Convention, 63, 171, 266
- Sustainability science, 6, 7, 39
- Sustainability/sustainable development
 definitions of and transitions for, 5, 36–38, 72, 73, 110–112, 143, 144, 177, 178, 208, 209, 253–261
 governance for, 38–40, 74, 75, 112–113, 144–146, 178–180, 209, 210, 261–268
 sharing stories of, 283, 284
 systems analysis for, 34–36, 70–72, 109, 110, 141–143, 176, 177, 206–208, 244–253
- Sustainable Development Goals (SDGs), 5, 70, 75, 233, 271, 272
- Sweden
 controls on mercury in products, 104, 163, 166, 231
 dental amalgams and, 103, 104
 dietary guidelines in, 107
 mercury export bans and, 66
 public concerns about mercury in, 238, 282
- Switzerland
 gold refining in, 185
 mercury exports, 66
 mercury treaty negotiations, 63
- Syphilis, 81, 90, 91, 101, 102, 112, 232

- Technosphere, 21, 22
- Thermometers, 88, 147, 148, 157, 166–168, 174, 175, 254, 282
- Thermoscope, 147, 148
- Thimerosal, 82, 92, 104–106, 276
- Trade. *See* Mercury trade
- Transition dynamics, drivers of, 260, 261
- Transitions versus transformations, 37, 38, 257–260
- United Nations Development Programme (UNDP), 68, 204, 271, 272
- United Nations Educational, Scientific, and Cultural Organization (UNESCO), 100
- United Nations Environment Programme (UNEP), 2, 3, 48, 63, 171
- United Nations Industrial Development Organization (UNIDO), 204
- United Nations Institute for Training and Research (UNITAR), 69
- United States. *See also* New Mexico, mercury poisoning incident in chlor-alkali production in, 158, 159 coal use in, 125, 129, 141, 144 controls on mercury in products, 99, 164–166 dental amalgams and, 102, 103 dietary advice in, 108 lithium production in, 160 mercury emission controls, 133–135, 137, 141, 144, 233, 238 mercury export ban, 60–62, 66, 73, 195 mercury mining in, 46, 87, 99 mercury treaty negotiations and, 63, 140 thimerosal and, 105
- Vaccines/vaccinations, 82, 92, 93, 104–106, 110, 113, 114, 249, 254, 255, 259, 276
- van Helmont, Jan Baptist, 88
- VCM (vinyl chloride monomer) production, 78, 152, 159, 160, 169, 170
- Vermillion, 151
- Wanshan, China, 46, 85, 100
- Washington, George, 90
- Waste Incineration Directive (EU; 2000), 135
- Weihe, Pál, 108
- Whole ore amalgamation, 193, 203, 206
- Wicked problems, 262, 263
- Wildfires, 58, 59
- Workplace exposure. *See* Occupational exposure to mercury
- World Health Organization (WHO), 54, 68, 103, 106, 107, 112, 195, 265, 276
- Yoshinaga, Rimiko, 1, 2

This is a section of [doi:10.7551/mitpress/11856.001.0001](https://doi.org/10.7551/mitpress/11856.001.0001)

Mercury Stories

Understanding Sustainability through a Volatile Element

By: Henrik Selin, Noelle E. Selin

Citation:

Mercury Stories: Understanding Sustainability through a Volatile Element

By: Henrik Selin, Noelle E. Selin

DOI: 10.7551/mitpress/11856.001.0001

ISBN (electronic): 9780262359108

Publisher: The MIT Press

Published: 2020

The open access edition of this book was made possible by generous funding and support from MIT Libraries



The MIT Press

© 2020 Massachusetts Institute of Technology

All rights reserved. No part of this book may be reproduced in any form by any electronic or mechanical means (including photocopying, recording, or information storage and retrieval) without permission in writing from the publisher.

This book was set in Stone Serif and Stone Sans by Westchester Publishing Services.

Library of Congress Cataloging-in-Publication Data

Names: Selin, Henrik, 1971– author. | Eckley, Noelle, author.

Title: Mercury stories : understanding sustainability through a volatile element / Henrik Selin and Noelle Eckley Selin.

Description: Cambridge, Massachusetts : The MIT Press, [2020] |

Includes bibliographical references and index.

Identifiers: LCCN 2019049225 | ISBN 9780262539203 (paperback)

Subjects: LCSH: Mercury—Environmental aspects. | Mercury industry and trade—Environmental aspects. | Sustainable development.

Classification: LCC TD196.M38 S45 2020 | DDC 363.17/91—dc23

LC record available at <https://lcn.loc.gov/2019049225>