

17th INTERNATIONAL CONFERENCE Mercury as a Global Pollutant



Book of **ABSTRACTS**

icmgp2026india.com

Conference Manager

meety[®]

TABLE OF CONTENTS

ID	Title	Page No.
OP 12	Spatial variation in mercury concentrations in Mankweng, South Africa Author: Monray Dean Belelie	1
OP 14	Values of access to information, inclusion and participation creates the enabling environment for change. Author: Ruth Spencer	2
OP 15	New insights into the trends and uncertainties in atmospheric mercury redox chemistry Author: Aryeh Feinberg	3
OP 16	Estimation of mercury released into the environment from the uncontrolled dumping of broken medical thermometers in hospitals in Cameroon, Africa Author: Samuel TETSOPGANG	4
OP 23	Relationships between Selenoneine, Ergothioneine, Methylmercury, and Blood Parameters among Inuit Living in Nunavik, Northern Quebec Author: Alexandrine Roy	5
OP 24	How and Where to Act? A review of policies and initiatives for controlling mercury contamination from gold mining to protect biodiversity in the Amazon Author: Allison Aldous	6
OP 25	Assessing ecological risk of mercury in subsea oil and gas infrastructure to inform decommissioning Author: Tom Cresswell	7
OP 26	Bridging Research and Policy for Mercury Management in Australia: Outcomes from the 2025 Mercury Australia Network Workshop Author: Tom Cresswell	8
OP 27	Modeling mercury cycle in the global ocean using NEMO-PISCES - redox reactions sensibility tests and impact of hydrothermal sources Author: Brunet Eline	9
OP 29	Multi-year Assessment of Atmospheric Mercury Deposition in a Tropical Urban Megacity: Flux Variability, Driving Factors, and Washout Processes Author: Ly Sy Phu Nguyen	10
OP 30	Quantifying the Role of Atmospheric Oxidants (OH, O ₃ , and Br) in Mercury Oxidation Using an Environmental Chamber Author: Alexis Harper	11
OP 31	Oxidation of Aqueous Elemental Mercury: An Overlooked Process Driving Atmospheric-Oceanic Mercury Input Author: Yongguang Yin	12



ID	Title	Page No.
OP 32	Mercury Exposure: It's occupational...right? Author: Daniel Cronje	13
OP 34	Forty-five Year Trying to Eliminate Mercury in Artisanal Gold Mining: Frustrations and Accomplishments Author: Marcello M. Veiga	14
OP 35	A study of mercury and gold losses at two artisanal gold mining and processing sites in Nigeria Author: Nnamdi C. Anene	15
OP 37	Climate-driven mercury accumulation and storage dynamics in tropical dry and rainforest Author: Juan Francisco Morales Arteaga	16
OP 38	Assessing risks of methylmercury contamination in the Ankobra estuary, Western Region, Ghana Author: Sampson D. D. P. Dordaa	17
OP 39	Mercury in the Bohai Sea food web: Quantifying trophic transfer, sources, and health risks Author: Deming Han	18
OP 42	Initiation, expansion and sustainability of laboratory proficiency testing for mercury to enhance collective mercury monitoring capacity Author: Saito, Mitsugu	19
OP 43	Atmospheric observations of gaseous elemental mercury in industrial and background areas of the Southern Baikal region Author: Lutskin Evgenii Sergeevich	20
OP 46	Spatial evaluation of total mercury concentrations in the South African atmosphere using lichen biomonitors Author: Patricia Forbes	21
OP 47	Climate-driven Ecosystem Changes and Mercury Cycling in Arctic Fjord Systems: Insights from the REFUGE-ARCTIC Campaign Author: Davide Mattio	22
OP 52	Dual-channel mercury measurements for a smog chamber study Author: KarLee Zager	23
OP 54	Experimental Investigation of Atmospheric Mercury Oxidation Using a 35 m ³ Environmental Chamber Author: Colleen Jones	24
OP 55	Long-Term Observations of Mercury Species in the Sargasso Sea Highlight the Effectiveness of the Minamata Convention Author: Jingjing Yuan	25

ID	Title	Page No.
OP 56	Mercury in skin-lightening cosmetics available to Japanese consumers: evidence from rapid screening and confirmatory analysis Author: Koichi Haraguchi	26
OP 58	Evidence of Reduced Methylmercury Levels in Freshwater Ecosystems: A Decade of Monitoring under the Minamata Convention Author: Seonghwan Kim	27
OP 59	Atmospheric Oxidant Variability Reshapes Future Global Mercury Load Author: Hema Bhatt	28
OP 60	Vegetation Regulation of Soil Hg(0) Evasion: Mechanistic Insights from Karst Landscapes and Global Patterns Author: Jicheng Xia	29
OP 61	Mercury in sediments of thermokarst lakes in the Malozemelskaya tundra: anthropogenic or biovector pollution? Author: Yury G. Tatsiy	30
OP 62	Distribution of total and bioavailable mercury concentrations in abiotic matrices in a South African nature reserve Author: Geyan Kempkes	31
OP 65	Factors influencing the mercury cycle in polar regions: observations from Svalbard snow and modelling Author: Veronica AMORUSO	32
OP 67	Study on the Adsorption Mechanism of Hg ₀ by Air Plasma Modified Carbon Nanotubes Author: Jinjing Luo	33
OP 68	Role of Humic Substances in the Speciation, Mobility, and Transformation of Mercury in Natural Aquatic Systems Author: Safonov Vladimir	34
OP 70	Deep-Sea Tailings Placement: An Emerging Source of Mercury to the Deep Sea Author: Omar Keshk	35
OP 71	Recent Insights into Mercury Distribution in Indian Coal and Emissions from Thermal Power Plants Author: Hridesh Agarwalla	36
OP 72	Atmospheric Hg(II) Chemistry: Insights from a Chamber Study Author: Sarrah M. Dunham-Cheatham	37
OP 73	Comparison of Selective Capture of Oxidized Mercury by Activated Carbon and Phosphate Glass Sorbents for Ambient Air and Waste Streams Author: Sarrah M. Dunham-Cheatham	38



ID	Title	Page No.
OP 74	Progress of the Asia Pacific Mercury Monitoring Network Author: Da-Wei Lin	39
OP 75	Characterizations of Atmospheric Mercury Concentration and Isotope Composition at Multiple Sites in Taiwan Author: Guey-Rong Sheu	40
OP 76	The State of the Environment in Idrija 30 Years After the Cessation of Mercury Production at the Idrija Mercury Mine, Slovenia Author: Tatjana Dizdarevič	41
OP 78	Selenoneine in marine fish and estimation of dietary intakes in Seychellois pregnant women Author: Olya Antropova	42
OP 79	New pathway of mercury methylation in methanogen (<i>M. hungatei</i> JF-1) Author: Ligang HU	43
OP 80	Seasonal and diurnal variations in atmospheric GEM concentrations and fluxes over a deciduous needleleaf forest in Japan Author: Akinori Takeuchi	44
OP 82	Investigating the status of mercury contamination in various freshwater and marine ecosystems of South Africa Author: Johannes H. Erasmus	45
OP 84	Law Enforcement and Its Challenges in Implementing the Minamata Convention on Mercury in Indonesia Author: Yuyun Ismawati	46
OP 87	Comparative Study of Child Anthropometry and Mercury Exposure in Coastal and ASGM Areas of Indonesia Author: Muflihatul Muniroh	47
OP 88	Distribution, speciation and exports of mercury in a restored gold-mined Amazonian watershed (French Guiana) Author: Naomi NITSCHKE	48
OP 90	Baseline characterization of aquatic biota before the reclamation of the Almadenejos mercury metallurgical precinct (Almadén Hg mining district) in the context of the LIFE HERMES Project Author: Pablo Higuera	49
OP 92	The Almadén mercury mining district: an update of environmental consequences of the exploitation of its Hg deposits Author: Pablo Higuera	50



ID	Title	Page No.
OP 94	Evidence of mercury contamination by gold mining activities in a large Amazonian watershed using stable isotopes: tracking mercury sources in the Maroni River sediments (French Guiana/Surinam) Author: Elaheh Lotfi-Kalahroodi	51
OP 95	Combining speciation of mercury and selenium compounds from fresh to marine waters: potential biogeochemical interactions as analogs or antagonists ? Author: David Amouroux	52
OP 98	Large-scale mercury stabilization: industrial case studies in chlor-alkali decommissioning and gold mining across Europe and Latin America Author: Angels CASTELLNOU	53
OP 99	Elemental mercury dominates the bigeochemical cycling of mercury in forest ecosystems Author: Xinbin Feng	54
OP 101	The HERMES project: reducing the affectation to general population of cinnabar processing residue. Author: Pablo Higuera	55
OP 103	Hg compounds dynamic and cycling in a periodically stratified mountain lake (Pyrenees, France/Spain): Potential influence of Climate Change Author: David Amouroux	56
OP 104	Selenoneine as a Natural Antidote to Methylmercury in Ocean Fish Author: Mélanie Lemire	57
OP 105	Determining biomass-based methylmercury concentrations in phytoplankton with the support of an Imaging Flow Cytobot and Flow Cytometer Author: Kristine C. Prelich	58
OP 106	Distribution and speciation of seawater mercury in the Queen Elizabeth Islands region of the Canadian Arctic Author: Bronson Ramoutar	59
OP 109	The Quantitative Analysis of Mercury in Skin Whitening Creams available in the Indian Market Author: Satish Sinha	60
OP 110	Heterogeneous Photooxidation of Atmospheric Mercury Enhanced by the Mixtures of Metallic Oxide and Sodium Chloride Author: Qingru Wu	61
OP 113	Mercury and Selenium Nanoparticle Formation in Amazonian Fish: Multi-Tissue Evidence of a Freshwater Detoxification Pathway Author: Marianna Alves Cancian	62



ID	Title	Page No.
OP 114	Breaking the sea ice: cracking the seasonal cycle of mercury in the Arctic cryosphere Author: Stephen G. Kohler	63
OP 115	Southern Ocean seabird population shifts over the Holocene revealed by peat sequestration of mercury from guano Author: Chuxian LI	64
OP 116	Long-term mercury remobilization from southern Baltic sediments under recurring resuspension events Author: Jacek Beldowski	65
OP 117	Probabilistic Health Risk Assessment of Multi-Pathway Mercury Exposure in Children from the Legacy Mercury Mining District of Idrija, Slovenia Author: Adna Alilović Osolin	66
OP 118	Remote-Controlled Climate Chambers for International Collaboration in Mercury Phytoremediation Research: Current Developments and Open Access Opportunities Author: Barna Heidel	67
OP 119	DeSOx technology, an effective system for reducing Hg emissions from fossil and alternative fuel combustion, using a precipitant and continuous Hg measurement Author: Karel Borovec	68
OP 120	Bidirectional air-surface exchange of gaseous elemental mercury reshapes the global mercury budget Author: Shuxiao Wang	69
OP 121	Unraveling mercury and selenium species dynamics in Amazonian riverine population. Author: Juliette Esplugas	70
OP 122	Mercury thermospeciation in coals Author: Dr. Nikolay Mashyanov	71
OP 125	Zeeman AAS as a universal approach for mercury determination in samples with complex matrices Author: Alexey Shashko	72
OP 126	Quantifying the role of chemistry, surface exchange, and transport on the hemispheric variability of mercury (Hg) Author: Eric M. Roy	73
OP 127	Mercury Speciation and Mobility in the Eastern Mt. Amiata Mining District (central Italy): Implications for Long-Term Environmental Risk Author: Federica Meloni	74
OP 129	Identifying the spatial extent of historical mercury smelter emissions using tree cores and stable isotope soil profiles Author: Steve Dent	75

ID	Title	Page No.
OP 130	Smart biochar for synergistic mercury remediation: A sustainable solution towards farmland-resilience, food security, and public health Author: Nathan Thadeo Yoashi	76
OP 131	Model of Mercury Exposure Controlling on Communities Surrounding Artisanal Small-scale Gold Mining in Sukabumi, Indonesia Author: Alfonsus H. Harianja	77
OP 132	Mercury Transfer Across Estuarine Biota: Implications for Biodiversity in the Industrially Impacted Estuary Author: Pavitra Chandrakant Mirjankar	78
OP 133	Mercury Speciation on Total Mercury and Methylmercury in the Water Column of the Anthropogenically Impacted Estuary Author: Pavitra Chandrakant Mirjankar	79
OP 136	Are peatlands doomed to be Hg hotspots: Hg critical zone fate revealed with micromet, isotopes, genomics, and an ice-age Author: Kevin Bishop	80
OP 138	Hg-contamination in the former Hg-mining area of Abbadia San Salvatore (Mt. Amiata, central Italy) Author: Orlando Vaselli	81
OP 139	Mercury in lakes of Andean Patagonia: patterns in deep and shallow lakes along a bioclimatic gradient Author: María C. Diéguez	82
OP 141	Air-Sea Exchange of Dimethylmercury in the Southern Ocean During GEOTRACES GP17-OCE and GP17-ANT Author: Yipeng He	83
OP 142	Comparison of mercury contents in plant species and mercury emissions from prescribed burning in Japanese grasslands Author: Satoshi Irei	84
OP 146	Global Mercury Cycling and Trends: A Multi-Model Assessment in Support of the Minamata Convention Author: Eric Roy	85
OP 147	Analytical insights into HgSe nanoparticle formation in marine food webs Author: María Jiménez-Moreno	86
OP 148	Mercury–selenium interactions in Amazonian riverine populations under contrasting exposure scenarios Author: María Jiménez-Moreno	87
OP 151	Mercury emission estimates and cycling simulations from global wildfires Author: Long Chen	88

ID	Title	Page No.
OP 152	From Fragmentation to Integration: Strengthening the Science-Policy Interface for Mercury Governance in India Author: Jagannath Biswakarma	89
OP 153	Beyond Emission Reductions: The Growing Role of Climate Change in Shaping Long-Term Atmospheric Mercury Trends Author: Lei Zhang	90
OP 155	Effectiveness evaluation – a model case of science policy interface Author: Eisaku Toda	91
OP 156	Hidden in Plain Sight: Human Mercury Vapour Exposure Risks Across the Oil and Gas Decommissioning Lifecycle Author: David Hunter	92
OP 157	Recent Trends of Anthropogenic Atmospheric Mercury Emissions and Concentrations in China Author: Hezhong TIAN	93
OP 158	Mercury Exposure from Cosmetics and Personal Care Products: Health Risk Assessment and Evaluation of Regulatory Effectiveness in Kerala, India Author: Swathy Krishna	94
OP 160	Organic carbon controls on mercury dynamics in mangrove sediments of the Godavari estuary, India Author: Shrutee Jain	95
OP 162	Mercury distribution pattern in soil at the UCIL site, Bhopal Author: Ekta Nagphase	96
OP 164	Atmospheric Transport Pathways and Source Apportionment of Mercury Wet Deposition at IIT Hyderabad Author: Vikas Kumar Meena	97
OP 167	Development of Multifunctional Phosphorylated Chitosan-Based Nanocomposite doped with Sulfur Nanoparticles for Efficient Removal of Hg from Surface Wastewater Author: Mvula Confidence Goci	98
OP 168	Novel application of ceramic membrane microfiltration technologies for the removal of particulate mercury from oil and gas process fluids Author: Stuart Baker	99
OP 169	Sulfurised Phosphorylated Chitosan-Based Electrochemical Sensor for Sensitive Detection of Mercury(II) Ions Author: Puleng Molete	100
OP 173	Identification of mercury species in waxy oil and assessment of the efficacy of both established and novel removal technologies. Author: Jac Hales	101

ID	Title	Page No.
OP 175	The SA Mercury Network (SAMNet): Latest Trends and findings Author: Lynwill G Martin	102
OP 178	Assessing mercury in skin-lightening products using a standardized monitoring framework: Evidence from Gabon, Jamaica, and Sri Lanka Author: Ashley Bastiansz	103
OP 179	Advances and challenges in anthropogenic mercury emission assessment: insights from the Emissions Database for Global Atmospheric Research speciated inventory for global emission hot-spot monitoring Author: Marilena Muntean	104
OP 181	Scientific report of the Open-Ended Scientific Group of the Minamata Convention Author: Eisaku Toda	105
OP 183	Updated review of post-2022 literature and the development of a global database for mercury-added skin-lightening products Author: Ashley Bastiansz	106
OP 184	Mercury exposure in humans: work of the Open-Ended Scientific Group for the Minamata Convention effectiveness evaluation Author: Janja Snoj Tratnik	107
OP 185	Biodiversity and Minamata Convention – synergies in multilateral environmental agreements Author: Eisaku Toda	108
OP 186	Trophic biomagnification of mercury in Arctic vertebrates across marine and terrestrial systems Author: Juliana Souza-Kasprzyk	109
OP 190	Mercury and Beyond: Environmental Health Risks in ASGM across Sub-Saharan Africa Author: Stephan Bose-O'Reilly	110
OP 192	Mercury–selenium interactions from exposure to molecular response: integrating toxicokinetics, redox biomarkers and omics evidence in human populations Author: Milena Horvat	111
OP 193	What national reports can tell on artisanal and small-scale gold mining Author: Eisaku Toda	112
OP 194	Mercury behavior during the formation of modern thermal fields of Kamchatka (Russia) Author: Anton Nuzhdaev	113
OP 195	Minamata Convention report on the challenges in eliminating mercury-added cosmetics Author: Eisaku Toda	114



ID	Title	Page No.
OP 197	From Pilots to Global Action: Insights on Eliminating Mercury and Harmful Chemicals from Cosmetics Author: Grace Halla	115
OP 198	Placental metal(loid)s in cohorts from Hg-mining and control environments Author: Ingrid Falnoga	116
OP 199	Considerations for the integration of pollution into the implementation of National Biodiversity Strategies and Action Plans (NBSAPs) and related MEAs reporting Author: Imelda Dossou Etui	117
OP 200	Non-Profit/Public Partnership Targets Harmful Skin Lightening Products Author: Lori Copan	118
OP 201	Stoichiometric relationship between mercury and selenium in the nutrition of populations in the Northwest Territories (Canada), with special emphasis on remote indigenous communities Author: Dirk Wallschläger	119
OP 203	Efficient Synergistic Removal of Multi-form Mercury from Cement Kiln Flue Gas Using Non-carbon Zinc Sulfide Author: Mingguang Zhang	120
OP 204	Measuring What Matters: Evidence-Based Approaches for Tracking Mercury Reduction in ASGM under Article 7 and National Action Plans Author: Anne Lillian Nakafeero	121
OP 205	Eliminating Production and Online Trade in Mercury Added Cosmetics Author: Elena Lymberidi-Settimo	122
OP 207	"Beyond Borders and Beauty: Tackling Mercury in Skin-Lightening Products – Lessons from Sri Lanka in a Three-Country Initiative" Author: Inoka Kamalinie Suraweera	123
OP 208	Human Biomonitoring Reveals High Mercury Exposure in Amazonian Communities Under Emerging ASGM Pressure Author: Claudia Vega	124
OP 209	Mercury Monitoring in Japan: Cooperation for Monitoring Capacity Development and the Challenges Thereof in Contribution to the Effectiveness Evaluation of the Minamata Convention Author: Tatsuya Hattori	125
OP 213	Low Temperature Thermal Decomposition of Metacinnabar (β -HgS) Nanoparticles to Elemental Mercury in Water and Glycol: Implications for Mercury Management Author: Gregory V. Lowry	126



ID	Title	Page No.
OP 214	Evaluating Mercury Impacts on Wildlife: Contributions to the Minamata Convention and Global Biodiversity Framework Author: Josh T Ackerman	127
OP 215	Interdisciplinary Approaches to address Mercury Pollution in ASGM: Bridging Environmental Science, Social Research, and Policy Implementation Author: DOMINIQUE BALLY KPOKRO	128
OP 216	Quantifying mercury pathways in the oil & gas sector Author: Peter Maxson	129
OP 218	Mercury Levels and Fluxes from Major Rivers in Japan Author: Toshio Sudo	130
OP 219	Individual particle-scale characterization of mercury in sediments can predict mercury bioavailability potential and provenance the source of mercury Author: Thomas Hoelen	131
OP 220	Comparison and experiences of sampling approaches for mercury in gaseous hydrocarbons Author: Warren T Corns	132
OP 221	A behavioural analysis of social, structural and psychological drivers of skin lightening in Gabon, Sri Lanka and Jamaica Author: Ammaarah Martinus	133
OP 222	Remote sampling technique for Hg fractionation in ambient air Author: Warren T Corns	134
OP 224	From transport to transformation: evolving understanding of mercury behavior in a river-reservoir system Author: Steve Dent	135
OP 226	Multi-stakeholder approaches towards managing mercury-containing cosmetic products in the Philippines Author: Jashaf Shamir Lorenzo	136
OP 227	Potential impacts of seafloor mining on the marine mercury cycle: Insights from the GEOTRACES program Author: Katlin Bowman Adamczyk	137
OP 229	Mercury distribution in bottom sediments in a tropical coastal lagoon: Tijuca Lagoon (Rio de Janeiro, Brazil) Author: Yan Ribeiro de Almeida Fernandes	138
OP 230	Mercury contamination and sediment resuspension: ecotoxicological algae and microcrustaceans in a tropical urban lagoon Author: Yan Ribeiro de Almeida Fernandes	139

ID	Title	Page No.
OP 231	Assessment of the mercury stability during the winter period based on its concentrations in atmospheric precipitation and in snow cover in the south of Western Siberia Author: Eyrikh Stella	140
OP 232	Mapping Mercury Contamination Risks to Biodiversity and People in Ecuador's Napo Basin Author: Allison Aldous	141
OP 233	Primary Mercury Mining Worldwide: Taking Stock of the Situation Ten Years After the Minamata Convention Entered Into Force Author: Romain Taravella	142
OP 235	Mercury Speciation and Distribution from the US GEOTRACES GP17-ANT Cruise in the Amundsen Sea Author: Carl Lamborg	143
OP 236	Mercury in the IPBES Nexus Assessment: bridging science, policy, and multilateral environmental conventions Author: Paula Ribeiro Prist	144
OP 237	Air mercury surveys at sulfides ore deposits Author: Alexei S. Rukhlov	145
OP 239	Review of Implementation of Article 7 Author: Thomas Verbaere	146
OP 240	Modeling the role of dimethylmercury on Hg air-sea exchange Author: Johannes Bieser	147
OP 241	Mercury in the South Pacific Ocean Author: Lars-Eric Heimbürger-Boavida	148
OP 243	Mercury cycling within sub-tropical North Pacific Ocean abyssal sediments Author: Marissa C. Despins	149
OP 245	Speciation and Distribution of Mercury in Soils from a Coal Mining Region in Northeast India Author: Bhargov Mudhukailya	150
OP 247	Revisiting Mercury Use in Indian Traditional Practices under the Minamata Convention Framework Author: Satish Sinha	151
OP 248	Occurrence of Mercury and Trace Elements in Tea Leaves from a Coal Mining Region in Northeast India Author: Prantik Sharma Baruah	152



ID	Title	Page No.
OP 249	Strengthening the Minamata Convention for the Effectiveness of Ending Mercury Use in the Artisanal and Small-scale Gold Mining Sector Author: Yuyun Ismawati	153
OP 250	Strengthening Health Aspects of the Minamata Convention on Mercury Author: Yuyun Ismawati	154
OP 251	Mercury isotopic signature in blood and hair: a study in Amazonian populations Author: Zoyne Pedrero Zayas	155
OP 253	The Intersection of Global Biodiversity Conservation Prioritization Areas and Mercury Threat Author: Mark E.H. Burton	156
OP 255	Stable isotopes and mercury in the trophic niche of the 'Lesser Goa Mustard Tarantula' <i>Thrigmopoeus truculentus</i> (Pocock, 1899), Goa, India Author: Manoj Borkar	157
OP 258	Advances in the global multimedia modelling of mercury: model improvements and constraining of inputs using MCMC Author: Asif Qureshi	158
OP 261	Training Tomorrow's Policymakers in Science-Informed Environmental Governance Author: Svetoslava Todorova	159
OP 264	Field Lab for Mercury Analysis of Amazonian Indigenous Hair, Brazil Author: ZULEICA CARMEN CASTILHOS	160
OP 269	Mercury Monitoring in the Caribbean Region Author: Dr Linroy Christian	161
OP 270	Environmental monitoring of Yanomami Land and the Upper Amazonas network Author: ZULEICA CARMEN CASTILHOS	162
OP 271	Hemp cultivation reduces mercury volatilization but increases solubility and leaching potential in contaminated soils Author: Antoine Delemazure	163
OP 272	Spatial and temporal trends of mercury in sediments off Goa, central West Coast of India Author: Krushna Vudamala	164
OP 273	Global use of mercury in Ayurvedic medicine Author: Peter Maxson	165
OP 274	Assessing Biodiversity Impacts from Mercury Release in Artisanal Small-Scale Gold Mining Using Birds as Indicators Author: David Evers	166

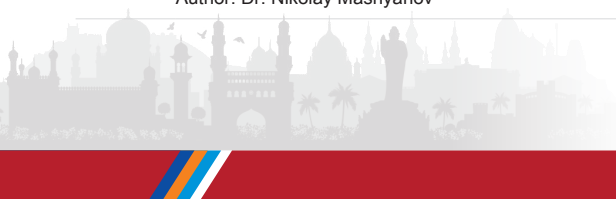
ID	Title	Page No.
OP 275	Mercury–biodiversity risk landscapes in artisanal gold mining systems of the Peruvian Amazon Author: Luis E. Fernandez	167
OP 276	Converting marine methylmercury science to decision-grade evidence: an evidence-to-action framework for Minamata Convention implementation Author: Luis E. Fernandez	168
OP 280	Atmospheric mercury monitoring to support international priorities Author: Alexandra Steffen	169
OP 421	Early-life invisible exposure: mercury in breastmilk and neonatal vulnerability in the Brazilian Amazon Author: Marta Turull	170
OP 1051	Mercury in avian ecosystems in India Author: Mahendiran M	171
OP 1056	Mercury in Biota – global synthesis of monitoring data for Effectiveness Evaluation Author: Mark Burton	172
OP 1057	Levels, Trends, and Spatial Patterns Across Environmental Media and Natural Archives: Insights from the First Synthesis Supporting the Minamata Convention Effectiveness Evaluation Author: Svetoslava Todorova	173
OP 1058	Effects of an Extreme Drought Event on Mercury Biogeochemistry in Central Amazon Sediments Author: Gabriela Santos Caldeira	174
OP 1059	A scoping initiative of the Arctic Monitoring and Assessment Programme (AMAP) to advance mercury monitoring in the Arctic using mercury stable isotopes Author: Sofi Jonsson	175
OP 1063	Mercury Removal Through Adsorption with Coal Fly Ash and Bottom Ash: Analysis Using Box-Behnken Design Author: Fuzi Suciati SASTRAATMAJA	176
OP 1064	Dimethylmercury contributes to mercury burdens in the California Current System Author: Erik T. Paulson	177
OP 1065	Human biomonitoring of mercury exposure in a vulnerable population: Levels, trends, sources, and economic impacts. Author: Brij Mohan Sharma	178
OP 1066	The Global Chemicals Monitoring Programme (GCMP) and its Contributions to the Effectiveness Evaluation of the Stockholm and Minamata Conventions. Author: Brij Mohan Sharma	179

ID	Title	Page No.
OP 1067	Eliminating mercury from pore characterization using eutectic gallium-indium porosimetry Author: Stefan Stauder	180
OP 1070	From Emissions to Metabolism: Addressing Gaps in National Mercury Accounting Author: Yvonne Ryan-Fogarty	181
OP 1212	Accelerating the Transition to Mercury-Free Healthcare: WHO Leadership, Global Partnerships, and Implementation of the Minamata Convention Author: Elena Jordan	182
OP 1213	mercury in traditional medicine in South Africa Author: Renee Streets	183
OP 1214	Rethinking Future Mercury in Fish: Bridging Model Predictions with Observations Under Global Emission Scenarios Author: Henna Gull	184
OP 1215	Mercury and its speciation in a few traditional formulation Author: Asif Qureshi	185
OP 1216	High lead and mercury exposure related to intake of Ayurvedic pharmaceuticals. Author: Marcial Velasco Garrido	186
OP 1217	Science Policy Interface on Chemicals, Waste and Pollution: A New Intergovernmental Panel Author: Sandra Averous-Monnery	187
PP 13	Mercury concentrations in the surface bottom sediments eastern Arctic seas Author: Ivanov Maksim	188
PP 17	Mercury in Drinking Water in a Historically Contaminated Mining Area: Integrated Assessment, Isotopic Evidence and Human Health Risk Evaluation in Idrija, Slovenia Author: Jože Kotnik	189
PP 22	Mercury in gas and oil deposits Author: Vladimir Ryzhov	190
PP 28	Key requirements and best practices for measurement comparability in marine mercury speciation analysis Author: Igor Živković	191
PP 36	Climate Controls on Holocene Mercury Dynamics Across Alaskan Arctic Terrestrial and Marine Systems Author: Masao Uchida	192



ID	Title	Page No.
PP 40	Simultaneous Measurement Using Gold Amalgamation Enrichment Mode and Direct Mode: A Creative Way Using Atomic Fluorescence Analytical Method for Mercury Analysis in Environmental Waters Author: Yumi Shimozuru	193
PP 41	Study on the Development of an Automated Cold-Vapor Atomic Fluorescence Spectrometry (CV-AFS) Analysis System for USEPA Method 1631E Author: Naoko Hishida	194
PP 44	From Regional Background to Global Signals: A Long Term Record of Atmospheric Mercury Concentrations and Wet Deposition at the Iskrba Regional Background Station (Slovenia) Author: Jože Kotnik	195
PP 45	"Food of the future": mercury determination in microalgae-based supplements by direct analysis Author: Valentina Carrara	196
PP 50	A geographic assessment and representation of mercury (Hg) concentrations in selected South African freshwater environments from 2022-2025 Author: Vernon Sydwil Somerset	197
PP 51	Department of Energy Savannah River Site Mercury Legacy: Progress in addressing Technical Challenges Author: Christopher J. Bannochie	198
PP 53	Automated, dynamic, SI-traceable field calibration of atmospheric elemental and oxidized mercury Author: Seth Lyman	199
PP 57	Climate-driven variability in the global mercury cycle: long-term warming and ENSO effects in a coupled atmosphere–ocean–land mercury model Author: Toru Kawai	200
PP 63	Arctic Permafrost as a Millennial Mercury Sink: Records from St. Lawrence Island, Bering Strait Author: Masao Uchida	201
PP 64	Impact of the U-768 wreck on mercury concentrations in sediments, bottom waters, and marine organisms Author: Rokhsana Malec	202
PP 66	Mercury concentrations in feathers, guano, and eggshells of Pygoscelis penguins from Admiralty Bay (Antarctica) Author: Rokhsana Malec	203
PP 77	Development of a Hg flux prediction model from unsaturated soils: An approach considering multiple Hg species and their potential of volatilization Author: Monami Kondo	204

ID	Title	Page No.
PP 81	Development of a Diagnostic Method for Prioritizing Remediation Measures for Residual Mercury in Mercury-Contaminated Areas Author: Kohji Marumoto	205
PP 83	DIRECT MERCURY SPECIATION IN SOLID SAMPLES USING THERMAL RELEASE COUPLED TO ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY Author: Dmitrii Yur'evich Troitskii	206
PP 85	Variability in mercury and dissolved organic matter quality in relation to catchment-lake processes: a spatiotemporal analysis in two deep oligotrophic lakes of Northern Patagonia (Argentina) Author: Rizzo Andrea	207
PP 86	Rapid Combustion and Trap Method for Concurrent Determination of Total Mercury and Sample Preconcentration for Stable Isotopes Analysis Author: NIMELAN VEERASAMY	208
PP 89	Legal and illegal gold mining in the Amazon: mercury species distribution and stable isotopes discrimination in a gold mine Author: Naomi NITSCHKE	209
PP 91	Presence of mercury in archaeological sites: The Tartessian sanctuary of La Bienvenida, adjacent to the Roman town of Sisapo (Ciudad Real province, Spain). Author: Mar Zarzalejos	210
PP 96	Mercury dynamics in shallow, pristine lakes of the Patagonian Andes (Argentina): climate influence on terrestrial inputs and internal processes Author: Zaida Fernandez	211
PP 100	Performance Evaluation of a Novel Screening Tool for Mercury in Skin-Lightening Creams to Overcome Analytical Burden Author: Sora Yasumatsu	212
PP 102	Immune Toxicity of Methylmercury Following Oral Exposure at Environmentally Relevant Levels Involves Myeloid HIF-1 α Regulation Author: Guangbo Qu	213
PP 108	Distribution of Total and Organic Mercury Concentrations in Soils from an Artisanal and Small-Scale Gold Mining Area and Mercury Elution from Contaminated Soils Author: Takashi Tomiyasu	214
PP 111	High-Frequency Observations of Dissolved Gaseous Mercury (DGM) in Korean Coastal Waters: Environmental Controls and Lagged Photochemical Responses Author: Huu-Viet Nguyen	215
PP 123	Air mercury monitoring in the Baikal Lake region, Siberia Author: Dr. Nikolay Mashyanov	216



ID	Title	Page No.
PP 128	Concentration, distribution, and speciation of mercury in hydrothermally altered ground from the Lakki Plain (Nisyros Island, Greece) Author: Federica Meloni	217
PP 134	Mercury in fur of some pinniped's species from different regions of Russia Author: Yuri G. Udodenko	218
PP 140	Methylmercury formation in Hg ²⁺ -spiked paddy soils: Relationships with soil composition, temperature, and microbial communities Author: Miku Bono	219
PP 143	Bedrock-Controlled Mercury Partitioning and Export in Glacier Meltwater River to Arctic Fjords Author: Hakwon Jeong	220
PP 144	Mercury in Antarctic vegetation as an indicator of uptake routes and bioavailable forms Author: Dominika Saniewska	221
PP 145	Mercury contamination in polar fish: Bioaccumulation and trophic transfer in <i>Notothernia coriiceps</i> from Admiralty Bay, maritime Antarctic Author: Dominika Saniewska	222
PP 149	Study of mercury–selenium interactions including nanoparticles in Brazilian Amazonian freshwater fish Author: María Jiménez-Moreno	223
PP 150	Measurements of Ambient PM _{2.5} -Bound Mercury in Windsor, Canada Author: Xiaohong Xu	224
PP 154	A Two-Step Reversible Model for Hg(II) Photoreduction: The Synergistic Roles of Thiolic DOM and Bicarbonate in Seawater Author: Seunghee Han	225
PP 161	Assessment of Heavy metal Concentration in the Pra River at the Shama District, Western Region, Ghana. Author: Winnifred Aku Adotey	226
PP 165	Synergistic Sulfur-Functionalized Phosphorylated Chitosan Nanocomposite for Enhanced Electrochemical Detection and Adsorptive Removal of Mercury(II) Ions from Aqueous Environments Author: Michael J. Klink	227
PP 177	Sources and cycling of mercury in the Baltic Sea following the entry into force of the Mianma Convention Author: Magdalena Beldowska	228



ID	Title	Page No.
PP 187	The Antarctic Shag (<i>Leucocarbo bransfieldensis</i>) as a bioindicator of mercury and methylmercury contamination in the King George Island (South Shetland Islands, Antarctica) Author: Maja Kuznik	229
PP 191	The Minamata Convention on Mercury in Slovenia: An Evaluation of Policy Implementation and Effectiveness in Relation to the Phase-Out of Dental Amalgam Author: Vanja Usenik	230
PP 202	Mercury variability in soils of in Arctic valleys in Svalbard Author: Wiktoria Zawrzykraj	231
PP 234	Preliminary Results from Monterey Bay Mercury Species Intercalibration Author: Carl Lamborg	232
PP 252	A Validated Method for Accurate Isotopic Analysis of Total Mercury, Methylmercury and Inorganic Mercury in Environmental Samples. Author: Elizabeth Crowther	233
PP 259	Geochemical redistribution of mercury in freshly added and aged mining soil systems Author: Sandra Carrasco-Gil	234
PP 1071	Mercury concentrations in the muscles and liver of waterbirds from the Curonian Lagoon, Kaliningrad Region (Russia) Author: Petr M. Glazov	235
PP 1072	Mercury concentrations in the organs of waterfowl from Central Yakutia (Russia). Author: Yuri G. Udodenko	236
PP 1515	A Novel Device Based on a Polymer Inclusion Membrane for the Monitoring of Hg in a Wastewater-Based Epidemiology. A Preliminary Study In Natural Waters Author: Marta Turull	237
PP 1516	Assessment of Bioaccumulation Potential of Selected Heavy Metals through Edible Macrophytes Author: Thokchom Grebilla	238
PP 1517	Beyond Awareness: Trust, Behavioural Economics, and the Gold Buyer as a Catalyst for Mercury-Free Artisanal Mining in Mali Author: Albekaye Samake	239
PP 1518	Decadal Variability of Mercury in the Sediments of Kongsfjorden, Svalbard, Arctic Author: Kannan VM	240
PP 1519	Decoupled Mercury and Methylmercury Dynamics Along a River-to-Terminal-Lake Gradient in the Korgalzhyn Nature Reserve, Kazakhstan Author: Alisher Alibekov	241

ID	Title	Page No.
PP 1520	Functional and Structural Dynamics of merA: Molecular Profiling and in Silico Insights Into Hg ²⁺ Reduction and Bioremediation By the MR1_IITISM Strain Author: Indrani Das	242
PP 1521	Human Health Risk Assessment of Mercury Exposure via Consumable Fish From East Kolkata Wetlands: Evidence from Kolkata Markets Author: Manish Kumar Sharma	243
PP 1522	Maternal Hair Mercury Levels and Associations with Neonatal Outcomes in the Brazilian Amazon Author: Marta Turull	244
PP 1523	Mercury in the Indian Coastal and Open-Ocean Water Column: Challenges and Future Directions Author: Sneha Hanchinamani	245
PP 1524	Mercury Pollution in River Ecosystems: Implications for Biodiversity Conservation Author: Mohd Kamaluddin Sheikh	246
PP 1525	Methyl Mercury Toxicity and Nanomaterial-Based Remediation Author: G. Satheesh	247
PP 1526	Multivariate Analysis of Mercury : Geochemical Associations and Hydrothermal Signatures Author: G. Satheesh	248
PP 1527	Quantifying Carbonate Turnover and Mercury Source Variations Along the Walvis Ridge Hotspot Trail, South Atlantic Ocean Author: Siddhant	249
PP 1528	Scope of utilizing lichens as biomonitors of atmospheric mercury pollution in India Author: Farishta Yasmin	250
PP 1529	Temporal and Spatial Comparison of Sedimentary Mercury in Vembanad Lake System, Kerala, India Author: Arun Ramachandran	251



ABSTRACT ID: OP 12

Title	Spatial variation in mercury concentrations in Mankweng, South Africa
Lead Author	Monray Dean Belelie
Co-Authors	Anzel De Lange, Farina Lindeque

ABSTRACT

South Africa ratified the Minamata Convention on Mercury in 2013 and became an official Party in 2019, committing to reducing anthropogenic mercury (Hg) emissions. Despite this commitment, ambient Hg monitoring has largely been limited to the Cape Point Global Atmospheric Watch station, a regional background site representing baseline atmospheric conditions. Measurements from the South African interior remain scarce and have primarily focused on industrial Air Quality Priority Areas dominated by large point sources. Communities where municipal waste removal is inconsistent or absent have not been assessed, despite informal waste burning being a common disposal practice and a potential source of atmospheric Hg. In many low-income settlements, uncollected waste is openly burned, yet the influence of this activity on local atmospheric Hg concentrations remains unknown. This study aims to assess the spatial variation in atmospheric Hg concentrations within a South African low-income settlement comprising two sub-areas: one receiving regular municipal waste removal services and the other receiving intermittent or absent waste removal. Sampling will be conducted from April to September 2026 to evaluate whether differences in service delivery are associated with localised Hg enhancements. The findings will provide the first baseline assessment of atmospheric Hg in a South African settlement affected by informal waste burning, contributing to improved emission inventories and supporting the country's ongoing obligations under the Minamata Convention.

ABSTRACT ID: OP 14

Title	Values of access to information, inclusion and participation creates the enabling environment for change.
Lead Author	Ruth Spencer
Co-Authors	

ABSTRACT

Local consultative processes that includes and allows for the full and effective participation of the people of the island will provide information and knowledge sharing that will enable us collectively to remove the prevailing ignorance and stop the harm to people from using skin lightening products with mercury. This method of uses the All of Society approach will reach the immigrants whose culture uses bleaching creams. The local ownership and buy in creates the environment the mechanism and the engagements to provide the data and the needed actions to bring about the changes.

The GEF 9 strategy embraces this approach coupled with strong localization efforts respecting the culture and local knowledge systems. Using a multifocal people centered approach focuses on harm to people and the environment from SLP , from chemicals of concern, waste and pollution targets the dangers to human and environmental health. It also ensures the effective and efficient use of resources.

The messages will come from trusted persons .whose words will they will listen to and believe,

As a follow up to the National Mercury Management program where the actions of 4 NGO's marked the turning point to get the population on board .led to the engaging of local community churches, youth, women, vulnerable and marginalized group in mercury management. Governance requires going to the people, hearing their voices, build trust and respect that leads to stewardship of our lives to control what we put into our bodies.

ABSTRACT ID: OP 15

Title	New insights into the trends and uncertainties in atmospheric mercury redox chemistry
Lead Author	Aryeh Feinberg
Co-Authors	A. Saiz-Lopez, C. A. Cuevas, R. P. Fernandez, J. Sonke, J. M. C. Plane, D. Roca-Sanjuán, T. Jokinen

ABSTRACT

The distance that mercury can travel in the atmosphere is determined by its redox chemistry, since elemental mercury (Hg^0) is insoluble and long-lived (~6 months), while oxidized divalent mercury (Hg^{2+}) is rained out within days. However, there are many uncertainties associated with Hg chemistry, leading to uncertain predictions of its fate and ecosystem impacts. In this presentation, I present results from our Horizon Europe-funded MSCA-PF project SUMAC that investigated the trends and uncertainties in atmospheric Hg chemistry.

Firstly, we investigated the role of historical trends in oxidant concentrations (e.g., ozone and halogens) in impacting Hg^0 oxidation. Using the chemistry-climate model WACCM, we studied Hg chemistry in preindustrial and present-day atmospheres. Our results suggest that in the Northern Hemisphere Hg^0 is oxidized 16% quicker in the present-day atmosphere compared to the preindustrial due to increases in two of its oxidants (O_3 and OH radicals). On the other hand, in the Southern Hemisphere the oxidation of Hg^0 slows by 20% due to decreases in a different oxidant, the Br atom. These regional oxidation changes shift Hg deposition patterns, increasing Hg delivery to tropical and subtropical oceans where tuna fisheries are located.

Secondly, an ongoing uncertainty is the role of iodine in Hg oxidation. We have implemented new iodine-mercury reactions in the WACCM model and evaluated the importance of iodine in Hg cycling. Iodine was found to contribute a minor direct role in Hg^0 oxidation, with the largest importance found in the lowermost stratosphere where iodine contributes around 10% of oxidation. The indirect role of iodine on Hg^0 oxidation can also be substantial, due to its impacts on important Hg^0 oxidants (O_3 , OH, and Br).

Lastly, we present efforts to use ambient measurements to improve our understanding of Hg chemical mechanisms, with the goal of refining global atmospheric Hg models.

ABSTRACT ID: OP 16

Title	Estimation of mercury released into the environment from the uncontrolled dumping of broken medical thermometers in hospitals in Cameroon, Africa
Lead Author	Samuel TETSOPGANG
Co-Authors	

ABSTRACT

The yearly mercury released into the environment from discarded broken thermometers was estimated through questionnaires submitted to medical personnel in two major cities, namely Yaounde and Bertoua, in Cameroon. 83 medical personnel made up of 17 assistant nurses, 56 nurses + midwives and 10 physicians responded to have handled a total of 3216 units of thermometers made up of 85% Hg-added and 15% digital during consultations. 624 units, all Hg-added and making about 19% of thermometers got broken during health consultations. This breakage led to the average annual disposal of 0.646 Kg of mercury. The mean rates of mercury release from broken thermometers were assessed to 0.056, 0.005 and zero, and 0.009, 0.002 and zero Kg per year, respectively, for assistant nurses, nurses + midwives and physicians in bigger and smaller cities, respectively. Assistant nurses alone disposed of 73%, 27% by nurses + midwives, and none released by physicians for the total estimated of 222.52 Kg of mercury disposed of from broken thermometers by medical personnel in hospitals in Cameroon. Out of the total mercury estimated, 63.71% and 36.21% were disposed of by medical personnel in bigger and smaller cities, respectively. The circumstances of the accidental broken of these mercury-added thermometers will expose medical personnel, patients, and the public to this toxic chemical.

ABSTRACT ID: OP 23

Title	Relationships between Selenoneine, Ergothioneine, Methylmercury, and Blood Parameters among Inuit Living in Nunavik, Northern Quebec
Lead Author	Alexandrine Roy
Co-Authors	(1,2,3)Pierre Ayotte, (1,2)Mariia Samoilenko, (2)Marcos Yedjenou, (4)Amira Aker, (5)Matthew Little, (1,2,6)Mélanie Lemire

ABSTRACT

Anemia is particularly prevalent in Nunavik coastal communities, as highlighted by the Qanuillirpita? 2017 Inuit Health Survey (Q2017). Its causes are multifactorial, including iron deficiency, chronic inflammation, and unexplained factors. High exposure to methylmercury (MeHg), found in certain local country foods, may contribute to anemia in Nunavik by binding to hemoglobin (Hb) and other critical proteins, inducing oxidative stress, disrupting iron and cellular homeostasis and shortening RBC lifespan. Conversely, marine country foods are central to Inuit culture and diet, and rich in several nutrients such as iron as well as two structurally related antioxidants: selenoneine (SeN) and ergothioneine (ESH). SeN may bind to Hb, protecting Hb and RBCs from oxidative damage caused by MeHg, and enhance MeHg detoxification. ESH may also protect RBC by preventing Hb and iron oxidation. This study uses Q2017 data to explore the associations between MeHg, SeN, and ESH with RBC parameters, including Hb concentration, hematocrit (HCT), mean corpuscular volume (MCV), RBC count, mean corpuscular hemoglobin (MCH), and RBC distribution width (RDW), as well as serum ferritin, iron status and anemia. Descriptive analyses and Bayesian Kernel Machine Regression (BKMR) analysis were used while adjusting for confounders. Hb, HCT, MCV, and RBC count were positively associated with MeHg and ESH, consistent with their preferential accumulation in RBCs. RDW was positively associated with MeHg, suggesting a decreased RBC integrity and lifespan while the contrary was observed for SeN, indicating a potential protective role against MeHg. Both SeN and EGT were associated with higher serum ferritin, whereas MeHg was negatively associated with this iron status marker. Overall, this study highlights that MeHg, SeN, and ESH may interact within RBCs and influence RBC lifespan and iron-related markers, and the importance of further studying SeN and EGT in coastal populations living off the consumption of marine species.

ABSTRACT ID: OP 24

Title	How and Where to Act? A review of policies and initiatives for controlling mercury contamination from gold mining to protect biodiversity in the Amazon
Lead Author	Allison Aldous
Co-Authors	Nick Fromherz, Vitor Domingues, Aline Lopes, Débora G. Zanetti

ABSTRACT

Gold mining using mercury is the largest source of mercury pollution worldwide, with particularly harmful consequences for freshwater fish and other biodiversity. Its impacts are especially severe in the Amazon, where illegal and informal gold mining destroys freshwater habitats and contaminates fish that many Indigenous peoples and local communities rely on for food. Gold mining with mercury has grown significantly in the past decade due to rising gold prices and governance challenges, and mercury levels in fish and fishing communities in parts of the Amazon exceed the World Health Organization's safety limits.

Mercury use in gold mining has drawn substantial attention over the past decade in both scientific literature and mainstream media. Yet determining how civil society can most effectively respond remains difficult because of the problem's scale, complexity, and deep links to illicit economies. To clarify where engagement is most needed, we developed a database of organizations working on these challenges and analyzed it to identify gaps and opportunities. One of the most striking gaps we found was the limited focus on national level legal and policy reform.

Given these findings, we examined the legal and policy frameworks governing mercury use and gold mining in five countries: Ecuador, Brazil, Peru, Colombia, and Bolivia. All five countries address the problems of gold mining using mercury in different ways. No single country has the best approach, and much can be learned from the successes and shortcomings of each. Here we present the key elements of effective policy: controls on mercury import, sale and trade; gold sector formalization; gold supply chain certification; environmental remediation; rights and engagement of Indigenous peoples and local communities; and cross-border cooperation, including through coordinated law-enforcement operations and improved exchange of information relevant to investigation and prosecution of illegal gold mining, mercury trafficking, and money laundering.

ABSTRACT ID: OP 25

Title	Assessing ecological risk of mercury in subsea oil and gas infrastructure to inform decommissioning
Lead Author	Tom Cresswell
Co-Authors	Alexandra Boyd, Marie Thomas, Elisabeth Tondl, Flora Mansour, Lhiam Paton, Francesca Gissi

ABSTRACT

Australian legislation requires the complete removal of all offshore oil and gas infrastructure at the end of operations. However, leaving certain infrastructure in situ may be permissible in limited circumstances, if environmental impacts and risks are acceptable among other requirements. Mercury within gas streams may accrue on internal surfaces of subsea export pipelines, which may present a risk to marine ecosystems if contaminated infrastructure remains on the seabed following decommissioning. This paper will present studies that have identified key mercury species present in natural gas distribution infrastructure, the potential fate of such species in the marine environment, and research into the potential bioaccumulation and food web transfer by marine organisms. This research fills critical scientific knowledge gaps concerning the risks associated with toxic contaminant releases from abandoned offshore infrastructure, to improve environmental risk assessments and support decommissioning decision making.

ABSTRACT ID: OP 26

Title	Bridging Research and Policy for Mercury Management in Australia: Outcomes from the 2025 Mercury Australia Network Workshop
Lead Author	Tom Cresswell
Co-Authors	Darren Koppel, Jenny Fisher, Simon Apte, Larissa Schneider

ABSTRACT

Robust science is important to develop and inform policy for the protection of the environment. However, there are not always clear communication pathways between research academics and those in government to inform and strengthen national policy on environmental protection. In November 2025, the Mercury Australia Network hosted a one-day workshop attended by twenty-six representatives, including researchers in the university and government sectors and policymakers and regulators from Australian Federal and State/Territory Governments. The workshop focussed on four key themes related to mercury (Hg) with links back to the Minamata Convention on Mercury:

- 1) Hg waste management, including for the emerging field of offshore oil and gas infrastructure;
- 2) Hg releases and contaminated sites in Australia, including historical contamination;
- 3) Hg exposure, pathways, and risks to human health;
- 4) Challenges for effectiveness evaluation (data gaps and lag times, i.e. between policy decisions and implementation, and between emission reduction and effects due to natural processes).

The Workshop also surveyed participants using an online interactive platform and the results were discussed in real-time. Survey questions included “What is the number one priority for mercury management in Australia?” and “How should the Australian research community and Government work together on managing mercury issues?”. Responses to the latter included improved data sharing & transparency (addressing confidentiality and public scrutiny issues), establishment and improvement of communication platforms, policy integration (i.e., linking research to regulation), improving national and international collaboration, improved resourcing via pooled expertise and shared fellowships, and focussing on multidisciplinary, applied and community-inclusive research, especially in collaboration with Indigenous peoples.

This presentation will summarise the key research insights and policy considerations discussed at the Workshop for each of the above themes, and will highlight the value of bringing together researchers, regulators, and policymakers for the improvement of environmental protection from mercury

ABSTRACT ID: OP 27

Title	Modeling mercury cycle in the global ocean using NEMO-PISCES - redox reactions sensibility tests and impact of hydrothermal sources
Lead Author	Brunet Eline
Co-Authors	Dutay Jean-Claude, Heimbürger-Boavida Lars-Eric

ABSTRACT

Mercury species are implemented in the global ocean NEMO-PISCES model first following the approach proposed by Zhang et al. (2014). It considers three inorganic mercury species: elemental gaseous mercury (Hg_0), oxidized mercury (Hg^{2+}), and particle-bound mercury (pHg), under both natural and anthropogenic conditions. The model includes major mercury sources such as atmospheric Hg_0 deposition, air-sea Hg_0 gas exchange, and riverine inputs (Liu et al., 2021). In our approach we have also considered hydrothermal inputs, that are rarely taken into account in ocean mercury modelling studies.

Mercury is removed from the ocean through two primary pathways: evasion of Hg_0 to the atmosphere via air-sea gas exchange, and burial of pHg in marine sediments. Mercury burial depends on pHg and particulate organic carbon concentrations as well as on the partition coefficient, which remains poorly constrained, with reported values ranging from 2×10^4 to 5×10^5 L/kg.

In the interior of the ocean, transformations between Hg_0 and Hg^{2+} are controlled by three types of redox processes. Photochemical redox reactions depend on photosynthetically available radiations, while biogenic redox reactions are parameterized either using cyanobacteria concentrations or particulate organic carbon remineralization as proxies. In addition, dark redox reactions, while weaker at local scales, constitute the dominant global control due to their occurrence throughout the full water column (Lamborg et al., 2021). The net reduction rate is a key regulator of surface Hg_0 concentrations and therefore strongly controls air-sea mercury exchange, one of the main oceanic mercury sinks.

In this study we have investigated the sensitivity of the model to different redox parameterizations and the importance of the hydrothermal source in the mercury global ocean natural and anthropogenic budget. Simulation are evaluated by comparison with observations derived from different oceanic campaigns, such as the GEOTRACES program.

ABSTRACT ID: OP 29

Title	Multi-year Assessment of Atmospheric Mercury Deposition in a Tropical Urban Megacity: Flux Variability, Driving Factors, and Washout Processes
Lead Author	Ly Sy Phu Nguyen
Co-Authors	Le Quoc Hau, Nguyen Thi Thuy, To Thi Hien

ABSTRACT

Atmospheric deposition is a critical process in the global mercury (Hg) cycle, particularly in tropical regions with intense precipitation. However, observational data of Hg deposition remain scarce, particularly across the tropical Southeast Asia region. This study presents two years of bulk Hg deposition measurements in Ho Chi Minh City (HCMC), a tropical urban megacity in southern Vietnam. THg concentration ranged from 1.87 to 47.1 ng L⁻¹, with the volume-weighted mean (VWM) THg concentration of 14.5 ng L⁻¹. The annual Hg deposition flux was estimated to be 27.6 µg m⁻² yr⁻¹, indicating substantial atmospheric Hg input to HCMC. Seasonal variations were evident, with significantly higher THg concentrations observed during the dry season (December-April). In contrast, deposition fluxes peaked during the rainy season (May-November), driven by enhanced precipitation amount despite lower concentrations. Approximately 78.3% of Hg deposition in HCMC was attributed to south-southwest transport pathways associated with the East Asian monsoon, as indicated potential source contribution function. Principal component analysis revealed that Hg originates from multiple sources, dominated by anthropogenic combustion and influenced by meteorological conditions. A marked decline in THg concentrations within the first 5-10 minutes of precipitation indicated the importance of below-cloud scavenging. This phase was typically followed by a relatively stable THg concentration period, during which differences among events suggested variation in cloud scavenging efficiencies. The estimated precipitation depth required for full washout efficiency was 6-7 mm. Our study provides critical insights for supporting the development of Hg emission mitigation strategies in rapidly urbanizing tropical regions.

ABSTRACT ID: OP 30

Title	Quantifying the Role of Atmospheric Oxidants (OH, O ₃ , and Br) in Mercury Oxidation Using an Environmental Chamber
Lead Author	Alexis Harper
Co-Authors	Jaron Hansen, Lizzy Lowe, Dallin Giauque, Callum Flowerday, Zach Giauque

ABSTRACT

Elemental mercury (Hg⁰) is the predominant form of mercury in the atmosphere. Although relatively inert and not immediately toxic, its long atmospheric lifetime enables global transport. Once oxidized to more reactive species, mercury becomes more water-soluble and readily deposits onto surfaces, where it can enter ecosystems and be converted into compounds such as methylmercury that are toxic and bioaccumulative in organisms. These transformations pose risks to human and ecological health.

Computational studies have identified hydroxyl radicals (OH), ozone (O₃), and halogen species, particularly bromine (Br), as key oxidants driving atmospheric mercury oxidation. However, direct experimental validation under controlled conditions remains limited.

To address this gap, we constructed a 35 cubic meter polytetrafluoroethylene (PTFE) environmental chamber equipped with UV-B lamps to simulate atmospheric conditions. Elemental and oxidized mercury were measured using a dual channel Tekran system and a modified Reactive Mercury Active System (RMAS). Selected oxidants were measured according to their absorbance in different Broadband Cavity-Enhanced Absorbance Spectrometers (BBCEAS). In this study, we systematically introduced elemental mercury and selected oxidants into the chamber to investigate their individual and combined contributions to mercury oxidation. Promising preliminary results show that nitrous oxide (NO) can contribute to oxidizing Hg, even in dark conditions without photolysis, which was not previously predicted in computational models. While data has been collected on NO as a contributor to mercury oxidation, future studies will include introducing other chemical species, such as HONO, ozone, and bromine, to assess the effects of other oxidants in this larger atmospheric mechanism. By quantifying oxidation rates under controlled conditions, mechanistic understanding of atmospheric mercury transformation pathways will improve, allowing for refinement of global models of mercury cycling and deposition.

ABSTRACT ID: OP 31

Title	Oxidation of Aqueous Elemental Mercury: An Overlooked Process Driving Atmospheric-Oceanic Mercury Input
Lead Author	Yongguang Yin
Co-Authors	Yanwei Liu, Xiaoyan Zhang, Yong Cai, Guibin Jiang

ABSTRACT

The ocean is one of the largest active pools in the global mercury cycle and participates in the global redistribution of mercury through storage, re-release, and ocean current transport, thereby affecting the spatial distribution and long-term fate of mercury. By controlling the diffusion, formation, and oxidation of elemental mercury (Hg(0)) in seawater, the ocean surface layer directly regulates the direction and intensity of the air-sea Hg(0) exchange, a key cross-sphere flux, which in turn affects the atmospheric background mercury level and the flux budget of the global mercury cycle.

The air-sea Hg(0) exchange flux is usually calculated based on the thin-film gas exchange model (as shown in Equation 1):

$$F = K_w \times ([\text{Hg}^{\text{aq}}] - [\text{Hg}^{\text{air}}] / H') \quad (1)$$

where F is the air-sea Hg(0) exchange flux; k_w is the gas exchange rate, which is mainly parameterized by dynamic conditions such as wind speed; $[\text{Hg}^{\text{aq}}]$ and $[\text{Hg}^{\text{air}}]$ are the concentrations of dissolved Hg(0) in surface seawater and Hg(0) in the atmosphere above the ocean, respectively; H' is the dimensionless temperature-corrected Henry's law constant. As shown in Equation 1, the Hg(0) concentration gradient between the ocean and the atmosphere determines the direction and intensity of the flux. Theoretically, the oxidation of aqueous Hg(0) will drive the input of Hg(0) from the atmosphere to the ocean, and further control key processes such as the settlement and methylation of particulate mercury in the water column.

This presentation will present the biological (microalgae) and chemical (organic matter, carbonate radicals, etc.) oxidation of Hg(0) in the marine aqueous phase, as well as its driving role in the input of Hg(0) from the atmosphere to the ocean.

ABSTRACT ID: OP 32

Title	Mercury Exposure: It's occupational...right?
Lead Author	Daniel Cronje
Co-Authors	

ABSTRACT

This case study examines a misattributed source of mercury exposure in a welder who presented with elevated blood mercury levels during routine health surveillance.

Initial investigations focused on occupational exposure due to the worker's role in metal repair and fabrication, particularly welding inside Liquefied Petroleum Gas (LPG) tankers. Notably, no pre-placement medical assessment for baseline blood mercury level was conducted.

A walkthrough survey and review of the task-based risk assessment (TBRA) identified potential mercury exposure from inadequate respiratory protection during welding on surfaces potentially impregnated with elemental mercury. The TBRA was subsequently updated to mandate the use of Powered Air Purifying Respirators (PAPR) fitted with mercury-specific filters.

To evaluate the effectiveness of controls, a quantitative occupational exposure assessment was performed. Both static and personal air samples revealed no significant airborne mercury concentrations, leading to a reclassification of the work as low risk. However, follow-up biological monitoring showed a continued rise in blood mercury levels. In accordance with company procedures, the welder was removed from the work area to ensure mercury levels returned to within acceptable limits.

Subsequent investigation shifted to non-occupational sources. A detailed personal history and questionnaire revealed daily use of a skin-lightening cream imported from overseas. Laboratory analysis confirmed significant levels of mercury in the product. Discontinuation of the cream resulted in gradual clinical improvement, with blood mercury levels normalising within six months.

This case highlights the critical importance of pre-placement medical assessments and baseline biological monitoring. It also underscores the need to consider non-occupational and culturally specific sources of toxic exposure in differential diagnoses.

ABSTRACT ID: OP 34

Title	Forty-five Year Trying to Eliminate Mercury in Artisanal Gold Mining: Frustrations and Accomplishments
Lead Author	Marcello M. Veiga
Co-Authors	

ABSTRACT

As a Brazilian-Canadian scientist, I provide comments about my 45 years of experience working as a metallurgical engineer, environmental geochemist, academic, research and consultant on 65 mercury and artisanal gold mining (AGM) projects in 35 countries. In 1982, Dr. Jacques Cousteau, visiting Serra Pelada, an AGM site in the Amazon, alerted authorities about the dangers of mercury pollution. From this date on, Brazilian and other international scientists dedicated their work to assessing mercury in environmental components. Most interventions fail because they lack metallurgical depth and proposing expensive or mineralogically inadequate techniques ignoring the miner's primary desire: better gold production, not mercury elimination. This should be the point of engagement of interventionists with miners. To an artisanal miner, mercury reduction is a secondary consequence. Many projects introduce "mercury-free" processes without first establishing a baseline for current gold extraction efficiency. To successfully engage miners, we must prove that a new method increases the percentage of gold recovered. Because efficient processing plants are capital-intensive, the most effective path forward is a coexistence model. In this framework, artisanal miners focus on extraction while organized, professional companies handle the processing responsibly ensuring both higher yields and the elimination of mercury. This paper provides a historical overview of global initiatives aimed at eliminating mercury in artisanal gold mining, analyzing their primary objectives and the systemic challenges that hindered their success. This study also analyzes case studies from 25 Latin American companies that have successfully implemented coexistence models to eliminate mercury in AGM.

ABSTRACT ID: OP 35

Title	A study of mercury and gold losses at two artisanal gold mining and processing sites in Nigeria
Lead Author	Nnamdi C. Anene
Co-Authors	Marcello M. Veiga, Bern Klein

ABSTRACT

In Nigeria, artisanal and small-scale gold mining (ASGM) involving gravity concentration and amalgamation continues despite ongoing efforts to formalise the sector. To date, technical interventions have not yet delivered the expected outcomes. Often, these initiatives mainly focus on stopping mercury use and addressing health emergencies, frequently overlooking miners' primary desire for higher gold recovery. This, coupled with inadequate regulations, inevitably undermines project acceptance. Nigeria published its national action plan for phasing out mercury in the sector, but inadequate baseline data impede the development of effective technical interventions. Accordingly, this study aims to evaluate the metallurgical balance of gold and mercury at ASGM sites in Uke and Minna, north-central Nigeria. High mercury loss-to-gold production ratios of 3.4 and 2.6 indicate significant inefficiencies in the amalgamation process. In both sites, the studies revealed that 34 to 42% of the mercury added is lost, with 17 to 26% loss to tailings and 16 to 18% volatilised. The study found that 70% and 57% of the gold is lost to the tailings at each site, respectively. As only free gold particles are amalgamated, about 94% of the gold was recovered during the amalgamation of the sluice concentrate. Metallurgical analysis of tailings' size fractions shows most gold is lost in coarse and fine particles, a common feature of gold distribution in artisanal quartz-vein deposits. This highlights the inadequacy of current grinding and sluicing systems in liberating gold and capturing fine gold grains, whether liberated or not. It was noted that the rise in crude cyanidation operations near ASGM sites in Nigeria is driven by the supply of gold-rich tailings. An estimated 8,000 miners operate across both studied sites. Integrating these findings can enable a small-scale plant using cleaner technologies to offer paid processing services to miners, letting them focus on ore extraction.

ABSTRACT ID: OP 37

Title	Climate-driven mercury accumulation and storage dynamics in tropical dry and rainforest
Lead Author	Juan Francisco Morales Arteaga
Co-Authors	Cesar Ivan Alvarez, Harald Biester, Marta Pérez-Rodríguez

ABSTRACT

Through their highly productive vegetation, tropical forests serve as significant global sinks for atmospheric mercury (Hg). However, Hg dynamics and budgets in these ecosystems remain less studied than in other forest types (e.g., temperate, coniferous), particularly in wide-spread tropical dry forests that are excluded from Hg estimation models. We examined how rainfall-driven seasonal changes influence Hg accumulation and storage in secondary tropical dry forests and rainforests by quantifying total Hg in foliage, soil, litter, and wood. In both forests, water availability was the main factor controlling Hg uptake. In rainforests dominated by evergreen trees, foliar Hg remained stable across seasons (53 vs. 52 $\mu\text{g kg}^{-1}$). In contrast, dry forests dominated by deciduous species showed high seasonal variability, with newly flushed leaves containing three times less foliar Hg during the dry than the wet season (17 vs. 51 $\mu\text{g kg}^{-1}$). Litter-derived Hg inputs were also seasonal, with dry forests showing higher inputs to soils during the dry season than the wet season (31 vs. 7 $\mu\text{g m}^{-2}$). In rainforests, litter-derived Hg inputs were also higher in the dry season (44 vs. 24 $\mu\text{g m}^{-2}$). Foliar seasonal patterns were also reflected in wood Hg accumulation, with rainforests characterized by longer leaf lifespans and continuous Hg uptake under humid conditions showing higher Hg concentrations in wood biomass than dry forests (3 vs. 0.9 $\mu\text{g kg}^{-1}$). In soil, continuous litter-derived Hg inputs and denser vegetation in rainforest resulted in soil Hg concentrations that were 3.4 times higher than in dry forests (115 vs. 34 $\mu\text{g kg}^{-1}$). By using the normalized difference vegetation index and soil carbon data, we further estimated the ecosystem service of Hg sequestration in both forests. Overall, our results underscore tropical forests as global Hg sequestrators and accumulators, and highlight the vulnerability of these ecosystems to prolonged drought under climate change.

ABSTRACT ID: OP 38

Title	Assessing risks of methylmercury contamination in the Ankobra estuary, Western Region, Ghana
Lead Author	Sampson D. D. P. Dordaa
Co-Authors	Chris Gordon, Daniel Nukpezah, Abraham K. Anang & Millicent S. A. Kwawu

ABSTRACT

Mercury contamination from artisanal and small-scale gold mining (ASGM) is a major environmental and public health challenge in many developing countries, especially in Sub-Saharan Africa, where illegal gold mining activities are widespread. Mercury (Hg) used in gold amalgamation often enters river systems, where microbial activity and organic matter facilitate its conversion into methylmercury (MeHg), the most toxic form of mercury. This compound bioaccumulates in aquatic organisms and biomagnifies through the food chain, posing serious neurological and developmental health risks to humans through fish consumption. This study assessed methylmercury concentrations in sediments and fish species from the lower Ankobra River and estuary and evaluated potential ecological and human health risks for the Ankobra estuarine community in the Western Region of Ghana. Sediment samples ($n = 10$) and fish tissue samples ($n = 8$) were analysed using Cold Vapour Atomic Absorption Spectrometry (CVAAS). Additionally, a survey of 100 residents was conducted to evaluate fish consumption patterns and potential exposure pathways. MeHg concentrations in sediments ranged from 22.00 ± 4.20 to $61.00 \pm 0.14 \mu\text{g/kg}$, remaining below the World Health Organisation (WHO) guideline limit of $200 \mu\text{g/kg}$. In fish, MeHg concentrations ranged from non-detectable levels to $352.30 \pm 2.40 \mu\text{g/kg}$, which were also below the WHO recommended limit of $500 \mu\text{g/kg}$. However, two species *Channa striata* ($176.90 \pm 2.60 \mu\text{g/kg}$) and *Mugil bananensis* ($352.30 \pm 2.40 \mu\text{g/kg}$), exceeded the United States Food and Drug Administration safety thresholds for frequent consumption. Although ecological risk (Er) and target hazard quotient (THQ) values suggested a low risk, frequent consumption of contaminated fish from the Ankobra river may still pose long-term health risks, especially for children and pregnant women. Community awareness, improved governance and monitoring are needed to reduce exposure risks while supporting sustainable resource management to meet the objectives of the Minamata Convention on Mercury.

ABSTRACT ID: OP 39

Title	Mercury in the Bohai Sea food web: Quantifying trophic transfer, sources, and health risks
Lead Author	Deming Han
Co-Authors	

ABSTRACT

Mercury (Hg) is a global toxic pollutant under Minamata Convention on Mercury. Ocean is one the most important pathway for global mercury transportation, however, there is limited knowledge regarding their bioaccumulation and trophic transfer behaviors within the food web. The methylmercury (MeHg), total mercury (THg) and its isotopes of biota were analyzed to investigate mercury sources, contamination characteristics and biogeochemical cycling in food web in the Bohai Sea. The trophic magnification factor (TMF) analysis results showed that biomagnification of MeHg (TMF = 1.48) was driven by its efficient trophic transfer, whereas inorganic mercury (IHg) underwent biodilution (TMF = 0.58). Shrimp was the most important diet sources (43.3%–47.5%) for crab and cephalopod, followed by gastropod (36.6–41.7%). The binary mixing model results quantified the relative contributions of four major potential sources/processes: anthropogenic direct emission, MeHg demethylation, atmospheric PBM deposition, and other source. Furthermore, we conducted structural equation model (SEM) to interpret and quantify impact of potential factors (e.g. fish size, fish age, trophic level, human activity) on MeHg bioaccumulation of fishes. Based on these geochemical, dietary compositions, and driver of THg and MeHg abundances in biota is beneficial in understanding the mercury trophic transfer and accumulation in the marine food web, under current and future environmental scenarios. Addressing these gaps is essential for accurately assessing the role of these factors influencing mercury variations and their broader implications for response of anthropogenic emissions mitigating to mercury variations in marine food web.

ABSTRACT ID: OP 42

Title	Initiation, expansion and sustainability of laboratory proficiency testing for mercury to enhance collective mercury monitoring capacity
Lead Author	Saito, Mitsugu
Co-Authors	Haraguchi, K., Uchida, K., Hattori, T., Nagasaka, H., Bhari B., Huno, S., Borongan, G.

ABSTRACT

United Nations Environment Programme (UNEP) implemented a Japan -funded project to support countries in the Asia-Pacific region for promoting the Minamata Convention in 2019 – 2025. Laboratory proficiency testing (PT) was planned to support countries conducting laboratory analysis to improve their skills. The PTs has been conducted annually since 2021. Asian Institute of Technology (AIT) was responsible for laboratory engagement and sample distribution, and IDEA Consultants, Inc. was responsible for preparation of PT samples. In 2023, networking webinars were launched to promote information exchanges among PT participating laboratories. After the UNEP project ended in June 2025, the PT and networking webinars were transferred to the National Institute for Minamata Disease (NIMD).

Performance of the results was evaluated by the robust z-score, which was calculated from the median and normalized interquartile range (NIQR). Individual laboratories received the evaluation terms “Satisfactory,” “Caution,” or “Action” based on their performance. At the beginning, most participating laboratories came from Asia-Pacific region as the project objective was to support countries in the region. As the project has progressed, participation from outside the region has increased. Networking webinars, organized online in every two months, have brought together the participants who were involved in frontline research activities, e.g., research planning and experiment, sample/specimen collection and analysis, and data processing and analysis.

The UNEP project was a time-bound activity, and the sustainability of post-project results was considered from the planning stage. Coordination between UNEP and NIMD was embedded into the concept at the very beginning and the responsibilities have been gradually transferred. NIMD has the technical skills on mercury analysis but limited capacity on logistic and global network. Conversely, UNEP has a global network while no in-house analysis has been conducted. A win-win partnership leveraging the distinct strengths of UNEP and NIMD made the transfer of operations seamless.

ABSTRACT ID: OP 43

Title	Atmospheric observations of gaseous elemental mercury in industrial and background areas of the Southern Baikal region
Lead Author	Lutskin Evgenii Sergeevich
Co-Authors	Shikhovtsev M.Y., Molozhnikova Y.V., Obolkin V.A., Khodzher T.V.

ABSTRACT

Gaseous elemental mercury (GEM) was used as an atmospheric tracer to develop an approach for identifying coal combustion emission sources in the urbanized areas of the Southern Baikal region. Coal combustion is one of the major anthropogenic sources of atmospheric mercury in Eastern Siberia and therefore plays a key role in regional atmospheric pollution.

A series of atmospheric measurements were conducted during 2024–2025 in the major industrial cities of the region, including Irkutsk, Angarsk, Shelekhov, Usolye-Sibirskoye, and Cheremkhovo, as well as in background areas over Lake Baikal. GEM concentrations were measured using a portable RA-915M mercury analyzer with GPS referencing. Simultaneous observations of air temperature, wind speed, and wind direction were used to assess the role of meteorological conditions in GEM variability.

The approach is based on comparing background GEM concentrations over Lake Baikal with elevated levels observed in anthropogenic areas, near major stationary sources, and at two stationary monitoring sites in the Baikal region, Irkutsk and Listvyanka. Background GEM concentrations over Lake Baikal averaged 1.20 ng m^{-3} in summer and 1.03 ng m^{-3} in autumn. In contrast, urban areas showed consistently higher levels: mean concentrations reached 1.95 ng m^{-3} in summer, 2.07 ng m^{-3} in autumn, 3.04 ng m^{-3} in winter, and 2.32 ng m^{-3} in spring.

Winter GEM concentrations were approximately twice as high as those observed in summer, indicating the influence of coal combustion during the heating season. Local maxima near coal-fired power plants reached 12.52 ng m^{-3} , while extreme spring peaks up to 370.6 ng m^{-3} were recorded in Usolye-Sibirskoye within the area affected by legacy mercury contamination associated with the former Usolyekhimprom industrial site (polyvinyl chloride production using mercury cathode technology).

The results show that GEM is an effective tracer for identifying atmospheric pollution sources associated with coal combustion and assessing their spatial variability under different meteorological conditions.

ABSTRACT ID: OP 46

Title	Spatial evaluation of total mercury concentrations in the South African atmosphere using lichen biomonitors
Lead Author	Patricia Forbes
Co-Authors	Marco Botha

ABSTRACT

South Africa has a coal dominated energy sector, therefore coal is extensively mined and combusted, leading to the emission of mercury into the atmosphere. In addition, there are numerous other potential sources including cement production and metal smelting. The biomonitoring of airborne heavy metals such as mercury can be achieved through the use of lichens, as they obtain nutrients directly from the atmosphere. In this study, 120 samples of the lichen species *Parmotrema austrosinense* were collected from trees at 47 sites across five provinces in South Africa, two of which served as comparative background locations. Lichens were carefully removed from trees at a height of > 1 m above ground using plastic tweezers. Samples were cleaned of foreign debris, and were then chopped into fine fragments and homogenised whilst cryogenically frozen with liquid nitrogen. The prepared samples were analysed using a direct mercury analyser, calibrated using a coal certified reference material and validated with white cabbage powder and human hair certified reference materials. The total mercury concentrations in the lichen samples ranged from 21 to 201 ppb overall. It was found that the lichens growing at the two background locations had lower total mercury concentrations, ranging from 21 to 88 ppb, with very similar average total mercury concentrations of 51 and 53 ppb, respectively. Lichens from the province in which the majority of coal fired power plants are located had total mercury concentrations ranging from 43 to 146 ppb, with a mean mercury concentration of 81 ppb. The highest mercury concentrations were found in samples from the most densely populated provinces, ranging from 27 to 201 ppb, whilst the average concentration was also 81 ppb. This study provides important information on the spatial distribution of total mercury in the South African atmosphere, which can inform both policy and intervention strategies.

ABSTRACT ID: OP 47

Title	Climate-driven Ecosystem Changes and Mercury Cycling in Arctic Fjord Systems: Insights from the REFUGE-ARCTIC Campaign
Lead Author	Davide Mattio
Co-Authors	L.E. Heimbürger-Boavida, D.Cossa, C. Donat, A. Kleindienst, A.Koenig, A.Dommergue, H. Angot

ABSTRACT

Climate-driven ecosystem changes in the Arctic are altering the biogeochemical cycle of mercury (Hg), perturbing terrestrial to marine fluxes and ocean-atmosphere exchange. In summer 2024, as part of the REFUGE-ARCTIC campaign, we conducted a comprehensive sampling effort in the Nares Strait and the fjords of Ellesmere Island (72–82°N). Our goal was to study the influence of glacier melt, sea ice decline and permafrost thaw on Hg levels across seawater, plankton, sea ice, and the atmosphere. Atmospheric gaseous elemental mercury (GEM) concentrations ranged from 0.92 to 1.48 ng/m³, and were influenced by air mass trajectories and reduced sea ice cover, highlighting the impact of sea-ice loss on ocean-atmosphere exchange. Throughout the cruise, total Hg (THg) concentrations were measured across multiple environmental compartments: seawater (0.87 ± 0.33 pM, n=91), permafrost-influenced Arctic river water (15.7 ± 12.8 pM, n=8), glacier meltwater (3.42 ± 3.17 pM, n=7), and sea ice cores (3.32 ± 2.71 pM, n=77). In the seawater THg concentrations were primarily controlled by the mixing of Atlantic and Arctic waters, with elevated levels observed in the upper thermocline (2.47 pM). Glacial rivers emerge as a significant Hg source to the coastal ocean, consistent with seawater profiles indicating strong terrestrial export. Preliminary assessments of methylmercury in seawater (0.43 ± 0.25 pM, n=29), alongside ongoing sediments and zooplankton measurements, suggest that these terrestrial Hg inputs may actively enter benthic and pelagic food webs. This study presents an integrated perspective of the Hg cycle, suggesting that climate warming—rather than direct anthropogenic emissions—may be the dominant driver of Hg levels in the region. These findings underscore the urgent need for future modeling efforts that explicitly integrate climate-driven changes, such as sea-ice loss, permafrost thaw, and shifting hydrological regimes, to better predict Hg dynamics and their ecological impacts in a rapidly changing Arctic environment.

ABSTRACT ID: OP 52

Title	Dual-channel mercury measurements for a smog chamber study
Lead Author	KarLee Zager
Co-Authors	Seth Lyman, Colleen Jones, Trevor O'Neil

ABSTRACT

Accurate quantification of atmospheric mercury speciation remains challenging due to the reactive and semivolatile nature of oxidized mercury compounds. We have developed a dual-channel pre-analysis system that enables oxidized mercury concentrations to be extrapolated from elemental mercury measurements obtained using a Tekran 2537X analyzer, and previous work has shown this system can accurately quantify oxidized mercury in field settings.

Ambient air is drawn into the system through a heated PTFE sampling line maintained at 120°C and split between two parallel channels. In the first channel, the sample passes through a thermal converter maintained at 650°C, which converts oxidized mercury species to elemental mercury while allowing existing elemental mercury to pass unchanged, providing a measurement representing total mercury. In the second channel, the sample passes through two cation-exchange membranes that selectively retain oxidized mercury compounds while allowing elemental mercury to pass through. Oxidized mercury concentrations are calculated by subtracting elemental mercury measurements from total mercury measurements using a custom data processing program.

We have adapted the dual channel system for use in a smog chamber study to evaluate known atmospheric mercury chemistry. With modifications for this study, the system can complete a full measurement cycle (elemental + oxidized) in four minutes with detection limits of 5-20 pg/m³ for elemental and oxidized mercury. The system can measure oxidized mercury concentrations over several orders of magnitude and recovers added calibration gas to within ±10% of expected values. Our tests show that Tekran 2537X analyzers can achieve detection limits with the dual channel system that are about an order of magnitude better than other available mercury analyzers, but the system can be coupled with many other commercial elemental mercury analyzers, providing a flexible, accurate method for atmospheric mercury speciation measurements.

ABSTRACT ID: OP 54

Title	Experimental Investigation of Atmospheric Mercury Oxidation Using a 35 m ³ Environmental Chamber
Lead Author	Colleen Jones
Co-Authors	Seth Lyman, Jaron Hansen, Ryan Thalman, Jessica Haskins, Sarrah Dunham-Cheatham, Mae Gustin

ABSTRACT

This NSF-funded project, led by Utah State University in collaboration with Brigham Young University, University of Utah, and University of Nevada, Reno, seeks to experimentally constrain the atmospheric oxidation of elemental mercury (Hg⁰). Although atmospheric models identify hydroxyl radicals (OH), ozone (O₃), and bromine species as primary oxidants, laboratory validation under atmospherically relevant conditions remains limited.

This presentation outlines the project's scope, objectives, and experimental framework. We constructed a 35 m³ polytetrafluoroethylene (PTFE) environmental chamber equipped with UV-B irradiation and purified intake air to simulate tropospheric chemistry. The chamber's large volume and optimized volume-to-surface-area ratio minimize wall-reaction artifacts that have complicated prior mercury kinetics studies.

An integrated instrumentation suite directly quantifies both elemental and oxidized mercury using a dual-channel Tekran system and a modified Reactive Mercury Active System (RMAS), complemented by cavity-enhanced and optical techniques for measuring radicals, halogens, and trace gases. Through controlled introduction of Hg⁰ and selected oxidants, we will determine oxidation rate constants, evaluate competing reaction pathways, and provide improved kinetic constraints for atmospheric mercury models and global biogeochemical cycling assessments.

ABSTRACT ID: OP 55

Title	Long-Term Observations of Mercury Species in the Sargasso Sea Highlight the Effectiveness of the Minamata Convention
Lead Author	Jingjing Yuan
Co-Authors	Robert P. Mason, Hannah Inman, Olivia Patrinicola

ABSTRACT

Mercury (Hg) is a global pollutant that threatens human and ecosystem health. Anthropogenic Hg emissions have increased atmospheric Hg concentrations and facilitated its global distribution, as recorded in natural archives. Aquatic systems, particularly the open ocean, receive Hg primarily through atmospheric wet and dry deposition, where it can be transformed into methylmercury (MeHg), bioaccumulated into organisms, and biomagnified in food webs. Therefore, tracking Hg concentrations and inventories in seawater is essential for understanding the impact of anthropogenic Hg inputs and the effectiveness of emission controls. The Bermuda Atlantic Time-series Study (BATS) station in the Sargasso Sea near Bermuda has provided a unique platform for long-term observations of Hg species in the water column, enabling insights into Hg biogeochemical cycling and climate change impacts. Trace metal clean seawater samples collected from the upper 1000 m during five cruises between September 2024 and February 2026 were analyzed for total Hg and MeHg concentrations. These data were further combined with existing datasets since the early 1980s to extend the observational record and estimate Hg inventories. We found that both total Hg and MeHg concentrations in the mixed layer (<100 m) were lower than previously reported, with MeHg accounting for less than 20% of total Hg. Higher Hg concentrations were observed in deeper waters (>400 m) during summer compared to spring and winter, likely reflecting seasonal variations in water mass structure and nutrient distribution. The Hg inventories in the upper 1000 m show trends consistent with sediment records, with increased deposition during industrialization followed by declines associated with emission reductions and policies before and since the ratification of the Minamata Convention. These results constrain the persistence of anthropogenic Hg in the Sargasso Sea and inform predictions of its fate and biogeochemical cycling under future emissions and climate change conditions.

ABSTRACT ID: OP 56

Title	Mercury in skin-lightening cosmetics available to Japanese consumers: evidence from rapid screening and confirmatory analysis
Lead Author	Koichi Haraguchi
Co-Authors	Mitsugu Saito, Chacriya Malasuk, Kyaw Nyunt Maung, Yumi Ushikai, Kanako Nagatomi

ABSTRACT

Mercury-containing skin-lightening products remain a global public health concern and are regulated under the Minamata Convention, which sets a limit of 1 ppm for mercury in cosmetics. This study investigated the occurrence of mercury in skin-lightening products available to Japanese consumers through domestic markets and cross-border e-commerce. A total of 44 products were analyzed using a two-step analytical framework consisting of rapid screening by X-ray fluorescence (XRF) followed by confirmatory analysis using atomic absorption spectrometry (AAS).

No mercury was detected in products purchased from domestic retail stores or Japanese e-commerce platforms (23 samples), indicating the effectiveness of current regulatory measures within the domestic market. In contrast, 8 of 13 products obtained through cross-border e-commerce exceeded the Minamata Convention limit. Overall, 8 of 44 products (16%) exceeded the regulatory threshold, including six samples (13.6%) with concentrations above 410 ppm. These levels raise potential health concerns based on dermal exposure assessment (hazard quotient >1). Statistical analysis (Fisher's exact test, $p < 0.0001$) demonstrated that products obtained via cross-border e-commerce had a significantly higher exceedance rate compared with other market channels, suggesting that cross-border distribution may represent a structural pathway undermining regulatory effectiveness.

No clear co-elevation of arsenic or lead was observed in the high-mercury samples, suggesting intentional mercury addition rather than contamination. Furthermore, all mercury-containing products showed inconsistencies between ingredient labeling and analytical results, highlighting challenges for consumer protection and market surveillance.

ABSTRACT ID: OP 58

Title	Evidence of Reduced Methylmercury Levels in Freshwater Ecosystems: A Decade of Monitoring under the Minamata Convention
Lead Author	Seonghwan Kim
Co-Authors	Seunghye Han

ABSTRACT

This study presents findings from the National Integrated Mercury Monitoring Network (2016–2025), established to assess the effectiveness of the Minamata Convention in South Korea's freshwater systems. Water, sediment, and fish samples were collected from five reservoirs (Okjeong, Buan, Chungju, Paro, and Paldang) and four downstream rivers (Geum, Nakdong, Yeongsan, and Han) to compare mercury (Hg) concentrations and speciation among distinct aquatic environments. In water, mean total mercury (THg) concentrations were higher in rivers (1.1 ± 0.79 ng/L) than in reservoirs (0.62 ± 0.36 ng/L), correlating with higher levels of suspended particulate matter (SPM). Conversely, mean filtered methylmercury (FMeHg) concentrations were comparable between reservoirs (24 ± 15 pg/L) and rivers (22 ± 10 pg/L). In sediments, THg and methylmercury (MeHg) concentrations were higher in reservoirs (97 ± 95 and 0.70 ± 0.68 µg/kg, respectively) than in rivers (40 ± 31 and 0.18 ± 0.23 µg/kg, respectively), reflecting longer water residence times in reservoirs. While 96% of fish samples contained THg below international guideline levels (< 500 µg/kg), fish from reservoirs (180 ± 200 µg/kg) had higher concentrations than those from rivers (54 ± 48 µg/kg), consistent with sediment Hg trends. Pearson correlations and principal component analysis consistently revealed that MeHg was positively related to chlorophyll-a (Chl-a) in reservoirs ($r = 0.55$, $n = 300$) and to SPM in rivers ($r = 0.30$, $n = 288$), identifying Chl-a as the primary in situ driver in reservoirs and rainfall-induced runoff as the main ex situ driver in rivers. Mann–Kendall tests revealed significant decreases in FMeHg concentrations across multiple sites during 2016–2025, likely attributable to (i) reduced primary production, (ii) shifts in the oxygen regime, and (iii) increased nitrate levels that may suppress Hg(II) methylation. These results indicate an effective reduction of MeHg in South Korea's freshwater ecosystems under the Minamata Convention.

ABSTRACT ID: OP 59

Title	Atmospheric Oxidant Variability Reshapes Future Global Mercury Load
Lead Author	Hema Bhatt
Co-Authors	Asif Qureshi

ABSTRACT

Mercury (Hg) is a long-range transported toxic pollutant whose distribution and deposition depend on its atmospheric lifetime, which is governed by atmospheric redox reactions. Anthropogenic emissions and climate change alter the concentrations of key atmospheric oxidants that regulate the oxidation of elemental mercury (Hg^0), including hydroxyl radicals ($\text{OH}\cdot$), bromine radicals ($\text{Br}\cdot$), and ozone (O_3). In this study, the GEOS-Chem chemical transport model was used to investigate changes in global atmospheric Hg load from 2020 to 2100 under Representative Concentration Pathways (RCP2.6, RCP4.5, RCP6.0, and RCP8.5). Results show that variations in atmospheric oxidant concentrations significantly affect Hg concentration and deposition patterns. The surface atmospheric Hg concentration exhibits ~2-6% of decreasing trend across all RCP scenarios, reflecting enhanced oxidation and removal processes. In contrast, deposition responses vary spatially with climate forcing and oxidant type. Wet Hg deposition flux increasing ~30-45% under higher forcing scenarios (RCP6.0 and RCP8.5), while decreasing ~5-15% under the low-emission scenario (RCP2.6 and RCP4.5) towards the end of the century, under changing OH. concentration scenario. Variations in other atmospheric oxidants ($\text{Br}\cdot$, O_3) responses under changing emission and climate scenarios led to spatially and temporally heterogeneous changes in atmospheric Hg concentration and deposition flux. These indicate that climate-driven oxidation processes can dominate over emission forcing in shaping future mercury distribution. This study highlights the critical role of evolving atmospheric chemistry in determining the fate of mercury, with implications for future mitigation strategies.

ABSTRACT ID: OP 60

Title	Vegetation Regulation of Soil Hg(0) Evasion: Mechanistic Insights from Karst Landscapes and Global Patterns
Lead Author	Jicheng Xia
Co-Authors	Jen-How Huang, Zaihua Liu, Min Zhao, Wei Yuan, Xun Wang, Tao Peng, Yanmei Zhou, Yixuan Shu, Weijun Luo, Xinbi

ABSTRACT

Soils represent the largest active mercury (Hg) reservoir in the terrestrial biosphere and vegetation plays a central role in regulating Hg exchange between soils and the atmosphere. Yet the mechanisms by which vegetation structure and environmental conditions control soil Hg(0) evasion remain incompletely resolved. This study investigates vegetation-soil interactions controlling Hg(0) emissions using a combination of controlled field manipulation, observations in natural and Hg-contaminated karst catchments in southwest China, and a synthesis of global flux datasets. In a controlled field system with contrasting land-cover types, Hg(0) emissions decreased systematically with increasing vegetation cover. Concurrent variations in $\delta^{202}\text{Hg}$ and $\Delta^{199}\text{Hg}$ of emitted Hg(0) indicate kinetically controlled Hg(II) reduction and reveal shifts in reduction pathways across vegetation types. These isotope signatures demonstrate that vegetation regulates Hg(0) evasion not only through shading and microclimatic buffering but also by modifying reduction environments at the soil surface. Investigations at natural sites further highlight the role of vegetation-soil interactions. Soil temperature emerged as the dominant driver of Hg(0) flux variability, while vegetation effects intensified markedly at a Hg-contaminated catchment, where the NDVI-Hg(0) flux relationship was nearly two orders of magnitude steeper than at background sites. This amplification indicates that vegetation control scales non-linearly with the size of the reactive soil Hg pool. Exposed karst rock surfaces provide an important mechanistic end-member. Despite extremely low Hg inventories, these surfaces emitted Hg(0) at rates comparable to soil-covered plots, reflecting efficient photochemical reduction under minimal organic and microbial influence. A global comparison shows that normalised soil Hg(0) emissions follow a climatic gradient (tropical > subtropical > temperate > subarctic), highlighting the combined influence of vegetation, substrate and climate on terrestrial Hg re-emission. These findings are particularly relevant for forest ecosystems, where dense vegetation cover, litter accumulation and buffered soil microclimates can strongly regulate atmosphere-soil Hg(0) exchange.

ABSTRACT ID: OP 61

Title	Mercury in sediments of thermokarst lakes in the Malozemelskaya tundra: anthropogenic or biovector pollution?
Lead Author	Yury G. Tatsiy
Co-Authors	

ABSTRACT

The Arctic is not a pristine, ecologically clean territory but a remote region that is affected by distant anthropogenic activities. The initial aim was to evaluate the potential anthropogenic impact on the environment by analyzing the sediments from three small thermokarst lakes in the Malozemelskaya tundra within the Nenets State Nature Reserve. The lakes are located close to each other in a continuous permafrost zone, away from any pollution sources. The results revealed unusual concentrations and distributions of various elements, including mercury. The enrichment factor (EF) for Hg in one of the lakes is 21, while in the other two it is 5 and 9. Despite minimal differences in the geological composition, climate, and atmospheric deposition of these lakes, increased organic matter content, as well as high concentrations of some elements in the upper layers of sediment, indicates strong biological and anthropogenic influences.

Unusually high concentrations of P and S in the sediments of some oligotrophic lakes indicate that two of the three lakes are likely subject to strong ornithogenic influence. Migratory birds are the biovector. The study area is essential for the migration of numerous bird species and serves as a resting, breeding, and molting site. Bird aggregations in a limited area have a profound impact on virtually all natural components. This is due to the introduction of organic and inorganic substances into the soil and water in the form of pellets, excrement, feathers, and other ornithogenic material. This study demonstrates the ornithogenic impact on Arctic ecology. It is a type of transboundary transfer where migratory freshwater birds act as a biovector.

The work was carried out at the expense of budgetary financing of the Vernadsky Institute of Geochemistry and Analytical Chemistry of the Russian Academy of Sciences (GEOHI RAS).

ABSTRACT ID: OP 62

Title	Distribution of total and bioavailable mercury concentrations in abiotic matrices in a South African nature reserve
Lead Author	Geyan Kempkes
Co-Authors	Marta Turull, Sergi Diez, Lynwill Martin, Patricia Forbes

ABSTRACT

South Africa is abundant in its biodiversity, industry and mineral resources. Consequently, there is a large interest in the protection of the natural environment and wildlife. Specifically for environmental mercury monitoring within the country, this remains limited in its spatial and temporal coverage, resulting in the need for more consistent efforts to ensure prominent point sources do not lead to negative impacts. Thus, the aim of this study was to determine baseline concentrations of total mercury within abiotic samples obtained within a previously unmonitored nature reserve, namely– the Oppenheimer Generations Research and Conservation Telperion Nature Reserve. Ten sites spanning a stretch of the Wilge River system, were passively sampled over three days (27-30 Oct 2026) by diffusive gradients in thin films (DGTs) for the first time in South Africa. Additionally, soil, sediment cores, river water and pore water were all grab sampled. Total mercury concentrations were determined by a direct mercury analyzer (DMA evo-tricell). Total and bioavailable mercury concentrations were determined, and further related to other parameters such as pH, total organic carbon (TOC) and water temperature. The majority of mercury concentrations found in river water (both total and bioavailable fractions) were found to be $< 1 \mu\text{g/L}$. Soil and sediment showed concentrations ranging from 2.9-11.9 and 1.6-12.2 $\mu\text{g/kg}$, respectively. Despite nearby point sources and a history of coal mining activities in the area, relatively low concentrations of mercury were found when compared to previously reported literature for regions impacted by nearby similar point sources. This is indicative of effective mercury release prevention strategies or that deposition of mercury is occurring in regions further from the sources as a consequence of predominant wind patterns.

ABSTRACT ID: OP 65

Title	Factors influencing the mercury cycle in polar regions: observations from Svalbard snow and modelling
Lead Author	Veronica AMORUSO
Co-Authors	Veronica Amoruso, Andrea Spolaor, Alfonso Saiz-Lopez

ABSTRACT

Mercury (Hg) cycle in polar regions has long fascinated the scientific community. The special light regime, mainly dividing the year into light and dark seasons, together with the bromine (Br) emissions from sea-ice, are considered key factors controlling the cycling of Hg between its elemental (Hg⁰) and oxidized (Hg^{II}) forms at the snow-air interface. However, disentangling the role of all involved variables, including atmospheric conditions and chemistry, requires information from both observations and modelling. Here, we present results from two field campaigns conducted in Kongsfjord (Svalbard) surface snow during years characterized by contrasting climatic conditions. We compared Hg concentrations in snow collected during a relatively “warm” (2019) and a “cold” (2020) year to investigate how factors such as temperature and sea-ice extent influence Hg exchange between snowpack and atmosphere. Overall, we find that the larger sea-ice extent and Br emissions in the “cold” year do not directly influence Hg atmospheric concentrations or deposition. Similarly, absolute temperature (T) does not impact Hg⁰ atmospheric depletion events, with T and Hg⁰ correlating both in “warm” and “cold” years. In parallel, we developed a model to simulate Hg⁰ emissions from snow and ice, implemented within the Community Earth System Model (CESM). Model simulations were used to assess how different environmental factors influence Hg snow–air exchange. Our study highlights the complexity of the interactions between environmental conditions and Hg cycling in polar environments. This talk covers the complex world of polar mercury cycling, emphasizing the complementary and indispensable roles of field observations and atmospheric modelling.

ABSTRACT ID: OP 67

Title	Study on the Adsorption Mechanism of Hg ⁰ by Air Plasma Modified Carbon Nanotubes
Lead Author	Jinjing Luo
Co-Authors	Ruoyu Li, Siqi Zhuo

ABSTRACT

In response to the poor adsorption performance of carbon nanotubes (CNTs) for Hg⁰, this study conducted plasma discharge modification of CNTs under simulated air atmosphere to increase the surface oxygen functional groups and introduce active sites to enhance the Hg⁰ removal performance. The modification mechanism and Hg⁰ adsorption mechanism of plasma discharge were also investigated. Through transmission electron microscopy (TEM), low-temperature nitrogen adsorption-desorption (BET), X-ray photoelectron spectroscopy (XPS), programmed temperature desorption (Hg-TPD), and kinetic model fitting, the analysis showed that the simulated air plasma etching effect led to the surface wrinkling of the modified carbon nanotubes (CNTs-air), an increase in the average pore diameter, and an increase in surface oxygen content. Successful introduction of oxygen-containing functional groups such as carbonyl and carboxyl was achieved. The Hg⁰ adsorption capacity of the modified CNTs was 538.27 µg/g, which was 1034 times higher than that of the original carbon nanotubes. Based on the characterization results, it can be concluded that Hg⁰ adsorption is dominated by chemical adsorption. After external surface adsorption and pore diffusion of Hg⁰, it forms Hg⁰ through electron transfer and mainly exists in the form of Hg²⁺.

ABSTRACT ID: OP 68

Title	Role of Humic Substances in the Speciation, Mobility, and Transformation of Mercury in Natural Aquatic Systems
Lead Author	Safonov Vladimир
Co-Authors	

ABSTRACT

This study investigates the geochemical processes governing mercury migration, transformation, and sorption in natural systems, with particular emphasis on the role of humic substances. Special attention is given to the influence of fulvic acids (FA) and humic acids (HA) on complexation, solubility, and distribution of mercury species in aquatic environments and sediment–soil systems. Analysis of the relationship between methylmercury concentration and total mercury content in natural waters demonstrates a nonlinear dependence. At relatively low concentrations of total mercury, the proportion of methylated forms is comparatively high, whereas an increase in total mercury content is associated with a greater contribution of inorganic mercury species. Experimental observations of methylmercury formation kinetics in solution indicate that the concentration of methylmercury chloride reaches a maximum approximately 20 hours after incubation, followed by a gradual decrease. The results show that the solubility of both elemental mercury and cinnabar increases with increasing fulvic acid concentration, highlighting the important role of natural organic matter in enhancing mercury mobility in aquatic systems.

The effect of FA is more pronounced for elemental mercury than for sulfide-bound mercury species. HA extracted from sapropelic material exhibit the highest affinity for mercury, while HA from marine sediments demonstrate considerably lower sorption capacity.

Overall, the results demonstrate that humic substances play a key role in controlling the mobility, speciation, and biogeochemical transformations of mercury in natural environments. Natural organic matter significantly influences the partitioning of mercury between dissolved and sorbed phases and contributes to the regulation of methylation and demethylation processes within aquatic and terrestrial ecosystems.

ABSTRACT ID: OP 70

Title	Deep-Sea Tailings Placement: An Emerging Source of Mercury to the Deep Sea
Lead Author	Omar Keshk
Co-Authors	P. Brandl, S. Petersen, C. Winter, G. von Rönn, J. Gottschalk, L. Heimbürger, J. Howe, S. Sander

ABSTRACT

Deep-sea tailings placement (DSTP) is a method of disposing mine tailings by direct discharge into the ocean where they settle in deep-sea environments, typically deeper than 1000 m, to circumvent impacts on the euphotic zone (Ellis & Ellis, 1994; GESAMP, 2016). The composition of these tailings depends on the ore composition and its processing but commonly contains elevated concentrations of trace metal(loid)s, including mercury (Hg). This study evaluates DSTP as a source of Hg to the deep sea and assesses its potential impacts.

For this purpose, a sediment push core was collected at 3042 mbsl in the Lihir Deep, ~60 km northeast of the Lihir gold mine in Papua New Guinea and along the downslope pathway of the tailing disposal pipe. The upper 5 cm of the core consists of orange-brown sediments, contrasting with the light-colored carbonate ooze background below. Excess lead-210 ($^{210}\text{Pb}_{\text{ex}}$) measurements, grain size, and geochemical signatures of the sediment indicate that this upper 5 cm layer reflects predominantly effects from 26 years of tailings disposal. This interval contains elevated concentrations of gold (Au), arsenic (As) and a total mercury (tHg) concentration of 465 ng g⁻¹, used here as a conservative estimate of the mean tHg in the deposited material.

Since the start of mining in 1997, 504 t of Au were mined by June 2020 (Gleeson et al., 2020). This corresponds to ~219 Mt of tailings discharged to the deep sea, yielding an estimated cumulative Hg discharge of ~102 t. The significant amount of tailings offshore at ~60 km from the discharge point shows that material from DSTP spreads far beyond the disposal area. As a result, the Lihir Deep is a depositional sink for Hg and associated contaminants over a much larger area than previously recognized, potentially causing more severe impacts on the deep-sea environment.

ABSTRACT ID: OP 71

Title	Recent Insights into Mercury Distribution in Indian Coal and Emissions from Thermal Power Plants
Lead Author	Hridesh Agarwalla
Co-Authors	Monalisa Gangopadhyay, Jyoti Kumari, Reginald Masto

ABSTRACT

India is among the major global emitters of mercury, with coal combustion in thermal power plants being the dominant source. Existing databases on mercury concentrations in Indian coal are largely two decades old, and limited information is available on the geochemistry and mode of occurrence of Hg in Indian coal.

In recent years, our laboratory has undertaken extensive work to better understand mercury occurrence in Indian coal. Our laboratory analyzed more than 165 coal samples collected from major coal-producing regions in India. Mercury concentrations ranged from 0.003 to 0.554 mg/kg, with an average value of 0.175 mg/kg. Coals from MCL, NCL, WCL, and CCL exhibited relatively higher Hg concentrations (>0.200 mg/kg), whereas ECL and BCCL coals showed lower values (<0.090 mg/kg). No significant correlation was observed between mercury concentration and coal rank; however, a positive trend with ash content was observed.

Sequential leaching results indicate that mercury is predominantly associated with the pyritic fraction (57–84%), followed by clay (8–10%) and organic fractions (8–9%). Weathering of pyrite leads to the formation of HgSO_4 and related mercury-bearing iron sulfate minerals.

In another work, mercury emission at four coal-fired and one lignite-fired power plants were studied. Mass balance analysis revealed that a significant portion of mercury is retained in fly ash, while bottom ash contains minimal mercury. Approximately 80–90% of mercury is emitted through stack gases in conventional coal-fired plants. In contrast, circulating fluidized bed boiler burning lignite captured about 64.8% of mercury in fly ash, with only 32.4% released to the atmosphere. Speciation analysis indicated that 50–60% of emitted mercury is in elemental form. These findings improve the current understanding of mercury distribution in Indian coal and its emission behavior in thermal power plants, which is critical for developing effective mercury mitigation strategies.

ABSTRACT ID: OP 72

Title	Atmospheric Hg(II) Chemistry: Insights from a Chamber Study
Lead Author	Sarrah M. Dunham-Cheatham
Co-Authors	Andrea K. Baker, Alexis Harper, Colleen Jones, Seth Lyman, Jaron Hansen, Mae Sexauer Gustin

ABSTRACT

Understanding oxidized mercury (Hg(II)) chemistry in the atmosphere is critically important for global mercury (Hg) biogeochemical modeling and risk assessment, as Hg(II) compounds can comprise a significant portion of the atmospheric Hg budget, deposit rapidly to surface environments, and are more toxic than elemental Hg (Hg(0)). However, ambient Hg(II) measurements are mostly limited to concentration measurements and not chemistry determinations. To probe Hg oxidation reactions and the resulting Hg(II) compounds, a large (35 m³) reaction chamber was constructed into which various atmospherically relevant oxidants (i.e., ozone, OH•, HONO, etc.) were added to simulate proposed stratospheric Hg oxidation pathways (ca. Shah et al. 2021). For each experiment, changes in the Hg(0):Hg(II) were monitored with high time-resolution measurements using a dual-channel system to understand reaction rates for set of physicochemical conditions.

Additionally, air from the chamber was actively sampled through a modified Reactive Mercury Active System (RMAS) to corroborate the dual-channel system Hg(II) concentration measurements and to provide information on Hg(II) chemistry. The RMAS is a membrane-based gas sampling manifold that utilizes a combination of membrane sorbents to quantify Hg(II) concentrations (i.e., cation exchange (CEM) and polytetrafluoroethylene (PTFE) membranes) and Hg(II) chemistry (i.e., nylon membranes), and has been tested under a wide range of atmospheric conditions. Despite known limitations of the nylon membrane Hg(II) measurements, this technique is currently the only technique readily available to probe Hg(II) chemistry. Hg(II) chemistry results from the chamber experiments will be presented, along with insights into possible redox pathways for oxidation of ambient Hg(0) to Hg(II) compounds.

ABSTRACT ID: OP 73

Title	Comparison of Selective Capture of Oxidized Mercury by Activated Carbon and Phosphate Glass Sorbents for Ambient Air and Waste Streams
Lead Author	Sarrah M. Dunham-Cheatham
Co-Authors	Laurel Sharpless, Krista Carlson, Mae Sexauer Gustin

ABSTRACT

Sorbent materials are needed that can pre-concentrate oxidized mercury (Hg(II)) compounds and release them into instruments for determination of Hg(II) compound concentration and chemistry. A current barrier to sorbent selection for ambient air monitoring and waste streams is a lack of understanding about selective sorption under different conditions. Predictable sorption performance under varying conditions must be achieved before the Hg research community can move forward with making accurate Hg(II) measurements. BATII-37, a sulfur-impregnated activated carbon, is intended to be used by the U.S.A. Department of Energy as a sorbent for Hg(0) and Hg(II) in low radioactivity waste off-gas, and cation exchange membranes (CEM) are currently being used for some ambient air Hg(II) monitoring; however, both materials have known limitations and present analytical challenges for total Hg concentrations and/or Hg(II) chemistry. Phosphate glass sorbents, especially calcium phosphate (CaP), have been demonstrated to selectively capture Hg(II) (as HgBr₂) under select laboratory and field conditions (Lown et al., 2025). However, CaP's selectivity and capture efficiencies have not yet been evaluated under a wide range of conditions. We will present results from various experiments designed to test the limits of the BATII-37 and CaP's abilities and capacities to selectively sorb Hg(II) compounds from air and waste streams, including active vs. passive (e.g., static vs. dynamic) sampling regimes, high concentration exposures, and varied matrix compositions (e.g., varied ozone, humidity, carrier gases). The results will be presented in the context of utilizing the sorbents for different sampling and analytical applications, including as a pre-concentration surface in the ambient air Reactive Mercury Active System (RMAS) for subsequent release into an analytical instrument for characterization and as a Hg scrubber for low radioactivity waste streams for long-term stable capture of Hg.

ABSTRACT ID: OP 74

Title	Progress of the Asia Pacific Mercury Monitoring Network
Lead Author	Da-Wei Lin
Co-Authors	Da-Wei Lin

ABSTRACT

The Asia Pacific Mercury Monitoring Network (APMMN) addresses critical data gaps in a region with the highest global mercury (Hg) emissions. By providing standardized, consistent measurements of Hg in precipitation, the APMMN supports the goals of the Minamata Convention to assess the magnitude of Hg pollution and the impact of emission controls. Operating since 2016, the network currently comprises 15 sites utilizing National Atmospheric Deposition Program (NADP)-based protocols and a centralized laboratory in Taiwan. High analytical precision is maintained through robust quality assurance programs. Current research highlights include a sampler inter-comparison study conducted in collaboration with the National Institute for Minamata Disease (NIMD) and National Central University (NCU), alongside a pilot study for passive air sampling. Future strategic objectives focus on fostering new partnerships, enhancing data accessibility, sharing monitoring expertise, and implementing a gaseous Hg network across the region.

ABSTRACT ID: OP 75

Title	Characterizations of Atmospheric Mercury Concentration and Isotope Composition at Multiple Sites in Taiwan
Lead Author	Guey-Rong Sheu
Co-Authors	Akane Yamakawa, Da-Wei Lin

ABSTRACT

To elucidate the spatio-seasonal dynamics of atmospheric mercury (Hg) in East Asia, this study investigated gaseous elemental Hg (GEM) concentrations and isotopic compositions across 13 sites in Taiwan during the 2025 Kao-Ping Experiment (2025 KPEX). Using passive samplers (MerPAS), two sampling campaigns were conducted in spring (March–May) and fall (September–November) 2025. GEM concentrations ranged from 1.40 to 3.22 ng m⁻³, with elevated levels at urban and industrial sites strongly correlating with combustion markers (CO, NO_x, and PM_{2.5}; R₂ = 0.45–0.47), confirming the dominance of primary anthropogenic emissions. These sites exhibited distinct isotopic signatures ($\delta^{202}\text{Hg} = -1.00$ to -1.82 ‰; $\Delta^{199}\text{Hg} = -0.08$ to -0.25 ‰). In contrast, the high-mountain background site (LABS) showed the lowest GEM levels, with $\Delta^{199}\text{Hg}$ values (-0.27 ‰) consistent with decadal active-sampling records, suggesting long-term isotopic stability in the North Pacific background atmosphere. A significant shift toward more negative $\delta^{202}\text{Hg}$ was observed in fall, driven by seasonal temperature changes (R₂ = 0.43). Unlike the vegetation-driven enrichment seen in higher latitudes, this tropical/subtropical pattern likely reflects monsoonal air-mass transitions or enhanced surface evasion. Furthermore, the lack of correlation between $\Delta^{199}\text{Hg}$ and O₃ (R₂ = 0.03) indicates that odd-MIF serves as a conservative tracer of air-mass origin rather than localized photochemistry. Negative even-MIF ($\Delta^{200}\text{Hg}$ down to -0.14 ‰) highlights the residual pool from upper-tropospheric oxidation, likely serves as a tracer for the vertical transport and mixing of processed air masses into the regional boundary layer. This study demonstrates the efficacy of MerPAS for regional Hg monitoring and establishes a critical baseline for evaluating Hg emission controls in East Asia.

ABSTRACT ID: OP 76

Title	The State of the Environment in Idrija 30 Years After the Cessation of Mercury Production at the Idrija Mercury Mine, Slovenia
Lead Author	Tatjana Dizdarevič
Co-Authors	

ABSTRACT

Five centuries of mercury (Hg) production in Idrija (1490–1995) had a great impact on the environment in the town and its broader surroundings. The Idrija ore deposit extends beneath the town in a length of 1,500 m and a width of 300–600 m. Centuries of exploitation have resulted in mine galleries spanning 700 km and reaching a depth of 382 m. The main ore mineral of the ore deposit is cinnabar (HgS). Native mercury (Hg⁰) also appearing in economic quantities. The Hg⁰ containing rocks lie directly on the surface which was one of the reasons for the development of specific environmental conditions in Idrija, where the effects of primary geogenic and secondary anthropogenic mercury pollution have accumulated. In terms of Hg production, the Idrija mine was the second largest Hg mine in the world next to Almadén in Spain and Monte Amiata in Italy at the time. In its 500-year history, 12,800,000 tons of Hg ore was excavated which contained 145,700 tons of Hg. 107,700 tons of mercury was produced and it is estimated that 38,000 tons of Hg were released into the environment.

Since 1995 when Hg production in Idrija stopped, Hg in the air decreased significantly, but for decades, tailings and contaminated soils in the Idrija region are eroded and serve as a continuous source of Hg pollution, ultimately of the Gulf of Trieste in Italy. The fact is that even 30 years after the cessation of Hg production in Idrija, Hg levels in the soil and river sediments show no trend toward the expected decrease. Research findings indicate that the quantity of Hg stored in the catchments, soils, and sediments of the Idrija River significantly exceeds the annual amount of Hg leaving the catchment (890 kg/year), which poses a problem of local, regional, and global concern.

ABSTRACT ID: OP 78

Title	Selenoneine in marine fish and estimation of dietary intakes in Seychellois pregnant women
Lead Author	Olya Antropova
Co-Authors	Melanie Lemire, Pierre Ayotte, Adel Achouba, Pierre Dumas, Ariane Barrette, Emelyn Schroff, Conrad Shamlaye, Emeir M. McSorley, Sean J.J. Strain, Alison Yeates, Philip Allsopp, Gary Myers, Gene Watson, Edwin van Wijngaarden, Maria S. Mulhern.

ABSTRACT

Marine fish are a rich source of protein and essential nutrients, particularly omega-3 polyunsaturated fatty acids, vitamin D, iodine and selenium (Se) which are essential for brain function. Fish also contain methylmercury (MeHg), a neurotoxin. Studies in high fish-eating populations, such as Seychelles consistently show neurodevelopmental benefits and no adverse associations from consuming ocean fish, indicating that eating fish is safe and important during pregnancy. One possible reason is the presence of Se and its ability to counter MeHg exposure. Assessing the risks-benefits of marine fish consumption during pregnancy represents a key step in developing public health advice.

Evidence suggests that Se mitigates the neurotoxic effects of MeHg, through selenoprotein antioxidant properties and the formation of stable and inert HgSe compounds. More recently, selenoneine (SeN), an organo-selenium compound identified in 2010 in bluefin tuna and later in other marine species, has been shown to exhibit strong antioxidant activity and capacity to counteract MeHg toxicity. Identifying and quantifying SeN in the diet is therefore important, particularly for pregnant women whose habitual diets are rich in marine fish.

The aim of this study was to quantify SeN in the most commonly consumed marine fish and estimate dietary SeN intakes in a Seychellois pregnant population. Fish species (karang, barracuda, fresh-tuna, tinned-tuna, red-snapper, grouper, parrotfish, spinefoot-shoemaker, mackerel, salted-fish, job) were analysed using a novel validated isotope-dilution liquid-chromatography tandem mass spectrometry (ID-LC-MS/MS) method. SeN was detected in 10 of the 11 species with mean concentrations ranging from 0.01 µg/g (spinefoot-shoemaker and salted-fish) to 0.64 µg/g (mackerel). Using frequency data from Fish Use Questionnaires completed by Seychellois pregnant women (n=1419) and the measured SeN concentrations in fish, dietary modelling will enable estimation of SeN intakes in this population. These findings will improve understanding of the potential role of SeN in modulating MeHg toxicity, which may help inform future fish consumption advisories.

ABSTRACT ID: OP 79

Title	New pathway of mercury methylation in methanogen (<i>M. hungatei</i> JF-1)
Lead Author	Ligang HU
Co-Authors	Jun Gao, Jianbo Shi, Yongguang Yin, Guibin Jiang

ABSTRACT

Methylmercury (MeHg) is a bioaccumulating neurotoxin mainly produced by anaerobic microorganisms, with methanogen being one of the important methylators. A critical aspect for understanding the mechanism for microbial mercury (Hg) methylation is the origin of the methyl group. However, the origin of methyl group in methanogen-mediated Hg methylation remains unclear. This study aims to identify the source of methyl group for MeHg synthesis in methanogens. Our study revealed that Hg methylation in *Methanospirillum hungatei* JF-1 is closely related to methanogenesis process, according to the results of proteomic study and substrate limitation study. Next, we proved that nearly all methyl group in MeHg derives from the Wolfe cycle in this species, rather than the previously demonstrated acetyl-coenzyme A pathway, based on the results of ¹³C labeling study. We then proposed the Wolfe cycle-dependent Hg methylation mechanism in this species. Further genome analyses and ¹³C labeling experiments indicated that the involvement of the Wolfe cycle in Hg methylation is probably a universal feature among Hg-methylating methanogens. These findings reveal a unique Hg methylation mechanism in methanogens. Our study broadens the carbon substrates and controlling factors for MeHg synthesis in the environment, which can inform the prediction of MeHg production potential and remediation strategies for MeHg contamination.

ABSTRACT ID: OP 80

Title	Seasonal and diurnal variations in atmospheric GEM concentrations and fluxes over a deciduous needleleaf forest in Japan
Lead Author	Akinori Takeuchi
Co-Authors	Yoshiyuki Takahashi

ABSTRACT

Continuous monitoring of atmospheric mercury (Hg) over a larch-dominated deciduous forest remains limited, despite the importance of understanding Hg dynamics within forested ecosystems. The Fuji North observation site in Japan, situated within a national park and representing a unique Japanese larch (*larix kaempferi*) ecosystem characterized by pronounced seasonal changes in canopy structure, provides an excellent opportunity to investigate atmosphere-biosphere Hg interactions. Continuous measurements of gaseous elementary mercury (GEM) at this site since 2024 have revealed distinct seasonal and diurnal patterns. GEM concentrations during the non-growing season were equivalent to Northern Hemisphere background levels ($1.5\text{--}1.6\text{ ng m}^{-3}$), whereas concentrations during the growing season (May–October) were slightly lower, ranging from 1.3 to 1.4 ng m^{-3} . In the late growing season, notable diurnal variability was observed, with nighttime GEM concentrations decreasing to approximately half of daytime values, while daytime concentrations remained comparable to background levels. Atmospheric stability analyses indicate that this pronounced diurnal cycle is attributed to the atmospheric rectification effect. Moreover, flux estimates suggested relatively continuous deposition exceeding $60\text{ }\mu\text{g m}^{-2}\text{ yr}^{-1}$, with limited seasonal variation in magnitude; however, flux variability was greater during the non-growing season. Additionally, the diurnal flux pattern differed substantially between seasons, likely reflecting changes in vegetative uptake associated with canopy development. These findings provide important insights into the natural processes that influence atmospheric Hg concentrations and are essential for evaluating the effectiveness of emission reduction efforts by Parties under the Minamata Convention.

ABSTRACT ID: OP 82

Title	Investigating the status of mercury contamination in various freshwater and marine ecosystems of South Africa
Lead Author	Johannes H. Erasmus
Co-Authors	Wynand Malherbe, Nico J. Smit, Victor Wepener

ABSTRACT

As global mercury (Hg) emissions are increasing, it is essential to investigate Hg contamination in various aquatic ecosystems. Anthropogenic sources contribute to Hg in aquatic ecosystems through artisanal and small-scale gold mining, coal combustion power stations, and non-ferrous metal production. All these major sources of Hg occur in South Africa (SA) and as a result, SA is one of the top ten contributors of global emissions. When Hg enters the environment, it does not only act as a local contaminant but can also be transported through long-distance atmospheric deposition, where our data have shown that it is readily accumulated in biota and biomagnified in food webs. This larger study determined the current Hg contamination status of SA freshwater and marine ecosystems by assessing various environmental matrices and the transfer of Hg within the environment. It is evident that Hg concentrations in SA have increased in water, sediment and biota over the last decade, in both freshwater and marine systems. When applying the USEPA human health risk assessment to the consumption of biota, it is evident that Hg can pose non-carcinogenic health risks to human consumers. Even though SA is a party to the Minamata Convention, which aims to reduce the effects of Hg on environmental and human health, more than 75% of the power generation in SA still relies on coal combustion power stations. Increased artisanal and small-scale gold mining activities also contribute to elevated Hg concentrations, especially in aquatic ecosystems. This study highlights the need to continuously monitor Hg concentrations in both freshwater and marine ecosystems to assess the exposure and effects on environmental and human health, especially in developing countries in the global South. Furthermore, the study also emphasised the need for better Hg integration into national policies to conserve biota and ecosystems.

ABSTRACT ID: OP 84

Title	Law Enforcement and Its Challenges in Implementing the Minamata Convention on Mercury in Indonesia
Lead Author	Yuyun Ismawati
Co-Authors	Marsya Mutmainah Handayani, Krishna Zaki

ABSTRACT

Indonesia ratified the Minamata Convention on Mercury through Law No. 11/2017, then issued Presidential Regulation No. 21/2019 and Minister of Environment and Forestry Regulation No. 81/2019 to guide national and local action plans for mercury reduction and elimination. These regulations establish a framework that assigns responsibilities across government agencies at both national and subnational levels. The Artisanal and Small-scale Gold Mining (ASGM) sector has been identified as one of the key sectors requiring urgent intervention, with over 200 mercury-affected sites across 30 provinces. The national target is to eliminate 100% of mercury use in these locations by 2025.

The national action plan requires law enforcement to stop unlicensed cinnabar mining, reduce mercury use in the ASGM sector, and intercept illegal mercury trade, aiming to seize 10 tons each year from 2019 to 2025. The Indonesian Police and Public Prosecutors are responsible for enforcement. Public Prosecutors also handle court cases and carry out court decisions. However, there are significant challenges in managing seized mercury and mercury-contaminated items. Key concerns include preventing seized mercury from being resold and ensuring it is handled safely to prevent pollution and health risks for enforcement personnel. The scattered locations of ASGM activities, along with limited technical skills and poor storage facilities for hazardous materials, exacerbate these problems.

To address these issues, the Attorney General issued Guidance No. 8/2025, which provides a set of rules for handling seized mercury. This paper elaborates on the law enforcement challenges, reviews court decisions about managing confiscated mercury, and discusses how the guidance aims to improve government capacity, address legal loopholes, and ensure that mercury taken out of use is handled safely and permanently - supporting Indonesia's commitment to implementing the Minamata Convention and the Bali Declaration.

ABSTRACT ID: OP 87

Title	Comparative Study of Child Anthropometry and Mercury Exposure in Coastal and ASGM Areas of Indonesia
Lead Author	Muflihatul Muniroh
Co-Authors	Aisyah Aisyah, Gabriela Rolanda, Saekhol Bakri, Ziyadatul Nabila, Megumi Yamamoto, Chihaya Koriyama

ABSTRACT

This study presents a comparative analysis of anthropometric measurements and stunting prevalence among children from two distinct regions: Jepara (coastal area) and Riau (artisanal and small-scale gold mining area or ASGM). The findings reveal significant differences in growth parameters and environmental exposure between the two populations. The growth status indicators, as reflected by Z-scores for height-for-age (TB/U) and weight-for-height (BB/TB), were significantly lower in Riau (-1.68 and -0.87) than in Jepara (-0.65 and -0.38), indicating poorer relative growth and potential chronic undernutrition or environmental stress in children subjected to ASGM ($p = 0.021$ and $p < 0.01$, respectively). Additional birth anthropometric data showed that children in Riau had significantly shorter birth length ($p < 0.01$), whereas birth weight did not differ significantly between the two groups ($p = 0.064$). Notably, mercury (Hg) concentrations measured in children's biological samples were substantially elevated in Riau (median 0.779 ppm) compared to Jepara (median 0.373 ppm) ($p < 0.01$), highlighting a potential environmental health risk linked to ASGM activities in Riau. The significantly lower height-for-age Z-scores in Riau children ($p < 0.01$) strongly suggest a higher prevalence of stunting, reflecting the impact of chronic malnutrition or persistent environmental challenges. These results underscore the complex interplay between environmental exposures, nutritional status, and child growth in diverse geographic and socioeconomic contexts. The elevated mercury levels and the nutritional status in children in ASGM raise concerns about the toxicological impacts on development, while anthropometric disparities call for targeted public health interventions.

ABSTRACT ID: OP 88

Title	Distribution, speciation and exports of mercury in a restored gold-mined Amazonian watershed (French Guiana)
Lead Author	Naomi NITSCHKE
Co-Authors	Stéphane GUEDRON, Jennifer HARRIS, Emmanuel TESSIER, Sylvain CAMPILLO, Elaheh LOTFI, David AMOUROUX

ABSTRACT

Artisanal and small-scale gold-mining (ASGM) in the Amazon region leads to hydrosystem contamination through the combination of liquid mercury (Hg) use for gold amalgamation, and release of geogenic Hg due to soil remobilisation. In French Guiana, the restoration of legal gold-mines is mandatory, but the extent and timespan of post-restoration contaminant export is still unclear. The distribution (particulate, filtered and sediment) and speciation of Hg (total Hg (THg), methylmercury (MeHg) and dissolved gaseous mercury) was studied, together with the impact of goldmine restoration and past ASGM activities on Hg export. To achieve this, high-resolution discrete sampling of flood events during different periods was coupled to hourly turbidity and discharge data upstream and downstream of a gold-mined creek. A combination of tracers (multielemental concentrations, Fourier-transformed infrared spectroscopy (FTIR), and Hg isotopic composition) allowed to discriminate Hg sources into the creek. As a result, particulate THg was shown to originate from mining flat erosion while particulate MeHg was associated to organic matter and decreased during the flood event, due to dilution with remobilized river-bed sediment. Hg stable isotopes signature indicated an increasing contribution of anthropogenic Hg downstream of the mining flat. These results show that THg and MeHg sources in the river are distinct and that the influence of anterior illegal gold mining can still be observed in riverbed sediments. At the catchment scale, the majority of exports occurred during the rainy season (66±6%) and the restored gold-mining flat still induced a 2-fold increase in Hg fluxes 8 months after restoration (0.3-1.4 µg.s⁻¹.km⁻² downstream), with fluxes comparable to the heavily gold-mined Maroni river in French Guiana (0.05-0.2 µg.s⁻¹.km⁻²). Current mine restoration efforts focusing on topsoil stabilisation induce a reduction in THg exports associated to soil erosion, but additional efforts should be put on riverbank consolidation to limit long-term particle and Hg exports.

ABSTRACT ID: OP 90

Title	Baseline characterization of aquatic biota before the reclamation of the Almadenejos mercury metallurgical precinct (Almadén Hg mining district) in the context of the LIFE HERMES Project
Lead Author	Pablo Higuera
Co-Authors	Pablo Higuera 1 , José I. Barquero 1 , Feliciano Bacale 1 , Oscar A. Ávalos 1 , Ana Conde 2 , Javier Carrasco 2 , Rosina Martín 2 , Alicia Rivallo 2 , José Tejero 2 , Joan Formosa 3 , Jessica Giro-Paloma 3 , Josep Ma. Chimenos 3 , Andrea Esposito 4 ,

ABSTRACT

Mercury (Hg) is obtained from its main ore, cinnabar (HgS), through the process of calcination of the ore. For many years, this calcination process has been inefficient, resulting in two types of passive residue: old metallurgical sites of various sizes, depending on the methodology used; and accumulated wastes. Both Almadén in Spain and Abbadia San Salvatore (ASS) in Italy have been important sites for the extraction and processing of cinnabar to obtain liquid mercury. If not properly reclaimed, both types of sites can emit mercury vapours into the atmosphere, which can affect nearby populations in some cases. One of these is the decommissioned metallurgical precinct of Almadenejos, an area of approximately 33.500 m², located next to the locality. Additionally, the waste pile of Lama contains the residue from the calcination of cinnabar from ASS and is also located next to this area.

The HERMES project, which is funded by the European LIFE Programme, aims to evaluate the reduction of these emissions using a novel yet previously validated technology. This involves amending the soils in the Almadenejos area, as well as ASS wastes, by applying a low-grade magnesium hydroxide (a by-product of the calcination of natural magnesite (MgCO₃)). Previous laboratory and field experiments have demonstrated the effectiveness of this treatment in reducing the mobility of mercury in soils and wastes, thereby decreasing both leaching into water and atmospheric emissions.

The project partners include the following stakeholders responsible for technical validation, environmental monitoring, and dissemination activities: the mining company MAYASA; the producer of the proposed reagent, TERRESIS MAGNA; University of Castilla-La Mancha; University of Barcelona; and UCAVO/ Univ. of Florence, Italy.

ABSTRACT ID: OP 92

Title	The Almadén mercury mining district: an update of environmental consequences of the exploitation of its Hg deposits
Lead Author	Pablo Higuera
Co-Authors	S. Lorenzo, J.I. Barquero, F.M. Bacale, O.A. Ávalos

ABSTRACT

The Almadén mercury (Hg) mining district is considered as the most important producer of this element throughout history. It is located in the SW of the Ciudad Real province, South-Central Spain, and, from the geological point of view, it is hosted in a Palaeozoic sequence of shales and quartzites with sporadic but relatively frequent intercalations of mafic volcanic and subvolcanic rocks (basalts and diabases).

The area includes a huge mine (Almadén, with original reserves of some 300,000 t of Hg), three smaller but still important mines (with original reserves between 5,000 and 9,000 t of Hg), some 4 areas with incipient exploitation of cinnabar, and up to 65 sites where the presence of cinnabar has been noted and documented.

In this presentation we describe the most significant impacts produced by the presence of Hg in the environment. We also describe remediation works which have been applied to remediate/mitigate these effects.

As a very brief summary, soils in the area present Hg concentrations of some 5 mg kg⁻¹, which can be considered the local background; anomalous concentrations, located in proximity of the mining and metallurgical areas, can reach values above 100,000 mg kg⁻¹. Concentrations in water are usually below the threshold for drinking water, although in some streams, and during dry periods of the year the values can exceed this value. Very high concentrations of gaseous Hg, well above 1,000 ng m⁻³, were produced by the activity of the metallurgy and by the presence of residual Hg in the unrecovered dumps.

The ceasing of activities in the mine and metallurgical facilities in 2003, and the finalization of the restoration works on the main waste dump in 2008, reduced significantly the impact on atmosphere, as a first indicator of reduction of the global impact of this activity.

ABSTRACT ID: OP 94

Title	Evidence of mercury contamination by gold mining activities in a large Amazonian watershed using stable isotopes: tracking mercury sources in the Maroni River sediments (French Guiana/Surinam)
Lead Author	Elaheh Lotfi-Kalahroodi
Co-Authors	N. Nitschke, E. Tessier, S. Campillo, A. Thibault de Chanvalon, C. Gautheron, S. Guédron, D. Amouroux

ABSTRACT

Artisanal and small-scale gold mining (ASGM) is associated with mercury (Hg) contamination in French Guiana and subsequent threats to the population's health through fish consumption. Since the 1850s, gold mining activities have been reported to increase Hg concentration in the aquatic ecosystem through the use of anthropogenic Hg sources and/or its mobilization from geogenic sources by soil erosion. Despite Hg use prohibition since 2006, it is still used by illegal gold miners in the process of gold extraction. Hence, estimation of the exact extent of Hg emissions by this activity is challenging. Over the last three decades, gold mining has expanded across the Maroni River, one of the main watersheds of the Guiana Shield. Hence, it is crucial to provide a deep understanding of how gold mining affected Hg cycling and we therefore collected surface fluvial sediments from this watershed. We determined total Hg concentration (THg), and both mass-dependent ($\delta^{202}\text{Hg}$) and -independent ($\Delta^{199}\text{Hg}$) isotopes fractionation, and geochemical parameters such as carbon, major and trace elements concentration, and grain size distribution in >80 sites, including pristine locations, and sites downstream ASGM areas. THg varied from 65 to 310 ng g⁻¹, averaging 153±57 ng g⁻¹. A significant correlation was observed between THg and $\delta^{202}\text{Hg}$, suggesting a strong influence between Hg accumulation and isotopic composition in the Maroni watershed. $\delta^{202}\text{Hg}$ was enriched in heavier Hg isotopes from the upstream ($-2.41\pm0.16\text{‰}$) to the downstream ($-0.73\pm0.16\text{‰}$) of the watershed, supporting increasing influence of anthropogenic Hg emissions from gold mining activities (similar discrimination for $\Delta^{199}\text{Hg}$ from $-0.70\pm0.09\text{‰}$ to $-0.09\pm0.09\text{‰}$). A binary isotopic mixing model revealed that the contribution of anthropogenic Hg in sediments increased from upstream to downstream section of the watershed. Overall, our results demonstrate that the (il)legal gold mining activities may contribute up to 50% of Hg inputs in such major river systems.

ABSTRACT ID: OP 95

Title	Combining speciation of mercury and selenium compounds from fresh to marine waters: potential biogeochemical interactions as analogs or antagonists ?
Lead Author	David Amouroux
Co-Authors	Emmanuel Tessier, Maité Bueno

ABSTRACT

Almost no study has considered simultaneously selenium (Se) and mercury (Hg) speciation in waters and their potential interactions. Se and Hg in aquatic systems exhibit both inorganic-oxidized, organic-methylated, reduced-elemental and gaseous compounds. Se speciation investigations in natural waters are limited but there is a rising interest for its role in protecting living organism and its potential role against Hg toxicity (Hg-Se antagonism). To better constrain how Hg and Se aquatic biogeochemistry evolves, investigations were conducted along a coastal range watershed including pristine lakes, downstream river, estuary and coastal zones (Adour river - Bay of Biscay, France). Sampling was carried along different seasons to evaluate the annual variability. Speciation of Se (TDS_{Se}, Se(IV), Se(VI), Se(0-II), gaseous-TVSe) and Hg (THg, iHg(II), MeHg(II), gaseous-DGM) were determined in water column samples. For Hg, total dissolved Hg remained below ng.L⁻¹ range in upstream pristine waters and increased downstream above 1 ng.L⁻¹ in more impacted estuarine waters. Methylated Hg (MeHg) remained low and in similar range in all waters (MeHg<0.01–0.08 ng.L⁻¹) but was higher in anoxic bottom waters. DGM exhibited high variations levels mainly in surface waters (0.02–1.0 ng.L⁻¹). For Se, concentration of total dissolved Se (TDS_{Se}) ranged from 7 to 200 ng.L⁻¹, mainly as Se(VI) in most cases (>50% TDS_{Se}), while Se(IV) and reduced Se fraction average lower proportion of TDS_{Se}. For Total volatile Selenium (TVSe) concentration increased from upstream to downstream ranging from <0.01 to >1 ng.L⁻¹. We established that in similar aquatic systems Se and Hg exhibit specific and distinct reduction and methylation extent, while analogous fate was observed in anoxic zones following biotic reduction and methylation pathways. These results allowed integrating Se:Hg ratios for total and species-specific concentrations overall exhibiting a global increase from upstream to coastal waters with potential implication for both element baseline uptake in the aquatic biota.

ABSTRACT ID: OP 98

Title	Large-scale mercury stabilization: industrial case studies in chlor-alkali decommissioning and gold mining across Europe and Latin America
Lead Author	Angels CASTELLNOU
Co-Authors	Philippe ZANETTIN

ABSTRACT

Background: The global proliferation of mercury (Hg) contamination from industrial sources constitutes a significant environmental and public health challenge. In response to escalating regulatory pressure — including the Minamata Convention, the U.S. Mercury Export Ban Act (2008), and EU Regulation (EC) No. 2017/852 — the industrial sector has been compelled to adopt scientifically rigorous and legally compliant mercury waste management strategies. The complete phase-out of mercury-based chlor-alkali production in Europe by 2017 has further intensified the demand for safe, permanent mercury disposal solutions.

Objective: This study presents the technical methodology and operational framework employed by BATREC Industrie AG (Wimmis, Switzerland) for the large-scale decontamination, stabilization, and permanent disposal of elemental mercury derived from industrial sources, with particular emphasis on chlor-alkali plant decommissioning and gold mining operations.

Methods: BATREC employs a patented wet-chemical stabilization process in which liquid metallic mercury (Hg⁰) is converted to mercury sulfide (HgS) via reaction with sulfide reagents. The resulting HgS is permanently disposed of in a certified underground salt mine. Full regulatory compliance is maintained throughout, encompassing transboundary waste shipment notifications under the Basel Convention, ADR/IMDG transport regulations, and applicable EU waste directives.

Results: Two industrial case studies are presented: (1) the decommissioning of a mercury-based chlor-alkali facility in Spain, involving the stabilization and disposal of more than 700 metric tonnes of liquid mercury; and (2) mercury waste management for gold mining operations in Latin America, involving the transboundary shipment and stabilization of more than 800 metric tonnes of mercury. Cumulatively, BATREC has processed in excess of 3,000 metric tonnes of mercury from chlor-alkali decommissioning projects across nine European countries since 2016.

Conclusion: The BATREC patented mercury stabilization process, combined with a comprehensive regulatory and logistical framework, constitutes a scientifically sound, operationally robust, and legally compliant solution for the permanent elimination of mercury

ABSTRACT ID: OP 99

Title	Elemental mercury dominates the biogeochemical cycling of mercury in forest ecosystems
Lead Author	Xinbin Feng
Co-Authors	Xun Wang, Wei Yuan

ABSTRACT

Significant knowledge gaps exist in the fate of mercury (Hg) and its isotopic fractionation in forests and limit the understanding of the global Hg mass budget. This study, for the first time, conducted a whole-ecosystem Hg isotope study to depict the Hg biogeochemical processes in a subtropical evergreen forest. Results show that atmospheric Hg⁰ is the primary source of Hg in foliage, woody biomass, throughfall water, runoff water and the food chains of birds. The studied subtropical evergreen forest is an atmospheric Hg⁰ sink of $57.6 \pm 43.9 \mu\text{g m}^{-2} \text{ year}^{-1}$, and an atmospheric Hg²⁺ sink of $11.5 \pm 6.2 \mu\text{g m}^{-2} \text{ year}^{-1}$. The Hg mass-dependent fractionation Hg⁰ driven by the biogeochemical processes leads to a $-0.69 \pm 0.58\text{‰}$ in $\delta^{202}\text{Hg}$ of atmospheric Hg⁰ but an insignificant shift for $\Delta^{199}\text{Hg}$. This study provides a protocol for quantifying the atmospheric Hg⁰ and Hg²⁺ sink over the whole forest ecosystem and the impact of vegetation on Hg⁰ isotopic shift; and demonstrates the use of stable Hg isotopes in tracing atmospheric Hg cycle in terrestrial ecosystems.

ABSTRACT ID: OP 101

Title	The HERMES project: reducing the affectation to general population of cinnabar processing residue.
Lead Author	Pablo Higuera
Co-Authors	Pablo Higuera 1 , José I. Barquero 1 , Feliciano Bacale 1 , Oscar A. Ávalos 1 , Ana Conde 2 , Javier Carrasco 2 , Rosina Martín 2 , Alicia Rivallo 2 , José Tejero 2 , Joan Formosa 3 , Jessica Giro-Paloma 3 , Josep Ma. Chimenos 3 , Andrea Esposito 4 ,

ABSTRACT

Mercury (Hg) is obtained from its main ore, cinnabar (HgS), through the process of calcination of the ore. For many years, this calcination process has been inefficient, resulting in two types of passive residue: old metallurgical sites of various sizes, depending on the methodology used; and accumulated wastes. Both Almadén in Spain and Abbadia San Salvatore (ASS) in Italy have been important sites for the extraction and processing of cinnabar to obtain liquid mercury. If not properly reclaimed, both types of sites can emit mercury vapours into the atmosphere, which can affect nearby populations in some cases. One of these is the decommissioned metallurgical precinct of Almadenejos, an area of approximately 33.500 m², located next to the locality. Additionally, the waste pile of Lame contains the residue from the calcination of cinnabar from ASS and is also located next to this area.

The HERMES project, which is funded by the European LIFE Programme, aims to evaluate the reduction of these emissions using a novel yet previously validated technology. This involves amending the soils in the Almadenejos area, as well as ASS wastes, by applying a low-grade magnesium hydroxide (a by-product of the calcination of natural magnesite (MgCO₃)). Previous laboratory and field experiments have demonstrated the effectiveness of this treatment in reducing the mobility of mercury in soils and wastes, thereby decreasing both leaching into water and atmospheric emissions.

The project partners include the following stakeholders responsible for technical validation, environmental monitoring, and dissemination activities: the mining company MAYASA; the producer of the proposed reagent, TERRESIS MAGNA; University of Castilla-La Mancha; University of Barcelona; and UCAVO/ Univ. of Florence, Italy.

ABSTRACT ID: OP 103

Title	Hg compounds dynamic and cycling in a periodically stratified mountain lake (Pyrenees, France/Spain): Potential influence of Climate Change
Lead Author	David Amouroux
Co-Authors	H. Cervello, E. Tessier, B. Duval, M. Sébilo, P. Anschütz, A. Thibaut de Chanvalon

ABSTRACT

While mercury (Hg) is a major concern in all aquatic environments few studies consider Hg cycling in remote alpine lakes. Mountain lakes are emblematic elements of the Pyrenean landscape, highly vulnerable to recent climate change and human activities such as atmospheric inputs of pollutants, tourism and pastoralism. It is therefore now very important to assess the dynamics of such climate “sentinels” and their biogeochemical responses toward Hg cycling. This study investigates the biogeochemical dynamic in water and sediments of a seasonally stratified sub-alpine lakes (Lake Gentau, Western Pyrenees, France). The objective was to determine how biogeochemical processes can lead anoxic conditions promoting biogenic gases formation such as methane (CH₄) and biomethylation of mercury. To this end, we have integrated some important biogeochemical variables of the dynamics of the water column and lake sediments according to previous sampling campaigns conducted from 2018 to 2023. Water column, porewaters and sediment, Hg speciation analysis of inorganic mercury (iHg(II)), methylmercury (MeHg), and dissolved gaseous mercury (DGM) were measured, and the formation rate of MeHg in different water and sediment zones has been determined by in-situ incubation experiments with isotopic tracers. Depth profiles and incubation experiments highlighted the importance of in-situ biotic methylation triggered by anoxic conditions in bottom waters and sediments. In-situ incubations confirm that significant methylation and demethylation extents can also take place in the water column. Overall, drastic environmental changes occurring seasonally in alpine lakes are providing conditions that can both promote Hg methylation and methane production (stratified anoxic waters). Acquiring this type of information is a prerequisite to study the influence of climate change methyl-Hg production and exchanges at the sediment-water interface (Contribution to P4C EU LIFE project, Pyrenean Observatory of Climate Change - OPCC).

ABSTRACT ID: OP 104

Title	Selenoneine as a Natural Antidote to Methylmercury in Ocean Fish
Lead Author	Mélanie Lemire
Co-Authors	Ayotte P, Achouba A, Archambault P, Barrette A, Médieu A, Lorrain A, Point D, Waeles M, Mulhern M, Schroff E, Shamlaye C, McSorley E, Strain JJ, van Wijngaarden E, Yeates A, Myers G, Watson G, Antropova O, Winkel L, Béziat P

ABSTRACT

Marine fish are a key source of high-quality protein, omega-3 fatty acids, and essential micronutrients for brain development and general health. Reconciling the nutritional benefits of marine fish consumption with the perceived risks associated with methylmercury (MeHg) has been a long-standing challenge for risk assessors and public health authorities. Growing evidence suggests that selenoneine, an organoselenium compound of marine origin, may counteract MeHg toxicity and help explain inconsistencies between epidemiological studies.

Selenoneine is a predominant selenium species in the muscle of many marine fish, including tunas and mackerels. It exhibits a strong antioxidant capacity, a high affinity for mercury, and promotes demethylation of MeHg. In marine birds and mammals, detoxification of mercury through the formation of inert mercury selenide (HgSe) complexes in the liver and kidneys is well established. Emerging data now suggest that selenoneine may participate in the detoxification pathway leading to the formation of HgSe in marine fish such as tunas and marlins, and potentially in humans, although the underlying mechanisms remain incompletely understood.

The importance of selenium–mercury interactions could help explain the contrasting findings from two major birth cohort studies. Neurodevelopmental deficits were associated with prenatal MeHg exposure in the Faroe Islands, where exposure is largely derived from pilot whale meat low in selenoneine. To the contrary, minimal or no adverse effects were reported in the Seychelles Child Development Study, where exposure originates mainly from ocean fishes rich in selenoneine. Thus, selenoneine may mitigate MeHg neurotoxicity at exposure levels relevant to ocean fish-consuming populations.

By moving beyond total mercury measurements and incorporating selenium speciation, this presentation will summarize current knowledge on selenoneine as a natural antidote to MeHg exposure, highlight our recent ecological, experimental and epidemiological findings, and discuss their implications for human health risk assessment and communication.

ABSTRACT ID: OP 105

Title	Determining biomass-based methylmercury concentrations in phytoplankton with the support of an Imaging Flow Cytobot and Flow Cytometer
Lead Author	Kristine C. Prelich
Co-Authors	Z. Baumann, H. Sosik, H. Levine, K. Randolph, E. Peacock, E.T. Crockford, C. Mouw, A. Ciochetto

ABSTRACT

Methylmercury (MeHg) is toxic to humans who are primarily exposed to it through the consumption of marine fish. Laboratory experiments have shown that MeHg enters the marine food web via phytoplankton. These studies demonstrated that uptake from seawater results in volume-based concentration factors (VCFs) that are 6–9 orders of magnitude higher than seawater concentrations. However, despite these experimental advances, these results have not been validated by field-based observations of MeHg concentrations in natural marine phytoplankton, largely because accurate estimates of phytoplankton biovolume and biomass from filtered samples have been impossible or difficult to obtain. This project employs a new approach to quantify MeHg per unit biovolume and biomass using the Imaging FlowCytobot (IFCB) and a Flow Cytometer (FCM). Both instruments analyze live phytoplankton directly from seawater: the IFCB captures images of individual cells, while the FCM measures cell size based on forward light scattering. Together, they generate cell counts and size-related attributes (e.g., diameter and biovolume) for phytoplankton in the ~1–150 μm size range. By combining these data with MeHg measurements using modified EPA Method 1630 from sequentially filtered (size-fractionated) phytoplankton samples, we calculate MeHg VCFs (unitless) and concentrations in ng/g wet weight. Using this approach, we will for the first time share MeHg concentrations in micro-, nano-, and picoplankton from the North Atlantic Ocean and compare the resulting VCFs with those previously reported from laboratory experiments on pure cultures of ranging cell sizes.

ABSTRACT ID: OP 106

Title	Distribution and speciation of seawater mercury in the Queen Elizabeth Islands region of the Canadian Arctic
Lead Author	Bronson Ramoutar
Co-Authors	Debbie Armstrong, Feiyue Wang

ABSTRACT

Mercury pollution negatively affects Indigenous Peoples of the Canadian Arctic due to high mercury exposure through country foods such as seal and beluga. Through the GEOTRACES program seawater mercury has been studied in many locations of the Arctic; however, the Queen Elizabeth Islands (QEI) region of the northwestern Canadian Arctic Archipelago has seen little research. As the QEI region is in proximity to the Last Sea Ice Area and glaciers, and is isolated from human settlement, it provides a unique environment to study the cycling of marine mercury given the changing cryosphere.

During the September 2025 expedition on-board the Canada Coast Guard Ship (CCGS) Amundsen to the QEI, seawater was collected at various depths via a Trace Metal-Clean Rosette System during the annual sea-ice minimum, with surface seawater salinity and temperature ranging from 24 to 31 and -1.6°C to 0.9°C respectively. Total mercury (HgT) in these samples was analysed via cold-vapour atomic fluorescence spectroscopy on-site in a portable clean lab. Water samples were sent to the University of Manitoba where analysis for methylmercury (MeHg) is ongoing. Preliminary results reveal low HgT concentrations (0.82 ± 0.24 pM), with elevated surface concentrations up to 1.55 pM in the narrow waterways within the influence of glacial melt-water. Elevated HgT concentrations up to 1.3 pM were also observed in deeper waters at four sampling locations in the Prince Gustaf Adolf Sea and Byam Martin Channel. We will report our results and discuss the impact of glacier melt and sea ice on seawater mercury concentration and speciation. Of particular interest is whether a subsurface MeHg enrichment layer similar to that observed in other Arctic locations is present in this region. This research will provide a baseline understanding of environmental mercury in the QEI, and improve the understanding of how sea ice and glacial melt influence seawater mercury.

ABSTRACT ID: OP 109

Title	The Quantitative Analysis of Mercury in Skin Whitening Creams available in the Indian Market
Lead Author	Satish Sinha
Co-Authors	Piyush Mohapatra, Alka Dubey

ABSTRACT

Background

In India, skin whitening creams are being used since ages as white complexion has been associated with prosperity and beauty for thousands of years. These products contain mercury compounds due to their melanin-inhibiting properties. Inorganic mercury compounds such as mercurous chloride (calomel), mercurous oxide, mercuric chloride or ammoniated mercury, which are predominantly used in skin-whitening creams, could penetrate the skin. As mercury bio-accumulates in the body tissue, its long-term exposure can have impact to the brain, heart, kidneys, lungs and immune system particularly, in unborn children and babies. Skin whitening reams may contribute to environmental contamination via wastewater as well. Though India has prohibited mercury in cosmetics under the Drugs and Cosmetic Rules, 2020 of the Drugs and Cosmetics Act, 1940, mercury containing products are still easily available in Indian market.

Method

In the present study fifteen skin whitening cream brands were purchased from retail outlets and online platforms across selected Indian cities. The samples included both domestically manufactured and imported products. Mercury concentrations were determined in an accredited laboratory using Inductively Coupled Plasma–Mass Spectrometry (ICP-MS) following standard analytical protocols.

Results

Mercury was detected in six of the fifteen analysed brands. Only one product contained mercury at 0.3 ppm, below the permissible regulatory limit of 1 ppm, while the remaining five products contained extremely high mercury concentrations ranging from 4,000 ppm to 14,000 ppm. Label information indicated that all six mercury-containing products were imported. In contrast, all seven creams manufactured in India were found to be free from detectable mercury. Two imported brands also reported no mercury.

Conclusion

The availability of highly contaminated imported skin whitening creams in the Indian market highlights gaps in regulatory enforcement and market surveillance. Strengthened monitoring of imported cosmetics and online marketplaces is necessary to reduce mercury exposure and support the global objectives of the Minamata Convention.

ABSTRACT ID: OP 110

Title	Heterogeneous Photooxidation of Atmospheric Mercury Enhanced by the Mixtures of Metallic Oxide and Sodium Chloride
Lead Author	Qingru Wu
Co-Authors	Pei Fang

ABSTRACT

Heterogeneous process plays an important role in atmospheric mercury (Hg) reaction, yet Hg uptake induced by the mixed components remains unknown. Here we developed an integrated approach combining a coated-wall flow tube reactor system with theoretical calculations to investigate gaseous elemental mercury ($\text{Hg}_0(\text{g})$) uptake on the surface of metallic oxides and sodium chloride (NaCl). The mixture of titanium dioxide (TiO_2) and NaCl was found to be vital for $\text{Hg}_0(\text{g})$ uptake. This uptake can be enhanced significantly under light irradiation across a range of relative humidity (RH) levels, overcoming the inhibitory effect of higher RH that occurs with TiO_2 alone. The uptake coefficients for the mixture of TiO_2 +NaCl range from 2.10×10^{-5} to 1.21×10^{-4} across RH=10% to 85%. In contrast, uptake on TiO_2 alone was only observed at $\text{RH} \leq 55\%$. Integrated with density functional theory calculations, our results reveal that the synergistically-enhanced mechanism of $\text{Hg}_0(\text{g})$ uptake on TiO_2 +NaCl transitions from air-solid to air-liquid interfacial dominance as humidity increases, a process aided by chloride radical formation and migration. These findings highlight a critical, previously overlooked pathway for atmospheric Hg transformation driven by heterogeneous chemistry. Incorporating these effects into global models is essential for improving the accuracy of Hg deposition and its associated risk assessments.

ABSTRACT ID: OP 113

Title	Mercury and Selenium Nanoparticle Formation in Amazonian Fish: Multi-Tissue Evidence of a Freshwater Detoxification Pathway
Lead Author	Marianna Alves Cancian
Co-Authors	Beatriz Gomez-Gomez ² , Tamara Fernández-Bautista ¹ , Marta Miranda ⁴ , Marta López-Alonso ⁵ , Fabio Edir Albuquerque ³ , Antonio Humberto Hamad Minervino ³ , David Amouroux ¹ , Zoyne Pedrero Zayas ¹

ABSTRACT

Mercury (Hg) bioaccumulation in Amazonian fish induce a risk a riverside community relying on them as a food source. Although Selenium (Se) could mitigate Hg toxicity via tiemannite (HgSe) nanoparticle (NP) formation in marine organisms, this mechanism remains largely unexplored in freshwater ecosystems, where most studies focus on total Hg and Se concentrations restricted to muscle tissue. Using splCP-MS, this reports the occurrence and characterizes Hg and Se NPs in Amazonian fish, providing new insights into methylmercury (MeHg) detoxification.

Multi-organ analysis of Pirarucu revealed tissue-specific accumulation, with the liver showing the highest concentrations (Hg: $2.3 \mu\text{g g}^{-1}$) than muscle, kidney and gills. This study reports the first identification of Hg and Se NPs in gonads and belly tissue, organs in which they have not, to the best of our knowledge, been reported even in marine organisms. While MeHg represented ~90% of total Hg in most organs, it remained around 50% in the liver. As total Hg and NP concentrations increased, hepatic MeHg percentage also decreased. This pattern indicates the liver is a potential site of MeHg demethylation and suggests that inorganic Hg may be immobilized through biomineralization into stable HgSe nanoparticles.

To assess this mechanism's prevalence, five species with contrasting trophic strategies were investigated: Tucunaré, Caparari, Pirarucu, Aracu, and Acari. Piscivorous species showed higher liver Hg and Se levels (Hg: $0.1\text{--}26.7$; Se: $1.0\text{--}54.3 \mu\text{g g}^{-1}$) than muscle (Hg: $0.1\text{--}8.9$; Se: $0.8\text{--}5.2 \mu\text{g g}^{-1}$). Non-piscivorous species displayed uniform Hg distribution but higher hepatic Se than muscle. Hg and Se NPs followed the same pattern, with higher concentrations in liver tissue, its role in Hg detoxification and sequestration.

These findings provide the first evidence that tropical freshwater fish may also utilize biomineralization as a defense mechanism, highlighting a potential detoxification pathway in tropical aquatic ecosystems.

ABSTRACT ID: OP 114

Title	Breaking the sea ice: cracking the seasonal cycle of mercury in the Arctic cryosphere
Lead Author	Stephen G. Kohler
Co-Authors	Pedro Duarte, Philipp Assmy, Dmitry Divine, Sebastian Gerland, Sébastien Moreau, Lars-Eric Heimbürger-Boavida

ABSTRACT

In the rapidly changing Arctic, sea ice acts as a barrier, reservoir, and transporter of mercury (Hg), yet its role in modulating Hg release to surface waters remains poorly constrained. Existing models are limited by a lack of seasonal measurements and Hg speciation data in sea ice, creating substantial uncertainty in the timing of Hg release from brine and meltwater to the surface ocean, and how this impacts the cycling of toxic methylmercury (MeHg). This study investigates the seasonal cycling and speciation of Hg in Arctic sea ice by combining archived samples, new field observations, and sea ice modelling. Archived sea ice cores, measurements from recent Arctic expeditions, and newly collected samples from the first Tara Polar Station drifting campaign across the Central Arctic Ocean (Polaris I) are/will be analyzed for total Hg and MeHg, generating a seasonal dataset and time series in Arctic sea ice. Hg speciation, partitioning coefficients, and phase exchange processes will be added to the CICE–Icepack sea ice model to simulate Hg transport and behavior within sea ice, as well as exchanges with the ocean and atmosphere. The new observational data set and model evaluation will allow quantification of seasonal inorganic Hg and MeHg fluxes associated with cryospheric processes such as exchanges at the ice-ocean interface due to brine drainage, turbulent exchanges and melting. These results are further evaluated alongside biological indicators, including particulate organic carbon and chlorophyll a, to examine how ice type, season, and biological activity influence Hg speciation and delivery from sea ice to Arctic surface waters.

ABSTRACT ID: OP 115

Title	Southern Ocean seabird population shifts over the Holocene revealed by peat sequestration of mercury from guano
Lead Author	Chuxian LI
Co-Authors	Stephen J. Roberts, Martin Grosjean, Adrien Mestrot, Martin Wille, Richard A. Phillips, Maxime Enrico, Kevin Bishop, et al.

ABSTRACT

Monitored seabird populations have declined by up to 70% worldwide since the 1950s. Yet, data on long-term seabird population dynamics prior to the anthropogenic era are largely unknown. This limits our ability to understand future population trajectories, particularly in the Southern Ocean, where seabirds are facing multiple environmental threats. Here, we use mercury (Hg) derived from seabird guano in peatland catchments as a novel tracer of colony population sizes on sub-Antarctic Bird Island (South Georgia). Peat Hg flux and isotope signature results show that the first sustained seabird colonies after deglaciation were established on the island between 6800 and 6100 years ago, pre-dating evidence for colonization on other sub-Antarctic islands by more than 1000 years. The four subsequent periods with large local seabird populations occurred during phases of less intense Southern Hemisphere westerly winds. Our study unveils significant and repeated millennial-scale shifts in seabird abundance in response to natural climate changes, implying that the present-day increase in westerly wind intensity may lead to further declines in seabird populations in the Southern Ocean.

ABSTRACT ID: OP 116

Title	Long-term mercury remobilization from southern Baltic sediments under recurring resuspension events
Lead Author	Jacek Beldowski
Co-Authors	Agnieszka Jędruch, Jaromir Jakacki

ABSTRACT

Marine sediments of the southern Baltic Sea store significant legacy mercury (Hg) and can act as a secondary contamination source when disturbed. Our experimental study showed that sediment resuspension is the main driver of Hg release to near-bottom waters, far exceeding diffusion, and that remobilization depends on sediment properties, total Hg content, and Hg speciation.

Using field data from five regions — Arkona Basin, Bornholm Basin, Gdańsk Basin, Słupsk Furrow, and Mecklenburg Bay — combined with bottom current estimates and modeled frequencies of resuspension events, we propose a long-term assessment of Hg release. This framework integrates experimentally derived Hg fluxes with hydrodynamic thresholds and current statistics to upscale local measurements to basin-scale estimates.

The Gdańsk Basin exemplifies a depositional area prone to Hg remobilization due to its fine-grained, organic-rich sediments enriched in labile Hg. The critical current velocity for resuspension is $\sim 10.3 \text{ cm s}^{-1}$ [1], while average bottom currents are $\sim 3.6 \text{ cm s}^{-1}$. Strong near-bottom flows occur episodically for several days, totaling 37–73 days annually, whereas extreme currents ($\sim 35.0 \text{ cm s}^{-1}$) occur only about 5 days per year.

Even under conservative assumptions, cumulative Hg remobilization may be substantial. For the deepest muddy part of the Gdańsk Basin (below 100 m), annual remobilization is estimated at $\sim 200 \text{ t Hg}$. This should be treated as an upper-bound estimate, assuming uniform sediment properties and sustained peak fluxes during high-energy events.

This approach links sediment geochemistry with hydrodynamic forcing and provides a practical method for scaling experimental results. It is particularly relevant for the Baltic Sea, where climate-driven changes and increasing offshore activity may intensify sediment disturbance and prolong the role of sediments as secondary Hg sources.

This work was conducted within MUNIMAP project (Interreg Baltic Sea Region Programme).

ABSTRACT ID: OP 117

Title	Probabilistic Health Risk Assessment of Multi-Pathway Mercury Exposure in Children from the Legacy Mercury Mining District of Idrija, Slovenia
Lead Author	Adna Alilović Osolin
Co-Authors	Janja Snoj Tratnik, Tome Eftimov, Milena Horvat

ABSTRACT

Idrija, Slovenia, was the site of world's second-largest mercury (Hg) mine that operated for over 500 years (1490-1995). Despite mine closure, legacy contamination still raises concerns about chronic Hg exposure, especially in vulnerable populations such as children. This study presents a probabilistic multi-pathway human exposure and health risk assessment for children aged 7-15 years, residing in Idrija municipality.

For this purpose, data for Hg concentrations (total and/or speciated) in outdoor air, soil, dust, water, vegetables, fish, and mushrooms, were collected. Concentration data for local environmental media were derived from site-specific measurements, combining original data with publicly available datasets from Idrija. As no local indoor air measurements were available, multiple plausible, literature-informed indoor/outdoor concentration ratio scenarios were evaluated. Fish Hg concentrations were sourced from the Slovenian market monitoring programme, as Idrija residents consume commercially available rather than locally caught fish. Data on local children's behavioural patterns and body weight were obtained through questionnaires (n = 142).

Ten exposure pathways were assessed, across ingestion, dermal and inhalation routes. For environmental media with sufficient measurement data (n ≥ 20), concentration and behavioral parameters distributions were generated through bootstrap resampling, and for data-limited media, Bayesian inference with weakly informative prior distributions was used to derive posterior concentration estimates. A Monte Carlo simulation (10 000 iterations) sampled from the derived distributions, and propagated uncertainty through the exposure and risk equations to generate distributions of pathway-specific Hazard Quotients (HQ) and total Hazard Index (HI). Sensitivity analyses examined the influence of the indoor/outdoor air concentration ratio, Hg speciation assumptions in fish, mushrooms, soil, and dust, and the fraction of locally grown vegetables consumed, on overall risk estimates.

ABSTRACT ID: OP 118

Title	Remote-Controlled Climate Chambers for International Collaboration in Mercury Phytoremediation Research: Current Developments and Open Access Opportunities
Lead Author	Barna Heidel
Co-Authors	Daria Severyn, Vladimir Stack Lara

ABSTRACT

Raising awareness and fostering international collaboration in research and education are essential to address mercury (Hg) contamination. This presentation introduces a self-developed, remote-monitored, and fully automated climate chamber system designed to study mercury accumulation in plants under controlled conditions. Following its conceptual debut at the ICMGP2024, we now present operational results, technical refinements, and the system's open architecture, which enables real-time, cross-border cooperation in both research and teaching.

The climate chambers combine modular hardware and software to precisely regulate environmental parameters (temperature, humidity, light, CO₂, soil parameters and Hg exposure). Their remote accessibility via a secure web interface allows international partners to co-design experiments, monitor progress, and analyze data without geographical or financial constraints, making advanced research accessible even to institutions with limited travel resources. This capability is transformative for collaborative education and joint research projects, particularly in underfunded regions.

Preliminary data reveal consistent Hg uptake patterns in model plants under simulated conditions, validating the system's reliability for comparative studies. The open-source framework ensures transparency, adaptability, and shared ownership, inviting global contributions to protocol development, data interpretation, and publication efforts. The chambers facilitate direct comparability of results across laboratories, a critical step toward scalable phytoremediation solutions.

Beyond research, the system serves as a platform for international teaching collaborations, enabling students to participate in real-time experiments and gain hands-on experience with cutting-edge environmental technologies. We showcase pilot projects involving cross-university teams and discuss plans to integrate the chambers into curricula worldwide.

We invite attendees to join this growing network, leveraging the chambers to advance mercury mitigation while training the next generation of environmental scientists. By breaking down barriers to collaboration, this initiative aligns with global sustainability goals and demonstrates how open science can accelerate impactful solutions.

ABSTRACT ID: OP 119

Title	DeSOx technology, an effective system for reducing Hg emissions from fossil and alternative fuel combustion, using a precipitant and continuous Hg measurement
Lead Author	Karel Borovec
Co-Authors	Lukaš Pilař, Zbyszek Szeliga, Zdeněk Neufinger,

ABSTRACT

DeSOx technology contributes to the capture of Hg emissions in the range of 10-30%. By effectively dosing a sulfide-based reagent directly into the absorber, while continuously measuring Hg emissions before and after the DeSOx technology, the efficiency of the technology can be increased to 90% and thus achieve emission limits according to BAT relatively cheaply. The contribution will present 2 types of reagents with the highest efficiency and describe the CEMS Hg Durag technology, which was validated by the VSB-TUO, CEET, VEC measurement group for DeHg tests regarding measurements in unsulfurized flue gases.



ABSTRACT ID: OP 120

Title	Bidirectional air-surface exchange of gaseous elemental mercury reshapes the global mercury budget
Lead Author	Shuxiao Wang
Co-Authors	Yuying Cui, Eric M. Roy, Noelle E. Selin, Qingru Wu

ABSTRACT

Mercury cycling controls its redistribution across the atmosphere, land, and oceans, with implications for ecosystem and human exposure. However, model evaluations of terrestrial gaseous elemental mercury (Hg₀) air-surface exchange exhibit substantial uncertainty (-900 to 1200 t yr⁻¹), primarily due to the simplified unidirectional parameterizations adopted in current models. Here we develop a process-based bidirectional air-surface exchange scheme based on compensation points and in-series resistance theory. Key parameters are constrained by year-round flux observations from multiple sites using particle swarm optimization, resulting in a well-constrained and observation-based parameterization. The optimized scheme is coupled into the three-dimensional chemical transport model GEOS-Chem and evaluated against available flux, concentration, and wet deposition observations. The improved representation reduces stomatal flux biases across Asia, Europe, and South America (NMB=0.12, 0.01, and -0.07) and alleviates seasonal soil flux underestimation (NMB from -0.75~-0.79 to -0.36~-0.27 across seasons). It also improves the representation of seasonal variability and phase of air-surface exchange fluxes (NMB from -0.96 to -0.29). These corrections propagate to atmospheric concentrations (NMB from -0.31 to -0.21), and wet deposition (NMB from -0.17 to -0.05), providing a more consistent process. Though observational constraints are limited, accounting for bidirectional exchange changes suggests a smaller terrestrial uptake, altering the global mercury budget. In the model, the global Hg₀ air-surface exchange weakens from -997 to -54 t, shifting the terrestrial system from a strong sink to near balance. Consequently, simulated atmospheric mercury increases by 21% (+775 t Hg₀; +71 t HgII and HgP), oceanic Hg₀ evasion decreases by 8% (-245 t), and HgII and HgP deposition increases by 16% (+148 t to land; +580 t to ocean), reflecting a reallocation of mercury among reservoirs. This underscores the need for further direct measurements of uptake fluxes in order to better quantify oceanic mercury loading and human exposure risks.

ABSTRACT ID: OP 121

Title	Unraveling mercury and selenium species dynamics in Amazonian riverine population.
Lead Author	Juliette Esplugas
Co-Authors	1Emmanuel Tessier.2Gabriel Neves Cezarette.1Camille Chen.2Fernando Barbosa Jr..1Maïté Bueno.1Zoyne Pedrero Zayas

ABSTRACT

Amazonian riverside population exhibits a unique global mercury (Hg) status, exceeding international safety thresholds. These individuals are mainly exposed to Hg via the consumption of local freshwater fish. Because Hg toxicity, transport, and excretion depend on its chemical form, approaches limited to total Hg or methylmercury (MeHg) measurements in a single matrix are insufficient to resolve metabolic processes and the fate of Hg in humans remains poorly understood. Multi-matrix speciation, particularly considering the potential antagonist role of selenium (Se) is essential to better understand Hg toxicity.

This study is part of a cross-sectional human biomonitoring investigation conducted among volunteers from 13 communities located in the Tapajós and Amazon River basins, in the state of Pará, Brazil. Hg speciation was performed in blood, plasma, urine and hair samples from individuals with blood Se concentrations ranging from 66 to 840 µg/L and Hg concentrations ranging from 0.3 to 139 µg/L. This work reveals matrix-specific and dissimilar distribution of Hg species in humans, with variable Se influence. MeHg dominated in blood (mean: 76% of total Hg, n= 56) with a distinct partitioning to plasma ($7 \pm 5\%$) compared to inorganic mercury (iHg) ($24 \pm 15\%$). Blood MeHg partitioning into plasma decreased with increasing Hg and Se blood levels. Urinary Hg excretion was dominated by iHg, positively correlated with Se excretion and modulated by Se levels in blood. In hair, Hg was mainly excreted as MeHg (mean: 90% of total Hg) and positively correlated with Se. The screening of Hg (and Se) binding biomolecules will be also presented. Together, these results provide new insights into human Hg dynamics and its interactions with Se, opening new avenues for understanding its fate at the global scale.

ABSTRACT ID: OP 122

Title	Mercury thermospeciation in coals
Lead Author	Dr. Nikolay Mashyanov
Co-Authors	S.E. Pogarev, M.W. Mathebula, E.G. Panova, V.V. Ryzhov, N.S. Ivanov,

ABSTRACT

The mercury (Hg) concentration in coal varies widely, from a few ppb to hundreds of ppm, with a world average of 100 ppb. Variations in the mercury distribution within productive horizons are governed by syngenetic and superimposed geochemical processes, which can lead to significant variability even within a single deposit. Mercury speciation in coal includes syngenetic mercury bound to the organic matrix, elemental mercury (Hg^0), and mercury incorporated into the crystal lattice of sulfides and silicate minerals. Limited data on this distribution and variability can increase uncertainty in estimating average mercury concentrations in coal and, consequently, in calculating mercury emissions at local, regional, and national scales.

We studied the total mercury concentration and mercury thermospeciation in coals of various ranks from nearly 50 deposits in Russia, Ukraine, Spain, and South Africa using a Zeeman atomic absorption analyzer RA-915M. A thermoscanning technique, which detect in real time the dynamics of mercury release from a sample during gradual heating, was used to identify mercury species with different matrix binding energies.

The total mercury concentration in the studied coal samples varies widely, from 2 to 3000 ppb. A greater degree of variability is observed for hard coals compared to lignites. In South African coals from the Vaal, Highveld, and Waterberg basins, the mercury concentration ranges from 8 to 2000 ppb. Notably, high variability can be observed even within a single productive horizon, for example, at the Vaal coal field.

The analysis of various coal types reveals mercury thermospectra with distinct shapes, enabling the determination of low-, mid-, and high-temperature mercury species. These are interpreted as elemental mercury (Hg^0), mercury bound to the coal organic matrix, and mercury associated with sulfides, respectively. This additional information can be used to enhance coal pre-treatment technologies aimed at reducing mercury emissions to the environment.

ABSTRACT ID: OP 125

Title	Zeeman AAS as a universal approach for mercury determination in samples with complex matrices
Lead Author	Alexey Shashko
Co-Authors	Sergey Sholupov, Sergey Pogarev, Vladimir Ryzhov, Nikolay Mashyanov

ABSTRACT

Mercury pollution is a challenging environmental issue. It is crucial to control mercury content in various matrices with complex compositions and a wide range of concentrations. The thermal decomposition method combined with atomic absorption spectroscopy with Zeeman background correction (Zeeman AAS) provides a universal approach for the analysis of any solids and liquids. This includes samples with complex matrices such as foodstuffs, cosmetics, biological samples, coal, crude oil, and products of its distillation.

The advantages of this method include rapid analysis and high selectivity (i.e., it can tolerate up to a 5-fold attenuation of the radiation beam by combustion products), a low detection limit at the ppb level, and no memory effect. A software-controlled, programmable furnace temperature enables an optimal decomposition mode for any sample type and makes the study of mercury thermospeciation possible. The automatic closed-loop temperature control function provides a wide dynamic range of measurements (5 orders of magnitude) and prevents data loss for samples with high mercury concentrations

ABSTRACT ID: OP 126

Title	Quantifying the role of chemistry, surface exchange, and transport on the hemispheric variability of mercury (Hg)
Lead Author	Eric M. Roy
Co-Authors	Noelle E. Selin

ABSTRACT

The environmental fate of mercury (Hg) remains poorly understood due to the complex influence of emission, deposition, and chemistry which lack sufficient observational constraints in many regions. The atmospheric lifetime of Hg is determined by its redox chemistry that controls the rate at which atmospherically dominant gaseous elemental Hg (GEM) is converted to oxidized Hg (OM). Despite persistent observational limitations, previous studies have shown that GEM concentrations have a seasonal variation that is similar to carbon dioxide, with pronounced drawdowns in the Northern Hemisphere (NH) during its summer and muted seasonal variations in the Southern Hemisphere (SH). This variation is thought to be driven by hemispheric gradients of terrestrial uptake of GEM, however global chemical transport models (CTMs) struggle to reproduce this observed mode of variability despite the inclusion of vegetative uptake fluxes, suggesting a lack of understanding of key fluxes in existing budgets.

We employ a two-phase modeling exercise to identify the ranges of emission, deposition, and chemical fluxes that can explain observed Hg seasonality in the NH and SH. We first construct a computationally efficient model to simulate monthly variations in GEM and OM concentrations which consists of three boxes representing the NH troposphere, SH troposphere, and stratosphere. We use this model to efficiently explore a range of seasonally varying emission, deposition, and chemical fluxes to identify combinations that can reproduce the seasonal variability of observed GEM and OM loadings at hemispherically representative measurement sites (e.g., Mauna Loa, USA; Amsterdam Island, FR). We then use this observationally constrained solution space to design simulations in a newly developed version of the GEOS-Chem model that incorporates interactive Hg redox chemistry, allowing us to assess the impact of budget uncertainty on simulated Hg inputs to vulnerable ecosystems and identify whether proposed oxidant loadings are consistent with concomitant species like ozone.

ABSTRACT ID: OP 127

Title	Mercury Speciation and Mobility in the Eastern Mt. Amiata Mining District (central Italy): Implications for Long-Term Environmental Risk
Lead Author	Federica Meloni
Co-Authors	Pablo Higuera 3 , Jacopo Cabassi 2 , Barbara Nisi 2 , Cristiano Romiti 2 , Daniele Rappuoli 4,5 , Orlando Vaselli 1,2

ABSTRACT

The environmental legacy of mercury (Hg) mining poses a significant threat to soil quality, particularly in historically active districts like Mt. Amiata in central Italy. This work is aimed at evaluating the distribution and geochemical behavior of Hg across 304 soil profiles which were collected down to the depth of 1.5 m. The study area, once a global epicenter for mercury extraction, exhibits a staggering range of contamination levels: total Hg concentrations were indeed fluctuating by six orders of magnitude, peaking at 1,030 mg/kg in top-soil (20-50 cm) and 1,250 mg/kg in sub-soil (50-150 cm).

To determine how easily mercury might be vehiculated from the pedological cover to the water systems, this study utilized thermal desorption and leaching protocols to identify specific Hg-bearing phases. The geochemical analysis revealed that the metal is predominantly locked within stable mineral structures, i.e. cinnabar (α -HgS) and metacinnabar (β -HgS) that constitute up to 60 and 20%, respectively, of total Hg.

However, smaller mercury fractions were also associated with organic matter, clays, and highly mobile compounds like HgCl₂ and HgSO₄.

Current geochemical conditions appear to keep this contamination largely sequestered, as only 3.94% of the samples surpass the Italian regulatory limits for soluble mercury. Nevertheless, this investigation warns against complacency. Fluctuations in some environmental parameters, though unlikely, such as soil acidification or changes in cation exchange capacity, could indeed destabilize sensitive Hg-organic complexes or soluble phases, triggering a toxic release, able to affect surface and groundwater. Ultimately, these findings emphasize that managing long-term risks in abandoned mining areas requires looking beyond total concentrations to understand the specific chemical speciation of this contaminant.

ABSTRACT ID: OP 129

Title	Identifying the spatial extent of historical mercury smelter emissions using tree cores and stable isotope soil profiles
Lead Author	Steve Dent
Co-Authors	Chris Eckley, Jennifer Crawford, Bryn Thoms, Mike Bollman, Jason Silvertooth

ABSTRACT

Legacy mercury mining and smelting sites present distinct challenges for understanding historical sources, transport pathways, and spatial extent of atmospheric mercury deposition. This study integrates dendrochemical records, depth integrated soil sampling using stable Hg isotopes, and historical mine production data to reconstruct mercury deposition patterns from smelting at the Black Butte Mine Superfund Site and assess potential impacts on selected background locations.

Native coniferous trees were cored at multiple locations spanning areas near historical furnace structures and areas further removed. Tree core samples were composited into multi-year year increments, ground and lyophilized, and analyzed for total mercury to evaluate temporal patterns of mercury uptake over pre mining, active smelting, and post smelting periods. Paired surface (0–15 cm) and subsurface (15–30 cm) stable isotope mercury soil samples were collected adjacent to several tree locations to distinguish the spatial extent of smelter deposition from contemporary atmospheric deposition and geogenic sources.

Historical mine records documenting annual mercury flask production were compiled and used as a surrogate indicator of smelting activity intensity. Tree core mercury concentrations were evaluated for temporal correlation with production records to assess whether they reflect changes in smelting activity. Results indicate that tree core mercury concentrations increase during periods of sustained mercury production and decline following reductions in smelting activity. Trees located closer to furnace structures generally exhibit higher magnitudes of mercury enrichment, while more distant trees show lower, but still detectable, enrichment, consistent with attenuation of atmospheric concentrations with increasing distance from the source.

The combined data from tree rings, soil depth profiles, and production records provides a robust, multiple line of evidence framework for reconstructing historical mercury levels near a legacy smelter. This integrated approach informs evaluation of potential smelter related influence at locations otherwise considered representative of site background.

ABSTRACT ID: OP 130

Title	Smart biochar for synergistic mercury remediation: A sustainable solution towards farmland-resilience, food security, and public health
Lead Author	Nathan Thadeo Yoashi
Co-Authors	Ling-Chu Chien*, Hsing-Cheng Hsi**

ABSTRACT

Mercury (Hg/CH₃Hg)-contaminated farmland poses a significant threat to food security due to the potential transfer of contaminants into food crops. In addition, climate change can alter the transport and mobility of Hg in soil, thereby constraining agricultural productivity and nutrient phytoavailability, while promoting ecological and human health risks. To mitigate these challenges, nitrogen (N)- and phosphorus (P)-engineered biochar (BioN) was employed to evaluate its effects on enhancing soil properties, nutrient and Hg immobilization, to reduce ecological, farmer, and public health risks. The BioN materials exhibited abundant and diverse oxygen, N, and P functional groups, together with a highly porous structure. Notably, BioN treatments increased available nutrients in the soil, including selenium, by up to 80%, and improved their subsequent uptake, indicating a strong potential for nutrient slow release and health benefit. BioN9 demonstrated superior performance, achieving 93.3% Hg and CH₃Hg immobilization efficiencies, and up to 88% inhibition of plant uptake. These effects translated into substantial reductions in human health risks and marked decreases in ecological risks, notably shifting Hg from “very high” to “medium” and “low” risk categories. Compared to conventional biochar, BioN has emerged as a practical and sustainable material for agricultural soil remediation near artisanal small scale gold mining and industrial sources, addressing impacts of climate change and offering a green and environmentally friendly solution applicable for farmland climate adaptation, resilience, and food security.

ABSTRACT ID: OP 131

Title	Model of Mercury Exposure Controlling on Communities Surrounding Artisanal Small-scale Gold Mining in Sukabumi, Indonesia
Lead Author	Alfonsus H. Harianja
Co-Authors	Haryoto Kusnoputranto, Tri Edhi Budhi Soesilo

ABSTRACT

The continuing application of mercury in gold amalgamation process of artisanal small-scale gold mining (ASGM) poses environmental and health issues to the community around. The problem in this research is the unavailability of a model of controlling mercury exposure in humans that considers economic, social and environmental criteria. This study aims to formulate a mercury control strategy for communities around ASGM using multi-criteria decision analysis (MCDA), combining strength, weakness, opportunity, and threats (SWOT) analysis, and the analytical hierarchy process (AHP). Data were collected using economic, social, and environmental assessments from 400 respondents from three sub-districts that have ASGM and representatives from thirteen stakeholders related to mercury control in Sukabumi Regency. These assessments aimed to establish criteria, sub-criteria, and alternative solutions for the SWOT-AHP modelling. The SWOT analysis results that the most appropriate alternative is the growth strategy, which combines strengths (S) and opportunities (O). Five alternative strategies were formulated are 1). Increasing community participation in the implementation of mercury-free ASGM processing technology (SO1); 2). Enhancing collaboration among institutions, including support for livelihood diversification (SO2). 3). Promoting district government regulations that support community welfare (SO3); 4). Utilizing the productive-age workforce for regulation implementation (SO4), and 5). Developing education and environmental awareness campaigns (SO5). This study concluded that the policy formulation using AHP produced the highest-rated scenario (0,013), which is to encourage district government regulations that support community welfare (SO3), by implementing mercury-free processing technology (O4). This model can be applied in the research location and adapted to other areas to develop an action plan for reducing and eliminating mercury in ASGM.

ABSTRACT ID: OP 132

Title	Mercury Transfer Across Estuarine Biota: Implications for Biodiversity in the Industrially Impacted Estuary
Lead Author	Pavitra Chandrakant Mirjankar
Co-Authors	Aaron Schultz ² , Tanveer Adyel ³ , Asif Qureshi ⁴

ABSTRACT

Estuarine ecosystems act as dynamic biogeochemical interfaces but are increasingly vulnerable to mercury (Hg) contamination due to intensified anthropogenic activities. This study investigates the distribution, methylation potential, and ecological risk of total mercury (THg) and methylmercury (MeHg) in sediments and representative biota from the Ennore estuary, southeast coast of India, an industrially influenced coastal system.

Sediment THg and MeHg concentrations ranged from 0.0024 – 1.06 mg/kg and 0.0017– 0.008 mg/kg, respectively, indicating substantial spatial variability across the estuarine gradient. The role of total organic carbon (TOC) in regulating mercury dynamics was evaluated to understand its influence on sediment metal partitioning and potential methylation processes within the estuary. Elevated TOC levels were associated with enhanced mercury retention and conditions favourable for Hg methylation. In marine organisms, THg and MeHg concentrations ranged from 1.17 – 54.82 µg/kg and 0.63 – 32.3 µg/kg, respectively, demonstrating clear evidence of bioaccumulation within the estuarine food web.

Species-specific accumulation patterns reflected ecological niches and physiological capacities for mercury uptake and elimination, with concentrations following the order: mussels > fiddler crabs > shrimps. Biota-sediment accumulation factors (BSAF) further confirmed the efficient transfer of mercury from sediments to organisms. Assessment using the geoaccumulation index (I_{geo}), referenced against local background levels, revealed that areas of the Ennore estuary influenced by intensive industrial activities exhibit extreme mercury contamination. The results highlight significant anthropogenic enrichment of mercury within the estuarine system and its propagation through biological compartments. Due to increasing anthropogenic pressure in the Ennore estuarine system, the results indicate enrichment of mercury contamination and bioaccumulation. The continuous monitoring of pollution sources, mercury distribution, and accumulation provides essential data for devising effective pollution management strategies in the Ennore estuary.

ABSTRACT ID: OP 133

Title	Mercury Speciation on Total Mercury and Methylmercury in the Water Column of the Anthropogenically Impacted Estuary
Lead Author	Pavitra Chandrakant Mirjankar
Co-Authors	Prentiss Balcom ³ , Elsie Sunderland ³ , Mayuri Bhatia ⁴ , Aaron Schultz ² , Tanveer Adyel ⁵ , Asif Qureshi ⁴

ABSTRACT

Estuaries act as critical interfaces where anthropogenic mercury inputs interact with complex biogeochemical processes that regulate mercury transformation and bioavailability. In particular, methylmercury (MeHg) formed or mobilised in estuarine waters can enter aquatic food webs and pose exposure risks to dependent coastal communities. This study examines the distribution and partitioning of total mercury (THg) and MeHg in the water column of the industrially influenced Ennore Estuary, located along the southeast coast of India, together with trace metals (Fe, Mn, Ni, and Co) and physicochemical parameters to better understand processes controlling mercury cycling. Average concentrations of THg and MeHg were $46.8 \pm 23 \text{ ng g}^{-1}$ and $0.18 \pm 0.09 \text{ ng g}^{-1}$ in suspended particulate matter and $0.15 \pm 0.17 \text{ ng L}^{-1}$ and $0.036 \pm 0.045 \text{ ng L}^{-1}$ in the dissolved phase, respectively. A significant positive correlation ($p < 0.05$) between THg and MeHg in both particulate and dissolved fractions indicates tightly coupled processes governing mercury transformation and partitioning.

Elevated particulate-bound Hg and MeHg highlight the importance of sediment deposition and resuspension in regulating mercury mobility within the estuary. Integration of Hg species with redox-sensitive elements (Fe, Mn, Ni, and Co) reveals strong coupling between mercury dynamics and Fe–Mn oxide cycling under suboxic conditions. In addition, salinity gradients and freshwater–seawater mixing influence Hg speciation, with higher dissolved MeHg in saline zones suggesting chloride-mediated stabilisation and phase redistribution. These findings highlight the role of particle dynamics, redox processes, and salinity-driven mixing in regulating mercury cycling in industrially impacted estuaries, with implications for mercury bioavailability and potential ecological and human exposure risks.

ABSTRACT ID: OP 136

Title	Are peatlands doomed to be Hg hotspots: Hg critical zone fate revealed with micromet, isotopes, genomics, and an ice-age
Lead Author	Kevin Bishop
Co-Authors	Chuxian Li, Wei Zhu, Haijun Peng, Stefan Osterwalder

ABSTRACT

Since humans began utilizing mercury, pollution has increased atmospheric Hg seven-fold. Mercury (Hg) contamination is the single largest cause of waters in the European Union failing to meet the standards of the EU Water Framework Directive. Peatlands, which have accumulated a legacy of past atmospheric Hg pollution, are major sources of Hg contamination in downstream aquatic ecosystems. Despite peatlands having accumulated Hg for millennia, independent lines of research indicate that some northern peatlands are now returning Hg to the atmosphere. This raises questions about what controls the fate of the pollution legacy Hg stored in peatlands. We hypothesize that legacy Hg accumulated in peat during earlier periods of higher atmospheric Hg pollution is no longer in balance with the lower Hg levels of the contemporary atmosphere, leading to net Hg evasion. Several methodological advances were applied to test this hypothesis on a 2000-year chronosequence of mires created by isostatic uplift along the northern coast of Sweden as well as the nearby Degerö peatland that is even older. Despite uniform climate and atmospheric Hg concentrations across the 15 km extent of the chronosequence, the stock of Hg differs by a factor of two. Novel Hg eddy covariance quantified the Hg exchange between the land and atmosphere. Distributed measurements of dissolve gaseous elemental mercury (GEM) in shallow peat groundwater quantified seasonal variation in a potential source of the evading Hg. Natural abundance of Hg isotopes and community-level expression profiling of microbial metabolisms identified the role of specific processes in the transformation of Hg within peat profiles along the chronosequence. This paper reports on puzzle pieces that have fallen into place, such as isotopic evidence for the role of photoreduction in producing GEM, and the challenges that remain to complete the picture.

ABSTRACT ID: OP 138

Title	Hg-contamination in the former Hg-mining area of Abbazia San Salvatore (Mt. Amiata, central Italy)
Lead Author	Orlando Vaselli
Co-Authors	Federica Meloni, Barbara Nisi, Jacopo Cabassi, Francesco Bianchi, Daniele Rappuoli

ABSTRACT

The Mt. Amiata mining district (central Italy) was considered the third largest Hg producer in the world after those of Almaden (Spain) and Idrija (Slovenia). It has been estimated that more than 100,000 tons of liquid mercury by roasting cinnabar (HgS) were produced until 1982 when all the facilities, after 100 years of activity, were closed due to the decreasing demand of mercury by the global market as well as its overt toxicity. Cinnabar was cultivated from the 54 sites that were distributed in the whole district but the exploitation and production area of Abbazia San Salvatore (about 65 ha) was by far the most important. After 2008, when the mining concession passed to the local municipality, a remediation plan was designed, giving space to geochemistry a relevant role in characterizing the geogenic (soil and waters) and anthropic (e.g. concrete, tails, paint, plaster, rust, mining machineries) materials and air.

The main results suggested that a remarkable mercury contamination was affecting the different matrices with concentrations that were well above the limits requested by the local and national authorities, making any remediation actions very delicate. To date, the most contaminated area was prevalently concentrated in the mining structures where the Nesa and Gould furnaces were located. Here, the gaseous mercury (Hg⁰) was >50,000 ng/m³ whilst mercury in soils in front of these edifices was up to 7% by wt. and up to 7,000 mg/L in MilliQ-leachates. Similarly, the local groundwater system showed Hg concentrations up to 350 mg/L in filtered water whereas they were up to 1 mg/L in the unfiltered waters. Currently, the reclamation operations in the former mining and production area are about to be completed and at the end of 2026, this site is expected to be turned into a public mining park.

ABSTRACT ID: OP 139

Title	Mercury in lakes of Andean Patagonia: patterns in deep and shallow lakes along a bioclimatic gradient
Lead Author	María C. Diéguez
Co-Authors	Marina Arcagni, Zaida Fernandez, Carolina Soto Cárdenas

ABSTRACT

Andean Patagonian lakes are pristine ecosystems influenced by glacial and volcanic processes and atmospheric deposition. Frequent eruptions in the Andean volcanic belt (Southern Volcanic Zone, SVZ) reflect in high levels of natural geogenic elements in different environmental compartments of Andean catchments, particularly in lake water and sediments. This study examines mercury (Hg) levels in shallow (SL) and deep lakes (DL) along a bioclimatic gradient in Nahuel Huapi National Park (NHNP), Patagonia, Argentina. We evaluated the spatial and seasonal variation in [Hg] and availability among and within lakes, focusing on Hg-DOM co-dynamics and environmental drivers. Lakes were surveyed in wet and dry seasons, and water samples were collected in the depth profile, every 2-3 m in SL and every 10 m in DL, recording environmental parameters. Water samples were analyzed for [THg] by CV-AFS, and physicochemical parameters following APHA methods, focusing on dissolved organic matter (DOM) characterization through absorbance and fluorescence spectroscopy. Multivariate analyses based on environmental and water physicochemical variables, including [THg] and DOM quanti- and qualitative features, ordered the lakes first by their trophic status (SL grading from mesotrophic to oligotrophic and DL being ultraoligotrophic), and discriminated SL and DL due to [THg] and availability. By comparison, SL exhibited higher [THg] (up to 80 ng/L) and [DOC], as well as lower Hg availability due to the prevalence of high-molecular-weight/size humic DOM with an elevated affinity for Hg. In DL, [THg] were lower (up to 18 ng/L), but Hg availability was much higher due lower [DOC] and DOM pools composed of small molecular weight/size, aromatic compounds with lower Hg-binding capacity. The quality of lake DOM effectively traced the co-transport of Hg and DOM from the catchment during the wet season, and in the dry season, it traced the internal redistribution from the sediments.

ABSTRACT ID: OP 141

Title	Air-Sea Exchange of Dimethylmercury in the Southern Ocean During GEOTRACES GP17-OCE and GP17-ANT
Lead Author	Yipeng He
Co-Authors	Marissa Despins, Carl Lamborg, Robert Mason

ABSTRACT

Air-sea exchange is a key pathway in the global mercury (Hg) cycle, yet the role of dimethylmercury (DMHg), a volatile and highly toxic Hg species, remains poorly constrained, particularly in remote ocean regions. Here, we present results from the U.S. GEOTRACES GP17-OCE and GP17-ANT cruises, spanning the Pacific sector to the Southern Ocean, to investigate DMHg dynamics across contrasting hydrographic regimes. High-resolution underway measurements of dissolved DMHg and elemental Hg (Hg₀) in surface seawater were conducted. Concurrent atmospheric measurements and meteorological observations enabled the estimation of air-sea exchange fluxes. Surface DMHg concentrations exhibited strong spatial variability, with elevated levels associated with upwelling regions, frontal systems, and waters influenced by Circumpolar Deep Water (CDW). Calculated DMHg fluxes were consistently positive, indicating that the ocean acts as a source of DMHg to the atmosphere. In several regions, DMHg evasion fluxes were surprisingly higher than previous measurements in other open oceans. The Southern Ocean showed pronounced DMHg supersaturation, likely driven by subsurface production and physical supply processes, including vertical mixing and upwelling. These results provide new constraints on the role of DMHg in ocean-atmosphere Hg exchange and suggest that DMHg evasion represents a significant, previously underappreciated pathway for transferring methylated Hg to the atmosphere. Incorporating DMHg into global Hg budgets is therefore essential for improving predictions of Hg cycling under ongoing environmental change.

ABSTRACT ID: OP 142

Title	Comparison of mercury contents in plant species and mercury emissions from prescribed burning in Japanese grasslands
Lead Author	Satoshi Irei
Co-Authors	Seiichiro Yonemura, Satoshi Kameyama, Hiroto Shimazaki, and Asahi Sakuma

ABSTRACT

Uptake of atmospheric gaseous mercury by plant species is potentially a large sink pathway, but our understanding of this process is still limited. Recent reports on the significant dry deposition onto the land surface have been catching attention, but obtaining the experimental evidence for this is technically difficult. Mercury emissions from biomass burning are a relatively new important source in the global mercury cycle, and there may be biomass burning sources that have gone uncoun- ted. All of these processes occur in vegetated fields, including forest and grassland ecosystems. Semi-natural grasslands are interesting fields due to their low canopy height and the ease of collecting representative plant samples for these areas. To evaluate the above processes that atmospheric mercury undergoes, we have conducted field studies on mercury emissions from prescribed grassland burning and field surveys of the mercury contents in the aboveground biomass of plant species in the Japanese semi-natural grasslands.

Our results from the prescribed biomass burning demonstrated an increase in total gaseous mercury concentrations during the combustion events, suggesting the release of mercury stored in the grassland surfaces. Meanwhile, preliminary results on mercury contents in plant samples showed that mercury was present in the grassland plant species at the concentrations ranging from 6 to ~20 ng Hg g⁻¹. Those mercury concentrations were normalized by carbon concentrations in the combustion plumes and plant species and then compared to evaluate the potential significance of dry deposition of atmospheric mercury. This indirect experimental approach to evaluating the dry deposition will be discussed in this presentation.

ABSTRACT ID: OP 146

Title	Global Mercury Cycling and Trends: A Multi-Model Assessment in Support of the Minamata Convention
Lead Author	Eric Roy
Co-Authors	H����� Angot, Johannes Bieser, Flora Broczka, Ashu Dastoor, Aryeh Feinberg, Jan Ga�����, Ling Li, Jerry Lin, Eric Roy, Andrei Ryjkov, Anne Soerensen, Xun Wang, Yanxu Zhang

ABSTRACT

The Multi-Compartment Mercury Modelling and Analysis Project (MCHgMAP) is an international scientific initiative supporting the effectiveness evaluation of the Minamata Convention through coordinated multi-model assessment of spatial patterns and temporal trends in global mercury (Hg) pollution. The project integrates atmospheric, oceanic, terrestrial, and multi-media mass balance models and fosters collaboration between emissions, monitoring, and modelling communities to improve data consistency and policy relevance.

Given the limited and geographically uneven coverage of measurement networks, particularly outside the Northern Hemisphere, model simulations provide a more comprehensive picture of global Hg distributions. An ensemble of state-of-the-art models was used to simulate Hg cycling over the period 2010-2020 under multiple emission scenarios, enabling attribution of observed trends to anthropogenic, geogenic, and secondary sources, as well as environmental drivers.

The results show that secondary emissions from soils dominate the land-atmosphere exchange, while biomass burning drives interannual variability. Atmospheric Hg concentrations are elevated over industrial and artisanal mining regions, with deposition hotspots in tropical forests and northern mid-latitudes. Declining Hg(0) concentrations in the Northern Hemisphere are primarily linked to reductions in anthropogenic emissions, reflecting early impacts of the Minamata Convention, whereas trends in the Southern Hemisphere are strongly influenced by artisanal and small-scale gold mining (ASGM).

Ocean Hg levels remain largely stable, with natural variability (e.g. ENSO) driving short-term changes, and the ocean acting as a net Hg source to the atmosphere. Legacy re-emissions from soils and oceans dominate the global Hg cycle (~70% of annual fluxes), highlighting the long-term influence of past emissions.

Future projections suggest that, under current policies, global emissions will remain broadly stable, while strengthened implementation of the Minamata Convention could lead to moderate reductions. Significant uncertainties remain, particularly for ASGM and waste-related emissions.

ABSTRACT ID: OP 147

Title	Analytical insights into HgSe nanoparticle formation in marine food webs
Lead Author	María Jiménez-Moreno
Co-Authors	Marta Hernández-Postigo ¹ , Armando Sánchez-Cachero ¹ , Ángel Ríos ² , Rosa Carmen Rodríguez Martín-Doimeadios ¹

ABSTRACT

Mercury selenide nanoparticles (HgSeNPs) are claimed to be the final and most stable products of mercury (Hg) detoxification in high trophic level marine organisms, as selenium (Se) promotes methylmercury (MeHg) demethylation and subsequent biomineralization. Their characterization is essential for understanding Hg retention, mobility, and residual toxicity in biological tissues. However, analytical challenges, especially the extraction of intact HgSeNPs from complex samples, have limited progress in elucidating particulate Hg–Se interactions.

This study advances Hg–Se research by systematically assessing alkaline extraction strategies for the isolation and characterization of HgSeNPs in fish tissues using single particle ICP-MS (spICP MS). Two approaches, microwave-assisted and ultrasound-assisted extraction, were evaluated to develop an integrated workflow compatible with molecular and particulate Hg species.

Microwave-assisted extraction proved suitable for classical Hg speciation, total Hg and Se determination, and preliminary nanoparticle screening. Its main advantage lies in the wide range of information obtainable from a single extract, which is particularly valuable when the sample amount is limited. However, microwave irradiation yielded low HgSeNP recoveries, probably due to partial dissolution or thermal alteration of the nanoparticles. In contrast, under optimized conditions, ultrasound-assisted extraction achieved quantitative HgSeNP recovery, while preserving particle size and structural integrity. This allowed accurate determination of particle number concentration and equivalent diameters (~300–470 nm). In real fish samples (tuna and swordfish), ultrasound-assisted extraction produced concentrations around 10^7 NPs g^{-1} , compared with $\sim 10^5$ NPs g^{-1} after microwave treatment. Interestingly, HgSeNP abundance was not always directly related to bulk Hg or Se concentrations, suggesting species-specific biomineralization processes and highlighting the need to consider particulate forms in ecotoxicological and biogeochemical assessments.

By integrating HgSeNPs into the classical speciation framework, this work provides new insights into Hg–Se antagonism and detoxification in marine predators and establishes a robust analytical basis for evaluating nanoparticulate Hg in aquatic organisms.

ABSTRACT ID: OP 148

Title	Mercury–selenium interactions in Amazonian riverine populations under contrasting exposure scenarios
Lead Author	María Jiménez-Moreno
Co-Authors	Gabriela P. Arrifano ² , Sergio Fernández-Trujillo ¹ , Marcus Augusto-Oliveira ² , Leticia Santos-Sacramento ² , Amanda Lopes-Araújo ² , Barbarella M. Macchi ² , José Luiz M. do Nascimento ² , María Elena Crespo-López ² , Rosa C. Rodríguez Martín-Doimeadios ¹

ABSTRACT

Mercury (Hg) exposure remains a critical public health challenge in the Amazon, where riverine populations are chronically exposed to methylmercury through fish-based diets. The biochemical interaction between Hg and selenium (Se) plays a key role in modulating MeHg toxicity, yet the effectiveness of this protective mechanism under real Amazonian exposure conditions is still unclear. Understanding how Se status influences Hg detoxification across distinct environmental and dietary scenarios is essential for evaluating vulnerability in highly exposed communities and for strengthening regional risk assessment frameworks.

This study presents the most extensive hair biomonitoring assessment performed in the region (about 900 samples) examining Hg–Se interactions across two contrasting exposure contexts: the Tapajós River basin, historically impacted by gold mining involving mercury, and the Tucuruí hydroelectric reservoir, one of the largest in the world.

Hair Se concentrations were generally within World Health Organization's recommended ranges (1–5 µg/g), though regional differences were evident, with higher levels observed in Tucuruí. Hg and Se concentrations were positively correlated in both regions, indicating concurrent exposure. Despite this, the functional detoxification capacity, assessed via the Se:Hg molar ratio, was critically low. About 90% of participants exhibited Se:Hg ratios below 1, indicating insufficient selenium to counteract the prevailing mercury burden. This imbalance was most pronounced in Tucuruí, where median hair Hg levels (8.1 µg/g) were more than double those in Tapajós. Notably, 63% of women of reproductive age in Tucuruí exceeded the threshold associated with increased risk of fetal neurodevelopmental impairment, highlighting that local Se status does not provide adequate protection under long-term methylmercury exposure.

These findings demonstrate that large hydroelectric reservoirs can generate chronic exposure conditions that overwhelm the protective influence of dietary Se. Hence, the incorporation of public health strategies is crucial to more accurately evaluate and mitigate mercury risks in Amazonian populations.

ABSTRACT ID: OP 151

Title	Mercury emission estimates and cycling simulations from global wildfires
Lead Author	Long Chen
Co-Authors	

ABSTRACT

Mercury (Hg) emissions from global wildfires represent a significant component of global atmospheric Hg cycling. Previous estimates have relied on the emission factor (EF) approach, which carries substantial uncertainties due to its inherent limitations. Here, we developed mass-balance models to re-estimate Hg emissions from both biomass burning and topsoil heating during wildfires, enabling quantification of emissions from surface soil heating and combustion of vegetation tissues, litterfall, and peatland. Our results indicate that global annual Hg emissions average 378 Mg yr⁻¹, including 129 Mg yr⁻¹ from vegetation-derived combustion, 81 Mg yr⁻¹ from litterfall combustion, 70 Mg yr⁻¹ from peatland fires, and 98 Mg yr⁻¹ from surface soil heating. Emissions exhibit strong latitudinal and longitudinal variability, with hotspots in central Africa, the Indo-China Peninsula, and boreal Asia. By category, the largest contributors are Africa (49%) among continents, savannas (29%) among biomes, and leaves (58%) among vegetation-derived emissions. We used a global chemical transport model (GEOS-Chem) to simulate the global cycling of severe emission events such as the 2015 Indonesian fires, and quantifying the transport and deposition fluxes of these severe emission events. Results show the remarkable dry and wet deposition onto the downwind regions. This approach provides a more accurate and nuanced risk assessment of Hg emissions from global wildfires.

ABSTRACT ID: OP 152

Title	From Fragmentation to Integration: Strengthening the Science-Policy Interface for Mercury Governance in India
Lead Author	Jagannath Biswakarma
Co-Authors	Asif Qureshi

ABSTRACT

Mercury governance represents one of the most developed examples of global science-policy integration, culminating in the Minamata Convention on Mercury. However, translating scientific evidence into coherent national policy frameworks remains limited, particularly in rapidly developing countries where environmental regulation is distributed across multiple sectors and institutions.

This study evaluates India as a case study to examine how fragmented regulatory and institutional structures constrain effective mercury governance. Drawing on a systematic analysis of environmental policy instruments, including water quality standards, soil contamination guidelines, industrial emission regulations, and hazardous waste management frameworks, we identify critical gaps in cross-sectoral coordination and in the incorporation of scientific evidence into decision-making. Despite its global regulatory status, mercury management in India remains indirect and fragmented across multiple policy domains, leading to weak alignment between monitoring data, risk assessment, and regulatory implementation.

Mercury is conceptualised here as a sentinel contaminant for evaluating the effectiveness of science-policy integration, given its complex biogeochemical cycling, multiple environmental compartments, and established global governance framework. This work highlights the limited capacity of current systems to incorporate process-level scientific understanding, including redox transformations and methylation dynamics, into regulatory practice.

To address these gaps, we propose a three-tiered framework grounded in India's regulatory context. First, data integration requires linking currently siloed datasets, such as CPCB monitoring networks, emission inventories, and site-specific studies, into interoperable systems that capture mercury across air, water, and soil. Second, policy integration demands explicit incorporation of mercury into existing regulatory instruments, rather than its indirect treatment across fragmented frameworks. Third, institutional integration requires formal science-policy mechanisms to translate advances in mercury biogeochemistry into regulatory practice.

ABSTRACT ID: OP 153

Title	Beyond Emission Reductions: The Growing Role of Climate Change in Shaping Long-Term Atmospheric Mercury Trends
Lead Author	Lei Zhang
Co-Authors	Xia Liu, Jialin Zhang, Jingmeng Jin, Daniel Jaffe, Guichen Zhang, Weikang Zhang, Peisheng Zhou, Yu Zhao

ABSTRACT

A key challenge in evaluating the effectiveness of the Minamata Convention is disentangling the role of global anthropogenic emission reductions from other factors influencing long-term trends in atmospheric mercury (Hg) concentrations and deposition. The declining rates of the gaseous elemental mercury (GEM) concentrations and wet deposition fluxes across North America from the mid-1990s to the early 2010s were estimated to be -1.5% yr $^{-1}$ and -1.6% yr $^{-1}$, respectively, which was primarily attributed to reductions in anthropogenic emissions. This study analyzed trends in GEM concentrations across the United States from 2008 to 2024 based on the data from the Atmospheric Mercury Network (AMNet). We further employed an updated GEOS-Chem model to evaluate the respective contributions of emission changes intra-regionally and in East Asia and the global climate change to GEM concentrations and wet deposition fluxes in North America.

Over the 2008–2024 period, the median decreasing rate of GEM concentrations across AMNet was -0.9% yr $^{-1}$, substantially slower than the previous decade. We improved the GEOS-Chem model by refining its gas-particle partitioning module, resulting in enhanced simulation performance. The model results indicate that in 2015, anthropogenic Hg emissions from East Asia contributed an average of 12.5% to GEM concentrations and 12.1% to Hg wet deposition in North America, significantly lower than the 2005 contribution (17%) reported by Chen et al. (2014). Contributions from North American anthropogenic emissions to local GEM concentrations ranged from 1.2% to 14.0%, while contributions to wet deposition ranged from 0.8% to 32.9%, exhibiting stronger spatial heterogeneity. Meteorological variability introduces substantial fluctuations. Relative to the 2015 baseline, the 2020 meteorology explained -4.6% to 34.7% variability. The contribution of climate-driven wildfires to Hg pollution in North America is also increasing. These findings suggest that climate change is now reshaping the long-term trends of atmospheric Hg pollution, both regionally and globally.

ABSTRACT ID: OP 155

Title	Effectiveness evaluation – a model case of science policy interface
Lead Author	Eisaku Toda
Co-Authors	

ABSTRACT

Many multilateral environmental agreements (MEAs) have provisions for taking stock of progress towards their goals. The Minamata Conventions obliges the Conference of the Parties (COP) to evaluate the effectiveness of the Convention periodically.

MEAs are designed so that they are effective in achieving their objectives, and are implemented assuming that they are effective. Effectiveness evaluation means testing the hypothesis that the MEAs are effective, and therefore it is a scientific undertaking.

The first effectiveness evaluation of the Minamata Convention is to be completed in 2027. In 2023, the COP adopted 36 indicators for the evaluation. The Effectiveness Evaluation Group, consisting of experts nominated by Parties, collect and review data and information to evaluate the effectiveness of the Convention against those indicators. 27 out of 36 indicators are the number of Parties that have taken certain measures pursuant to individual articles, that can be counted from the periodic reports from Parties. Six indicators are the amount of mercury mined, traded, used, emitted or released, or the amount of mercury waste. One indicator is the amount of financial resources mobilized to support developing country parties. Some information for assessing these indicators is available from national reports, and the Effectiveness Evaluation Group has identified other sources of information such as trade statistics such as project reports.

Two indicators are levels of mercury in the environment, in humans, and in vulnerable populations. The Open-Ended Scientific Group, consisting of scientists nominated by Parties, is developing a scientific report addressing these indicators, also elaborating on sub-indicators for different environmental media and also using models to estimate the cause-effect relationship between mercury emissions and monitoring data.

The author will present an overview of the effectiveness evaluation process, indicators and methodologies as a model case where science contribute to the policy community.

ABSTRACT ID: OP 156

Title	Hidden in Plain Sight: Human Mercury Vapour Exposure Risks Across the Oil and Gas Decommissioning Lifecycle
Lead Author	David Hunter
Co-Authors	

ABSTRACT

The decommissioning of oil and gas assets presents a complex occupational health challenge: human exposure to mercury vapour. Mercury is a naturally occurring trace element concentrated within hydrocarbon production systems over decades of operation, and its mobilisation during decommissioning activities represents a significant and multi-faceted risk to worker health.

This presentation identifies and examines the critical junctures across the decommissioning process at which mercury vapour release can occur, from initial isolation and depressurisation through vessel entry, cutting, and the dismantling of pipework and production equipment. At several of these stages, measured vapour concentrations have been shown to exceed the Immediately Dangerous to Life and Health (IDLH) threshold of 1 mg/m³, presenting acute exposure risks that are not always anticipated, monitored or adequately controlled.

A key concern raised in this talk is the inadequacy of legacy atmospheric monitoring approaches. Conventional detection methods commonly employed on decommissioning sites leave temporal and spatial gaps in coverage, creating windows during which workers may be exposed without any alarm being raised. This has significant implications for both real-time safety management and retrospective exposure assessment.

The risk does not terminate at the decommissioning site boundary. Downstream processors, including metal recyclers and smelters, who handle scrap and material derived from decommissioned assets may face elevated mercury vapour exposure, often without awareness of the contamination history of the material they are processing. Furthermore, this presentation presents evidence that even assets subjected to recognised decontamination protocols can retain mercury in quantities sufficient to pose an ongoing inhalation hazard, challenging assumptions about the efficacy of current cleaning standards.

A lifecycle approach to mercury vapour risk management in decommissioning is suggested, one that spans from asset isolation through to final material disposition, and call for a critical reassessment of monitoring technologies, decontamination criteria, and supply chain auditing and communication.

ABSTRACT ID: OP 157

Title	Recent Trends of Anthropogenic Atmospheric Mercury Emissions and Concentrations in China
Lead Author	Hezhong TIAN
Co-Authors	

ABSTRACT

Mercury (Hg) pollution, with its associated health and ecological impacts, is a well-recognized global environmental issue, and anthropogenic Hg emissions and pollution in China have attracted significant attention. However, there have been a great decline tendency both in the magnitudes of Hg and its speciation emissions and their origins from different source categories/regions along with the implementation of Blue-Sky Defense Battle policies in China. In this work, we compiled an integrated emission inventory of Hg released from major anthropogenic sources for the year 2023 to clearly quantify the temporal and spatial variations of Hg emissions. Furthermore, by using the WRF-CMAQ modeling system, we simulated the spatiotemporal variations of atmospheric mercury concentrations and validated with observational data from multi-sources. Results show that cement production and non-ferro metals smelting have become major emission sources of Hg in China, together contributed over half of national total emissions (~340 tons), whereas the share of coal-fired power plants has declined to less than 15%. Top five provinces with high Hg emissions include Shandong, Henan, Inner Mongolia, Hebei and Sichuan. Spatial distribution of ambient Hg concentration displays a pattern with high in eastern areas while low in west areas, with annual average Hg concentration of over 8 ng/m³ in some grids in several province like Shandong and Henan. These findings would help better knowing the current situations of Hg emissions and concentrations in China and supply guidance on relevant policy making to prevent global and regional Hg pollution.

ABSTRACT ID: OP 158

Title	Mercury Exposure from Cosmetics and Personal Care Products: Health Risk Assessment and Evaluation of Regulatory Effectiveness in Kerala, India
Lead Author	Swathy Krishna
Co-Authors	Dr. Mahesh Mohan

ABSTRACT

Mercury remains a significant global environmental toxicant and an ongoing public health concern, underscored by historical poisoning events such as Minamata disease and its continued presence in widely used consumer products. As a ubiquitous transboundary pollutant, it undergoes long-range atmospheric transport and persists as a legacy contaminant, characterized by high persistence, non-biodegradability, and pronounced bioaccumulation and biomagnification potential. Various mercury compounds have been employed in cosmetic formulations due to their ability to inhibit melanin synthesis, making them effective in skin-lightening products, and as preservatives due to their antimicrobial properties. The present study evaluated Hg levels in commercial toothpaste and sunscreen brands, as well as in skin-whitening creams, including locally manufactured products and imported brands. Mercury concentrations ranged widely across product categories, from 0.0062–19,900 µg/g in skin-whitening creams, 0.0040–0.0105 µg/g in sunscreens, and 0.0034–0.014 µg/g in toothpastes. While Hg levels in sunscreens and toothpastes remained within the regulatory limit of 1 ppm, several skin-whitening creams showed substantial exceedances of the permissible threshold. The health risk assessment indicated that hazard quotients (HQs) for all toothpaste and sunscreen samples remained below the acceptable threshold ($HQ < 1$), whereas six skin-whitening creams exceeded this limit, with three exhibiting substantially elevated HQs, indicating a potential non-carcinogenic health risk with prolonged use. Findings indicate significant regulatory non-compliance and widespread market availability of these products in India. The study underscores the urgent need for stricter enforcement of regulations, enhanced oversight of product distribution and sale, greater accountability among manufacturers, and improved consumer awareness regarding potential health risks.

ABSTRACT ID: OP 160

Title	Organic carbon controls on mercury dynamics in mangrove sediments of the Godavari estuary, India
Lead Author	Shrutee Jain
Co-Authors	Syed Azharuddin Hashmi, Asif Qureshi

ABSTRACT

Mangrove ecosystems are blue carbon sinks, where high organic matter and anoxic sediment conditions promote long term carbon storage. However, these same conditions also favour mercury (Hg) retention and transformation into methylmercury (MeHg). The role of organic carbon in controlling Hg fate depends critically on its lability: labile organic carbon fuels microbial respiration and methylation processes, while refractory carbon acts as a more stable, long term sink for Hg. Understanding how the source and lability of organic matter regulate Hg retention and MeHg production is therefore essential for assessing contaminant risk in mangrove ecosystems.

This study investigates Hg distribution, speciation, and methylation potential in surface sediments across the Godavari estuarine mangroves on the east coast of India. Sixteen sampling points were established, with triplicate samples collected at each point from the water edge to slightly inland positions. Total mercury (THg) concentrations, determined using a direct mercury analyser, ranged from 4.3 to 30.4 ng g⁻¹ (mean 13.2 ± 6.3 ng g⁻¹), with pristine sites exhibiting the lowest levels (8.9 ng g⁻¹) and Coringa River sediments the highest (22.5 ng g⁻¹). Geoaccumulation index (I_{geo}) values (-4.3 to -1.5) indicate that sediments remain within the uncontaminated range. Water-edge samples showed lower THg than inland positions, suggesting a tendency toward mercury outwelling from to adjacent coastal waters with implications for trophic transfer in coastal food webs.

Thermal desorption analysis will fractionate Hg into labile forms: mercury halides and organically bound mercury and stable forms such as mercury sulphides, identifying fractions susceptible to mobilisation and export. Stable isotope analysis of carbon (δ¹³C) and nitrogen (δ¹⁵N) will distinguish labile from refractory organic carbon pools and assess how carbon source influences Hg speciation and methylation. The THg: MeHg ratio will evaluate in situ methylation potential. The findings are relevant for predicting contaminant fate in mangroves under increasing anthropogenic pressure.

ABSTRACT ID: OP 162

Title	Mercury distribution pattern in soil at the UCIL site, Bhopal
Lead Author	Ekta Nagphase
Co-Authors	Jagannath Biswakarma, Asif Qureshi

ABSTRACT

Mercury (Hg) contamination in soil represents a persistent environmental concern due to its toxicity, bioaccumulation and strong sorption to soil components such as organic matter and clay minerals. This study presents the mercury distribution in soils of the Solar Evaporation Pond (SEP) and the surrounding area (western hillside) at the former Union Carbide India Limited (UCIL) site, Bhopal where wastes from the pesticide manufacturing units were dumped historically. Soil samples were collected from 40 locations (up to 35 cm depth) and analysed for total mercury using Direct Mercury Analyser (U.S. EPA Method 7473). The results indicated that total mercury ranged from 1.57 to 434.29 µg/kg, with overall mean concentration of 39.59 µg/kg. Surface soils (0-9 cm; mean = 51.56 µg/kg) have higher mercury concentrations than deeper soils (9-35 cm; mean = 29.19 µg/kg) which indicates enrichment associated with anthropogenic inputs and limited vertical mobility. Spatial distribution of analysed samples shows localized hotspots with relative higher concentrations of mercury. The thermal desorption technique used for pre-screening of mercury species in selected samples revealed that HgS-like fraction (325°C) was present significantly (60-70%) while other major forms included Hg associated with soil organic matter (225°C; 15-20%) and Hg associated with oxides (475°C; 15-20%). The dominance of HgS-like forms suggests mercury has undergone geochemical aging, transforming into stable sulfide-bound species with reduced mobility while ensuring long-term persistence. These findings will improve understanding of mercury contamination at the UCIL site and provide critical insights for future environmental monitoring and site management strategies.

ABSTRACT ID: OP 164

Title	Atmospheric Transport Pathways and Source Apportionment of Mercury Wet Deposition at IIT Hyderabad
Lead Author	Vikas Kumar Meena
Co-Authors	Hema Bhatt, Asif Qureshi

ABSTRACT

Atmospheric mercury (Hg) deposition plays a critical role in transferring mercury from the atmosphere to terrestrial and aquatic ecosystems, influencing regional and global biogeochemical cycling. However, observational data on mercury wet deposition and its source regions remain limited. Therefore, it is crucial to investigate the variability of mercury concentrations in wet deposition and to identify potential transport pathways contributing to elevated deposition events. Here in this study, we have used weekly wet deposition data collected from July 2023-May 2025 at the Indian Institute of Technology Hyderabad, India, under the Asia Pacific Mercury Monitoring Network (APMMN) programme, alongside ambient air quality data sourced from the pollution control board database. Results showed that total Hg concentrations in precipitation samples have varied significantly with a mean of 10.96 ng L^{-1} and episodic higher concentrations of 68.43 ng L^{-1} , suggesting occasional influence of a high pollution source. Field-blanks obtained on dry days through funnel rinsing showed lower concentration of 1.49 ng L^{-1} , indicating precipitation as the dominant mechanism. Further observed wet deposition fluxes were compared with the Geos-Chem model simulations. The model result shows satisfactory comparison with observations. To investigate the origin of pollution and to identify potential source regions, HYSPLIT and Trajectory-based receptor modelling techniques such as concentration weighted trajectory (CWT) were applied. The result indicated elevated mercury concentrations are predominantly associated with regional source clusters corresponding to coal-fired power plant, industrial zones and combustion activities. The CWT analysis shows weaker local contribution while the higher concentration values indicated the influence of regional and long-range transport. Overall, this study provided insights into atmospheric transport pathways and potential source regions contributing to mercury wet deposition in southern India. The findings provide a valuable baseline information for regional mercury monitoring and future assessments under global mercury-reduction frameworks, such as the Minamata Convention on Mercury.

ABSTRACT ID: OP 167

Title	Development of Multifunctional Phosphorylated Chitosan-Based Nanocomposite doped with Sulfur Nanoparticles for Efficient Removal of Hg from Surface Wastewater
Lead Author	Mvula Confidence Goci
Co-Authors	Aanny Leudjo Taka, Lynwill G Martin, Vernon Somerset & Michael J Klink

ABSTRACT

Mercury (Hg) is a highly toxic and persistent heavy metal pollutant that poses severe risks to human health and ecosystems due to its bioaccumulation and long-range environmental mobility. In this regard, the present significant environmental challenge is to develop advance efficient materials and techniques for remediation of mercury pollution in water, soil and atmosphere, even at low concentrations. Hence, in this research, a sustainable, cost-effective, eco-friendly, an easy-to-use, and fabricate, multifunctional phosphorylated chitosan-based nanocomposite doped with sulfur nanoparticles (pCh-AgTiO₂@MWCNTs/S) as a novel bio-based adsorbent was synthesized and characterized for Hg removal from surface wastewater and contaminated soil. The synthesized phosphorylated chitosan biopolymer nanocomposite material was comprehensively characterized to evaluate its physicochemical, structural, and surface properties using series of techniques such FTIR, SEM/EDS, TGA, and Zeta potential. The SEM images revealed that the surface morphology of the pCh-AgTiO₂@MWCNTs/S adsorbent exhibited a smooth, flake-like structure with a dark greenish spherical appearance. EDS analysis confirmed the presence of Si, S, P, and Ag as the main elements, while Ti, C, and O showed the most intense peaks. Among these, Ti and C displayed the highest peak intensities, followed by O. The developed bio-polymer nanocomposite material was then used as an adsorbent to remove mercury in aqueous solution through batch adsorption study. The adsorption performance was systematically investigated by examining the influence of key operational parameters, including solution pH (2–10), adsorbent dosage (2.5–4.5 mg), initial mercury concentration (2–20 ppb), contact time (5–180 min), and temperature (25–55 °C). The optimal adsorption conditions were determined at pH 6, adsorbent dosage of 3.5 mg, initial Hg²⁺ concentration of 16 ppb, and contact time of 100 minutes. This study demonstrates the potential of multifunctional phosphorylated chitosan-based nanocomposites as sustainable and efficient adsorbents for mercury removal, contributing to cleaner water resources and environmental protection.

ABSTRACT ID: OP 168

Title	Novel application of ceramic membrane microfiltration technologies for the removal of particulate mercury from oil and gas process fluids
Lead Author	Stuart Baker
Co-Authors	Dr Chris Sweeney

ABSTRACT

The presentation discusses the removal of mercury from MEG and condensate to eliminate processing issues, allow products to meet required specifications and reduce the potential for release of mercury to the environment.

Mercury is commonly found as an undesirable constituent in oil and gas production, present in liquid condensates and crude oil and can contaminate process chemicals such as monoethylene glycol (MEG). It is often present as fine particulate matter, predominantly mercury sulphide, at concentrations from below 50 µg/l to over 10,000 µg/l and at particle sizes from sub-0.5 µm to over 60 µm. Conventional sub-µm cartridge and candle filters, while capable of achieving the required removal, suffer from high pressure drop, rapid blinding, frequent change-out, and disposal problems, making sustained and reliable mercury removal impractical.

This presentation describes the development and field evaluation of two technologies - Ceramic Microfiltration (CMF) and Ceramic High Flux filtration (CHF) as robust solutions for particulate mercury control across a range of oil and gas process streams. CMF employs ceramic membranes with pore sizes typically in the range 0.1 - 0.35 µm at operating pressures of 1 - 3.5 bar, and has been demonstrated on hydrocarbon condensate and fuel oil streams, achieving fluxes of approximately 200 l/m²/h. The design and operation of the CMF system successfully controls fouling and irreversible blinding. The ceramic elements are regenerable by back-flushing and cleaning-in-place. CMF is applied for both MEG and hydrocarbon condensate streams.

The CHF process shares the same basic principles as CMF but achieves substantially higher membrane fluxes of 1,000 - 3,500 l/m²/h at lower pressures of 0.5 - 2 bar, reducing capital and energy costs. CHF has been proven for produced water treatment, reducing suspended solids from over 4,000 mg/l to below 1 mg/l, and is evaluated here for continuous hydrocarbon condensate applications for the first time.

ABSTRACT ID: OP 169

Title	Sulfurised Phosphorylated Chitosan-Based Electrochemical Sensor for Sensitive Detection of Mercury(II) Ions
Lead Author	Puleng Molete
Co-Authors	Ezinne Ekwujuru, Anny Leudjo Taka, Lynwill G Martin, Mogolodi Dimpe & Michael J Klink

ABSTRACT

Mercury(II) ions (Hg^{2+}) represent one of the most hazardous environmental pollutants due to their toxicity, persistence, and ability to bioaccumulate through the food chain, causing severe neurological, and developmental disorders even at trace concentrations. Although conventional detection methods such as atomic absorption spectroscopy and inductively coupled plasma mass spectrometry offer excellent sensitivity, they are limited by high costs, complex sample preparation, and unsuitability for on-site analysis. Consequently, there is an urgent need for simple, rapid, and portable sensing platforms for real-time environmental monitoring. Herein, we report the development of a novel electrochemical sensor for Hg^{2+} detection based on glassy carbon electrode modified with sulfurised phosphorylated chitosan ($\text{So}_{0.25}\text{pchit/GCE}$). Chitosan was first phosphorylated using a modified method with phosphoric acid, triethyl phosphate, and phosphorus pentoxide, followed by functionalization with varying concentrations of sulfur (0.0625–1.0 g) to introduce thiol and sulfur-containing groups that exhibit strong affinity for mercury through stable Hg-S bond formation. The synergistic combination of phosphate groups providing binding sites and sulfur moieties enabling specific Hg^{2+} interaction significantly enhanced the sensor's analytical performance. The stepwise electrode modification was characterized using cyclic voltammetry and electrochemical impedance spectroscopy, which confirmed successful fabrication with the $\text{So}_{0.25}\text{pchit/GCE}$ exhibiting the lowest charge transfer resistance (49.57 Ω) and highest peak current (0.132 mA), indicating enhanced electron transfer kinetics. Under optimized conditions (0.25 g sulfur concentration and 10 min reaction time), the sensor demonstrated excellent analytical performance for Hg^{2+} detection using differential pulse voltammetry, with a wide linear range of 0.1–100 $\mu\text{M/L}$ and a limit of detection of 0.006985 $\mu\text{M/L}$ (6.985 nM). This detection limit is well below the maximum permissible limits set by the WHO (30 nM) and US Environmental Protection Agency (10 nM) for drinking water. This work presents a cost-effective, and sensitive electrochemical platform utilizing modified chitosan—an abundant, biodegradable natural polymer for real-time environmental monitoring

ABSTRACT ID: OP 173

Title	Identification of mercury species in waxy oil and assessment of the efficacy of both established and novel removal technologies.
Lead Author	Jac Hales
Co-Authors	Kieran Stuart

ABSTRACT

Mercury is a naturally occurring contaminant found in almost all oil and gas reservoirs. The processing of gas and hydrocarbon liquids that are rich in mercury can be problematic and it is often necessary to incorporate a mercury removal system into the production process.

An unconventional gas field in Eastern Europe, found mercury present in the produced oil. This oil was delivered and sold to a local refinery containing a mercury concentration that significantly exceeded the imposed sales specification of 100 µg/kg.

This presentation focuses on several aspects of the work undertaken with the objectives of (i) identifying and quantifying the mercury species present, (ii) evaluating different technologies aimed at reducing the mercury concentration within the waxy oil and (iii) successful implementation of gas stripping technology.

The following will be presented:

- The analytical testing conducted to identify and quantify the mercury species present.
- Evaluation of settling method employed by plant operator within the storage tanks to reduce the mercury concentration in the upper fraction.
- Trials undertaken to evaluate commercially available chemicals to convert mercury from a soluble to non-soluble form.
- Trials undertaken to assess the potential of using novel gas stripping to reduce the mercury content of the oil.
- Data obtained from a pilot plant study designed to evaluate and refine the gas stripping process to optimise mercury removal from oil.
- Data for the efficacy of removal obtained during full-scale operation of gas stripping process, including information on how the mercury removed is disposed of in a safe, environmentally friendly, and internationally accepted route.

ABSTRACT ID: OP 175

Title	The SA Mercury Network (SAMNet): Latest Trends and findings
Lead Author	Lynwill G Martin
Co-Authors	Casper Labuschagne, Goitsewang Lekota, Londolani Lethole, Thumeka Mkololo and Pieter Labuschagne

ABSTRACT

The SA Mercury Network (SAMNet) started in April 2020 and is SA's national scientific body providing guidance to the Department of Fisheries, Forestry and Environment (DFFE) with various aspects of the Minamata Convention. Since its inception, SAMNet ground-based observation has expanded from one site the world-renowned Cape Point GAW monitoring site to several sites across the country in four provinces. Besides air monitoring, the network now also focusses on aquatic monitoring within the various water management areas close to point sources as well as modeling and health impacts of communities close to mercury sources. The Network has also expanded into African through its partnership with Ministry of Environment Japan (MOEJ) and its MOYIA initiative focusing on capacity development. The presentation will highlight all these achievements as well as the contribution towards the effectiveness evaluation process networks can play

ABSTRACT ID: OP 178

Title	Assessing mercury in skin-Lightening products using a standardized monitoring framework: Evidence from Gabon, Jamaica, and Sri Lanka
Lead Author	Ashley Bastiansz
Co-Authors	Mark Burton, Tahlia Ali Shah, Helen Yurek, Cassie Gilham, David Evers, Malgorzata Stylo, Thamali Dhanushka, Leslie Hoo Fung, Guylène Nkoane Ndoutoume, Julie Désirée Imelda Mengue Bakaka Aboghe, Jean Hervé Mve Beh

ABSTRACT

Background: Mercury is a highly toxic metal that poses serious risks to human and environmental health. Beyond dietary, environmental, and occupational exposure, inorganic mercury compounds have historically been used in cosmetic formulations—particularly skin-lightening products (SLPs)—due to their ability to inhibit melanin production. The use of SLPs remains widespread in many regions due to entrenched cultural and social perceptions.

Through the Global Environment Facility (GEF) 10810 project, “Eliminating Mercury Skin Lightening Products,” activities were implemented to address regulatory, analytical, capacity-building, and awareness-raising needs in three project countries: Gabon, Jamaica, and Sri Lanka.

Objective: In collaboration with national partners, the Biodiversity Research Institute (BRI) aimed to develop, apply, and disseminate a standardized sampling and analytical framework for identifying mercury in SLPs, while strengthening national laboratory capacity, analytical skills, and data management practices. This work also supports knowledge sharing and capacity building among laboratories and regulatory stakeholders, contributing to global efforts highlighted at the International Conference on Mercury as a Global Pollutant (ICMGP).

Methods: Cross-sectional sampling of SLPs was conducted across formal retail outlets, informal markets, and online platforms. A structured protocol guided product identification, sampling, metadata documentation, and chain-of-custody procedures. Samples were screened using portable X-ray fluorescence (XRF) analyzers and quantified using a direct mercury analyzer (DMA).

Results: The standardized protocol enabled consistent identification and analysis of SLPs across countries. XRF screening and DMA analysis identified products exceeding the Minamata Convention limit of 0 ppm of mercury (upper range of 41,569 ppm), demonstrating that non-compliant SLPs remain available in both formal and informal markets.

Discussion: Mercury-added SLPs continue to persist despite regulatory restrictions. The standardized protocol provides a practical framework for monitoring, enforcement, and laboratory capacity building, generating comparable data to support national and global efforts to eliminate mercury-containing cosmetics.

ABSTRACT ID: OP 179

Title	Advances and challenges in anthropogenic mercury emission assessment: insights from the Emissions Database for Global Atmospheric Research speciated inventory for global emission hot-spot monitoring
Lead Author	Marilena Muntean
Co-Authors	Monica Crippa (1), Diego Guizzardi (1), Federico Pagani (1), Manjola Banja (2), Corrado Luini (2), Sara Ciarlantini (1), Andrea Simonati (3)

ABSTRACT

Over the last five and a half decades, global mercury emissions patterns have shifted significantly, modifying affected areas in terms of human health and environmental impact. Most existing mercury inventories do not provide speciated and gridded emissions that cover the entire globe, thus failing to supply the essential inputs needed for impact evaluation through chemical transport modelling. Given the importance of emission magnitude and location, here, the aim is to provide a comprehensive global inventory of speciated and gridded mercury emissions for key anthropogenic sectors. Utilizing the Emissions Database for Global Atmospheric Research (EDGAR) tool developed by the Joint Research Centre of the European Commission, we developed an independent mercury emissions inventory, offering national totals and spatially distributed data with high spatial and temporal resolution across all countries for the period 1970-2025. We identify emission hot-spots and present findings from the multi-decadal trend analysis by IPCC continental regions, complemented by a comparison with official national reports and an uncertainty analysis. The results indicate a decline in mercury emissions in the Northern Hemisphere, primarily attributable to the implementation of mitigation technologies in the power generation sector, despite a global fuel consumption increase exceeding 300%. In contrast, mercury emissions in the Southern Hemisphere have risen markedly, largely driven by the artisanal small-scale gold mining (ASGM) sector, which substantially contributes to total global mercury emissions. This accurate and independent inventory enhances research and analytical efforts related to mercury emissions mitigation within the international framework; it provides essential input to the Open-ended Science Group of the Minamata Convention on Mercury and contributes to the Multi-Compartment Mercury Modelling and Analysis Project (MCHgMAP).

ABSTRACT ID: OP 181

Title	Scientific report of the Open-Ended Scientific Group of the Minamata Convention
Lead Author	Eisaku Toda
Co-Authors	Alexandra Steffen, Dominique Bally Kpokro, Terry Keating

ABSTRACT

Article 22 of the Minamata Convention commits the Conference of the Parties (COP) to evaluate the effectiveness of the Convention, beginning no later than six years after the Convention's entry into force and periodically thereafter at intervals to be decided by the COP. The effectiveness evaluation is to be conducted on the basis of, among other things, available information on the presence and movement of mercury and mercury compounds in the environment, as well as trends in levels of mercury and mercury compounds observed in biotic media and vulnerable populations.

The main purpose of the effectiveness evaluation framework is to assess whether the Parties' collective implementation of the commitments in the Convention is, or is likely to, achieve the objectives of the Convention. To make this assessment, the COP must address the following questions: (1) Have the Parties taken actions to implement the Minamata Convention? (2) Have the actions taken resulted in changes in mercury supply, use, emissions and releases into the environment? (3) Have those changes resulted in changes in levels of mercury in the environment, biotic media and vulnerable populations that can be attributed to the Minamata Convention? (4) To what extent are existing measures under the Minamata Convention meeting the objective of protecting human health and the environment from mercury?

To consider these questions, the COP has created two bodies: the Open-Ended Science Group (OESG) and the Effectiveness Evaluation Group (EEG). The OESG is to draft a scientific report that assesses how changes in emissions and releases attributed to the Minamata Convention have contributed to observed changes in the levels of mercury in the environment and in exposures to biota and human populations). The authors will present the summary of the draft report, which will be made available for input from Parties in April 2026.

ABSTRACT ID: OP 183

Title	Updated review of post-2022 literature and the development of a global database for mercury-added skin-lightening products
Lead Author	Ashley Bastiansz
Co-Authors	Mark Burton, Tahlia Ali Shah, Allison Foster, David Evers, Malgorzata Stylo

ABSTRACT

Background: Skin-lightening products (SLPs) remain widely used globally, driven by social and cultural perceptions of skin tone. Some SLPs contain inorganic mercury compounds, historically used to inhibit melanin production, posing serious health risks including neurological, renal, and dermatological effects. Despite the Minamata Convention on Mercury, which mandates phasing out mercury-added SLPs by 2025, such products persist in markets worldwide. Under the Global Environment Facility (GEF) 10810 project, “Eliminating Mercury Skin-Lightening Products,” efforts focused on strengthening regulatory monitoring, analytical capacity, and public awareness by consolidating global data on mercury in SLPs.

Objective: The project aimed to develop a global database of mercury-added SLPs. Beyond compiling analytical results, the effort emphasized capacity building for laboratories and national authorities to support consistent testing, enforcement, and international information sharing.

Methods: Boolean searches from published literature conducted by Bastiansz et al. (2022) were updated to capture studies published from 2020–2026, supplemented with findings from the GEF 10810 project and recognized datasets including the Zero Mercury Working Group. Data was organized into an online platform documenting product characteristics, analytical results, and market information.

Results: A total of 4,139 SLP sample results were compiled, including 2,705 samples (64%) with detectable mercury (upper range of 41,569 ppm). Recurring brands and formulations across multiple regions highlight the continued international circulation of mercury-added SLPs.

Discussion: The global database provides a standardized, verified source of mercury data, enabling identification of high-risk products, supporting regulatory enforcement, and enhancing laboratory and stakeholder capacity. By consolidating new and published results, this platform strengthens global surveillance, advances efforts to eliminate mercury-added SLPs, and protects public health.

ABSTRACT ID: OP 184

Title	Mercury exposure in humans: work of the Open-Ended Scientific Group for the Minamata Convention effectiveness evaluation
Lead Author	Janja Snoj Tratnik
Co-Authors	Members of the Open-Ended Scientific Group of the Minamata Convention

ABSTRACT

The Open-Ended Scientific Group of the Minamata Convention collected available human biomonitoring (HBM) data on mercury levels in various populations across the globe to assess current exposure, geographical patterns and time trends. Data were obtained through: systematic literature search, submission by the parties of the Convention, and available data from national HBM programs. In total, mercury HBM data was extracted from 280 papers representing 62 countries, and additional datasets with regionally and nationally representative data from 11 countries.

The first findings from the cross-sectional studies review show that the highest mercury non-occupational exposures were observed for Indigenous freshwater fish consumers, who are mostly represented by South American riverside communities affected by artisanal small-scale gold mining activities. Overall, Indigenous Peoples have been consistently found to be among the most exposed populations worldwide. Across the general (background) population, the exposure is generally higher in populations residing in coastal regions than inland, which is most plausibly driven by dietary habits. Among the nationally representative surveys, countries with higher consumption of seafood (Japan, South Korea) reported to have higher exposure in adults - Japan approximately 6 times higher and Republic of South Korea 3 times higher than reported in national programs in North America and Europe. Generally, a stable or slightly decreasing trend in Hg exposure can be observed in the last two decades from the available nationally representative and Arctic regional data.

Although the slight decline in exposure cannot be attributed to mitigation measures implemented over the past nine years, this work has established a global baseline for ongoing temporal trend assessments and effectiveness evaluations under the Convention. Overall, HBM studies remain essential not only for establishing temporal trends in exposure, but also for documenting local diets and trends in possible sources of exposure, tracking populations with elevated levels, and studying health effects.

ABSTRACT ID: OP 185

Title	Biodiversity and Minamata Convention – synergies in multilateral environmental agreements
Lead Author	Eisaku Toda
Co-Authors	

ABSTRACT

Triple planetary crises – climate change, biodiversity loss and pollution – are interconnected with each other and cannot be resolved alone. The Bern Process started in 2019 to address cross-cutting issues among different multilateral environmental agreements, in response to the decisions of the Conference of the Parties to the Biodiversity Convention in 2018.

Minamata Convention started to explore its linkage with biodiversity agenda with the report “Interlinkages between the chemicals and waste multilateral environmental agreements and biodiversity”, developed in cooperation with the Secretariat of the Basel, Rotterdam and Stockholm Conventions and submitted to the fourth meeting of the Conference of the Parties (COP) in 2021 and 2022. COP-4 welcomed the report and requested the Secretariat to prepare a report on how the Convention could contribute to the post-2020 global biodiversity framework, once adopted.

The report was submitted to COP-5 in 2023, which adopted a decision “Mercury and the Kunming-Montreal Global Biodiversity Framework (KMGBF)”. In that decision, COP noted the absence in the monitoring framework for the KMGBF of indicators regarding the overall risk from highly hazardous chemicals, and invited the Biodiversity Convention COP to consider additional indicators, under target 7, to cover highly hazardous chemicals and mercury. Following up on this decision, in 2025, the Secretariat provided input on KMGBF indicators proposing the levels and trends of mercury in the environment and in humans as a new indicator.

COP-5 also requested the Secretariat to draft a road map to support parties in demonstrating and maximizing the co-benefits arising from the implementation of the Minamata Convention and the KMGBF. The road map was presented to COP-6, which adopted a decision encouraging Parties and other stakeholders to undertake the actions suggested in the road map, such as the inclusion of mercury reduction actions and targets in national biodiversity strategies, action plans and targets.

ABSTRACT ID: OP 186

Title	Trophic biomagnification of mercury in Arctic vertebrates across marine and terrestrial systems
Lead Author	Juliana Souza-Kasprzyk
Co-Authors	Tuany Alves Soares ² , Vinicius Peruzzi de Oliveira ³ , João Paulo Machado Torres ² , Przemysław Niedzielski ¹

ABSTRACT

Mercury (Hg) biomagnification is a key process governing contaminant transfer in Arctic food webs. This study aimed to quantify Hg biomagnification across marine and terrestrial trophic levels using stable isotopes as proxies of trophic position. Samples were collected opportunistically in the surroundings of Petunia Bay, Billefjord, Svalbard. Total Hg concentrations (ng g⁻¹ dry weight) and stable isotope ratios ($\delta^{15}\text{N}$, $\delta^{13}\text{C}$) were determined in seabird feathers (Fulmarus glacialis, n = 21; Alle alle, n = 14) and mammalian fur (Rangifer tarandus platyrhynchus, n = 16; Vulpes lagopus, n = 3). A single apex predator (Ursus maritimus) was also analyzed for contextual comparison. Hg concentrations were measured using a direct Hg analyzer (DMA-80 EVO, Milestone), and stable isotopes by isotope ratio mass spectrometry (IRMS; Delta V, Thermo Fisher Scientific). Total Hg concentrations ranged from 13.5 to 2916, with the lowest values in R. t. platyrhynchus (50.7 $\pm$ 23.3). Higher concentrations were observed in seabirds (A. alle: 1491 $\pm$ 418; F. glacialis: 874 $\pm$ 560) and V. lagopus (1311 $\pm$ 1457). The polar bear exhibited elevated Hg concentration (1209), consistent with its apex trophic position. Stable isotope values indicated clear separation between terrestrial and marine food webs, with $\delta^{15}\text{N}$ values ranging from ~3‰ in reindeer to ~13–16‰ in seabirds, confirming their higher trophic position. A strong positive relationship was observed between log-transformed Hg concentrations and $\delta^{15}\text{N}$ (R^2 = 0.786, p < 0.001), with a trophic magnification factor (TMF) of 1.30, indicating biomagnification across the combined marine–terrestrial trophic gradient. Species-level differences in Hg concentrations were significant (ANOVA, p < 0.001), with reindeer exhibiting significantly lower levels than all other taxa. These results demonstrate clear Hg biomagnification across interconnected Arctic marine and terrestrial food webs and highlight the importance of cross-ecosystem approaches for understanding contaminant transfer in polar environments.

ABSTRACT ID: OP 190

Title	Mercury and Beyond: Environmental Health Risks in ASGM across Sub-Saharan Africa
Lead Author	Stephan Bose-O'Reilly
Co-Authors	

ABSTRACT

Artisanal and small-scale gold mining (ASGM) provides livelihoods for millions in Sub-Saharan Africa (SSA), yet it is associated with substantial and often underestimated environmental health risks. The widespread use of elemental mercury in gold extraction remains a central concern. During amalgamation and smelting, mercury is released as vapor, resulting in significant occupational and environmental exposure. Once absorbed, mercury affects multiple organ systems, particularly the central nervous system, kidneys, and the developing fetus, leading to outcomes ranging from tremors and memory loss to cognitive impairment and adverse prenatal development.

Evidence from several SSA countries highlights the scale of exposure. Studies in Tanzania, Ghana, and Zimbabwe show that a considerable proportion of miners and nearby residents exceed international safety thresholds for mercury in biological samples. Neurological symptoms, including tremors, ataxia, and impaired coordination, are frequently observed. Particularly concerning are findings among pregnant women in mining regions, where elevated mercury levels pose serious risks to fetal health and early childhood development.

Importantly, mercury exposure rarely occurs in isolation. Mining communities are simultaneously exposed to a complex mixture of additional hazards, including arsenic, lead, cadmium, silica dust, and cyanide, alongside physical risks such as occupational injuries. While mercury-free gold extraction methods are increasingly promoted, these alternatives may also introduce health risks if not properly implemented and regulated.

Despite growing recognition, access to protective equipment, biomonitoring, and medical care remains limited. Health systems are often insufficiently equipped to diagnose and manage toxic exposures. Recent analyses, including a World Bank report on ASGM and health in SSA, highlight the need for integrated approaches combining exposure reduction, safer technologies, and health system strengthening.

Addressing multi-metal exposures in ASGM is essential to protect vulnerable populations and advance global commitments such as the Minamata Convention.

ABSTRACT ID: OP 192

Title	Mercury–selenium interactions from exposure to molecular response: integrating toxicokinetics, redox biomarkers and omics evidence in human populations
Lead Author	Milena Horvat
Co-Authors	Janja Snoj Tratnik, Adna Alilović Osolin, Ingrid Falnoga, Darja Mazej, Fernando Barbosa Jr

ABSTRACT

Mercury (Hg), particularly methylmercury (MeHg) from fish consumption, remains an important environmental health concern. However, biological responses to MeHg exposure vary considerably among populations due to differences in nutritional status, metabolic pathways and genetic susceptibility. Within the MERFISH project, we investigated Hg–selenium (Se) interactions across several levels of biological organisation, integrating evidence from human biomonitoring, toxicokinetic, untargeted metabolomics, redox biology and genetic determinants of response.

Human biomonitoring studies conducted in Amazonian riverine populations, European fish-eating adults and pregnancy cohorts show that internal Hg dose reflects not only exposure but also metabolic processes such as preferential partitioning of methylmercury into erythrocytes and gradual demethylation to inorganic Hg. Selenium status emerged as a key modifier of these processes and of downstream biological responses. Adequate Se availability supports selenoprotein-dependent antioxidant defense systems and may mitigate Hg-induced oxidative stress.

Recent molecular evidence further indicates that Hg exposure may influence epigenomic regulation and metabolic pathways, including processes related to oxidative stress, energy metabolism and lipid homeostasis. These responses appear to be partly modulated by Se status and genetic factors, including ApoE-related pathways.

Together, the results support an integrated framework linking MeHg exposure, nutritional status and molecular responses, highlighting the importance of considering Hg–Se interactions when interpreting biomonitoring data and health risk assessment.

ABSTRACT ID: OP 193

Title	What national reports can tell on artisanal and small-scale gold mining
Lead Author	Eisaku Toda
Co-Authors	

ABSTRACT

Parties to the Minamata Convention are to periodically report on the measures taken to implement the Convention. The reporting format includes five questions on artisanal and small-scale gold mining (ASGM): whether the Party has (1) taken steps to reduce or eliminate mercury from ASGM; (2) determined that ASGM is more than insignificant in its territory; (3) developed and implemented national action plans (NAPs); (4) conducted a review of the measures taken; (5) cooperated with other countries or other organizations.

The Conference of the Parties (COP) is to evaluate the effectiveness of the Convention based on these national reports and other available information. In 2023, the COP adopted indicators for this evaluation. The three indicators relevant to ASGM are (1) total amount of mercury used globally in ASGM; (2) number of parties that have taken steps to reduce or eliminate mercury from ASGM; (3) number of parties that have submitted NAPs and reviews.

The Convention Secretariat developed a report on mercury trade, supply and demand, in which total mercury used in ASGM was estimated as 1,400 – 2,800 tonnes, based on the estimates in NAPs and information from the UNEP Global Mercury Assessment. Other estimates in scientific literature have been reviewed, but there is still high uncertainty in the data.

The number of Parties that have taken actions on ASGM has been compiled in the Secretariat's analysis of the national report for 2017-2020. The number of Parties that have notified that ASGM is more than insignificant was 39, whereas around 80 countries worldwide have been known as having ASGM activities. The national reports for 2021-2024, submitted by 2025, are currently being analysed.

The effectiveness evaluation exercise will further reveal the information gaps and possible actions to fill the gap for the effective implementation of the Convention.

ABSTRACT ID: OP 194

Title	Mercury behavior during the formation of modern thermal fields of Kamchatka (Russia)
Lead Author	Anton Nuzhdaev
Co-Authors	

ABSTRACT

Between 2008 and 2026, a rare natural phenomenon—the modern formation of thermal fields—was observed twice in Kamchatka. In 2008, the Nizhne-Koshelevsky Novoe Thermal Field (Koshelevsky Volcano, southern Kamchatka) formed. This natural phenomenon resulted in temperatures reaching 100°C (212°F) at the surface, and open steam was recorded. This site existed until 2013. During this period of activity, work was organized to monitor the behavior, influx, and accumulation of mercury in the argillized rocks forming on the surface. As a result, it was shown that active mercury influx and anomalies occurred during the early stages. As the thermal field cooled, the accumulated mercury was gradually redistributed and transported beyond the thermal field boundaries.

In December 2023, on the slope of the Mutnovsky volcano, two kilometers from the Mutnovsky geothermal power plant, a slope collapse caused by the collapse of a well formed a crater up to 200 meters in diameter, from which hydrothermal solutions began actively flowing to the surface. Studies conducted to determine mercury concentrations in hydrothermal solutions showed that mercury concentrations for this site are four orders of magnitude (10,000 times) higher than background mercury concentrations. However, natural thermal fields in this area typically have mercury concentrations no more than 100 times higher than background

ABSTRACT ID: OP 195

Title	Minamata Convention report on the challenges in eliminating mercury-added cosmetics
Lead Author	Eisaku Toda
Co-Authors	

ABSTRACT

The Parties to the Minamata Convention have an obligation not to allow the manufacture, import and export of mercury-added cosmetics. The phase-out deadline for cosmetics containing more than 1 ppm of mercury was 2020, and for some Parties, the deadline was extended to 2025. The phase-out deadline for mercury-added cosmetics, irrespective of the mercury content, was 2025. However, Parties face challenges in eliminating mercury-added cosmetics, due to, among others, the unregulated sales of such products, illegal or informal manufacturing and import, and online sales. In 2023, the Conference of the Parties (COP) requested the Convention Secretariat to develop a report on the challenges that Parties face in preventing the manufacture, import and export of mercury-added cosmetics, as well as on current or proposed measures for addressing those challenges, based on the submissions from Parties and stakeholders. The report was presented at the sixth meeting of the COP in November 2025. The report concluded that eliminating mercury-added skin-lightening products is a multifaceted challenge that includes addressing regulations, supply chain management, capacity building and awareness-raising. The report listed five key challenges: lack of national

implementing legislation and/or measures, inadequate enforcement, lack of capacity and lack of awareness, and need for global cooperation. Having reviewed the report, the COP-6 encouraged the Parties without national legislation or other measures, or otherwise facing challenges in phasing out mercury-added cosmetics, to apply the Convention's provisions on capacity building and the Implementation and Compliance Committee. Secretariat was requested to develop a further synthesized report on these challenges. The report will also cover mechanisms to support Parties in identifying the presence of mercury in cosmetics, and an investigation of major sources of manufacture and import of mercury-added cosmetics. The author will present the report submitted to COP-6 and the progress in developing the report for COP-7.

ABSTRACT ID: OP 197

Title	From Pilots to Global Action: Insights on Eliminating Mercury and Harmful Chemicals from Cosmetics
Lead Author	Grace Halla
Co-Authors	Malgorzata Stylo

ABSTRACT

The global skin lightening industry surpassed US\$10 billion in 2025 and continues to expand, driven by deeply rooted beauty norms and widespread use across Africa, Asia, and the Caribbean. However, many products still contain hazardous substances, including mercury, steroids, hydroquinone, that pose serious risks to human health, pollute ecosystems, and perpetuate harmful social pressures.

In response, United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF), are partnering with governments, intergovernmental organizations, industry, academia, and civil society to eliminate mercury from cosmetics, transform supply chains, and promote safer and more inclusive beauty standards.

This session will present key achievements and lessons learned from pilot initiatives in Gabon, Sri Lanka, and Jamaica, demonstrating how coordinated action across environmental, health, and social justice agendas can drive systemic change.

It will also highlight upcoming plans to expand efforts to additional countries and explore how the knowledge, partnerships, and regulatory momentum generated through mercury-free cosmetics can be leveraged to address a broader set of chemicals in the beauty sector. Finally, the session will underscore how integrated, cross-sectoral approaches can accelerate the transition toward safer, more sustainable consumer products.

ABSTRACT ID: OP 198

Title	Placental metal(loid)s in cohorts from Hg-mining and control environments
Lead Author	Ingrid Falnoga
Co-Authors	Veronika Tursunova ¹ , Janja Snoj Tratnik ² , Darja Mazej ² , Marta Jagodic Hudabivnik ² , Peter Stegnar ⁴ , Milena Horvat ^{2, 4} , Rustam Tuhvatshin ³ , Zhanibek Muratov ¹ ,

ABSTRACT

The current study examined placental metal(loid)s and birth anthropometrics of healthy singleton pregnant Kyrgyz women with newborns living in a mercury-mining environment and a control environment with no known mercury mining history or metal industry: Aidarken, Batken region (n = 55) versus Kara-Suu, Osh region (n = 35). Thirteen essential (Na, Mg, P, S, K, Ca, Mn, Fe, Co, Cu, Zn, Se, Mo) and thirteen nonessential (Hg, As, Pb, Cd, Rb, Sr, Ba, Cs, Sn, Sb, V, Cr, U) metal(loid)s were measured in placental tissue using inductively coupled plasma mass spectrometry (ICP-QQQ). The exposed group shows a small statistically significant elevation in potentially toxic elements Hg, As, Sb, and U, along with an increase in essential Mo, but a decrease in Na, K, Cu, Co, and Cr ($p < 0.05$). Geometric means (ng/g) of exposure/control levels for potentially toxic elements and Se, as a protective element, were: Hg 1.30/0.45, As 3.03/1.59, Cd 6.92/6.72, Pb 4.33/3.51, Sb 0.316/0.076, U 0.257/0.043, and Se 195/205. Using adjusted linear regression models, we estimated the positive associations ($p < 0.05$) of newborns': i) birth weight with As, Ba, and U (close to significant also with Co, Sr, Pb; p 0.073, 0.108, 0.121); and ii) head circumferences with Ca, Mg, V, and Sr (marginally significant with P, Hg, Pb; p 0.59, 0.067, 0.091). For chest circumference, the association was significant only with Mg, while close to significance with Sr, Ca, P, V, Fe, and Pb.

The positive influence of (ultra)trace levels of potentially toxic elements on newborns' anthropometric characteristics can be attributed to their ability to mimic essential metals and use their physiological transport pathways. However, the potential adaptive or beneficial effects at various levels (such as Sr on bone growth, inorganic Hg against intestinal microbial infections) cannot be excluded.

ABSTRACT ID: OP 199

Title	Considerations for the integration of pollution into the implementation of National Biodiversity Strategies and Action Plans (NBSAPs) and related MEAs reporting
Lead Author	Imelda Dossou Etui
Co-Authors	Malgorzata Stylo, Haddy Guisse

ABSTRACT

Mercury and other chemical uses, emissions, and releases across sectors such as mining, healthcare, agriculture, and industry significantly impact ecosystems, biodiversity, and human health. For example, in ASGM, the use of mercury and cyanide contributes to biodiversity loss through deforestation, soil degradation, and contamination of terrestrial and aquatic systems, even within protected areas. In healthcare, hazardous chemicals found in pharmaceuticals, diagnostics, laboratory activities, medical devices, and lighting can enter wastewater and soils through medical and biomedical waste, bioaccumulating in ecosystems and causing long-term endocrine and ecological effects. In agriculture, the toxicity of agrochemicals leads to habitat loss, chemical pollution, water depletion, and soil degradation - major drivers of biodiversity decline.

UNEP is contributing to ongoing synergies along with the Global Biodiversity Framework (GBF), Global Framework on Chemicals (GFC) and relevant Multilateral Environment Agreements (MEAs) secretariats to strengthen linkages between the chemicals' pollution and biodiversity agendas. In addition to ongoing research and communication on linkages between mercury, ASGM and biodiversity, UNEP is developing a practical tool to support the integration of chemical pollution, including mercury, into the implementation of National Biodiversity Strategies and Action Plans (NBSAPs) and national reporting to the Minamata and Biological Diversity Conventions. The tool intends to provide governments and interested stakeholders with concise and comprehensive overview of linkages between chemicals pollution and biodiversity through a sectoral approach, recent decisions and tools that emphasize linkages between pollution and biodiversity pillars, as well as step by step roadmap to integrate chemicals pollution into NBSAPs and reporting, with countries' case studies

ABSTRACT ID: OP 200

Title	Non-Profit/Public Partnership Targets Harmful Skin Lightening Products
Lead Author	Lori Copan
Co-Authors	Michael Bender

ABSTRACT

Extensive testing by the California Department of Public Health (CDPH), the Mercury Policy Project (MPP) and others confirm that internet marketplaces continue to sell harmful and illegal skin lightening products (SLPs). Many of these products have already been identified by governments around the world as containing unacceptable mercury levels that unknowingly expose consumers and their families to this dangerous neurotoxin.

Mercury in SLPs are known to many local, state, federal, and international agencies as toxic and a risk to human health. Regular application of SLPs containing mercury can lead to neurological, renal, dermatological and other health effects in cream users and their children who are indirectly exposed through touch and mercury vapor in the air.

In this presentation, we will discuss a demonstration project on how civil society and government have worked collaboratively to systematically collect, screen and analyze suspect SLPs purchased online, and how they raise public awareness through postings of health alerts and social media messages.

Recognizing that mercury added SLPs are both a domestic and international challenge, MPP will describe the prohibited product policies that online marketplaces have in place and often fail to enforce. Next, the steps taken to identify suspect SLPs for sampling will be described and the process for documenting sales outlined prior to sending suspect SLPs to CDPH for testing. The lab testing methodology will be presented along with the steps CDPH has taken to warn the public, including through issuing a consumer alert and displaying products on their website.

Finally, on behalf of MPP, Greenfire Law LLC will explain the illegality under California's Proposition 65 for knowingly selling products known to cause reproductive harm without first providing a warning. Greenfire will close by describing the legal process to bring alleged offenders into compliance with California law.

ABSTRACT ID: OP 201

Title	Stoichiometric relationship between mercury and selenium in the nutrition of populations in the Northwest Territories (Canada), with special emphasis on remote indigenous communities
Lead Author	Dirk Wallschläger
Co-Authors	Alexander Branton

ABSTRACT

For this presentation, we compiled an inventory of the human diet in the Northwest Territories (NWT), Canada, with respect to the mercury (Hg) and selenium (Se) content in individual food items. For the 64 different food items contained in the revised Northern food basket (RNFB), which is assumed to represent the average diet of urban Northern Canadian populations, representative Hg and Se concentrations were gathered from the published literature. Mercury was only elevated in fish products, while Se was elevated in fish, meat, flour and milk products. Daily average uptake doses of 142 µg Se and 2.4 µg Hg were calculated, which appear to suggest no immediate health risk for the average NWT population. Furthermore, molar Se/Hg ratios were calculated for each food item, and ranged between 14 (in fish) to over 3,000 (in milk products), with an overall Se/Hg ratio for the RNFB of 151. This suggests that the average diet in the NWT contains sufficient Se to prevent toxic Hg effects.

Since rural, mainly indigenous, populations in the NWT consume more country foods (especially fish and caribou), an attempt was made to estimate the changed Hg and Se uptake of members of such rural communities. For this purpose, Se and Hg concentrations in fish from water bodies impacted by industrial operations and Hg concentrations in fish from lakes impacted by long-range atmospheric Hg transport were considered, and substituted into the “urban” NWT diet. While the Hg and Se uptake doses increased in the estimate for the rural populations in the NWT, they still remain within ranges considered safe, and the continued large molecular Se excess should provide additional protection against Hg-based effects. Therefore, aside from extreme individual cases, it is unlikely that the NWT population is at risk of negative health effects from either Hg or Se exposure.

ABSTRACT ID: OP 203

Title	Efficient Synergistic Removal of Multi-form Mercury from Cement Kiln Flue Gas Using Non-carbon Zinc Sulfide
Lead Author	Mingguang Zhang
Co-Authors	Bingxin Huang, Hailin Zheng, Jiefeng Chen, Hongxiao Zu, Fanyue Meng, Hailong Li

ABSTRACT

The cement industry is one of the major global anthropogenic sources of mercury emissions. Effective control of mercury emissions from this sector is of great significance for fulfilling the Minamata Convention on Mercury. However, the coexistence of multiple mercury species (Hg^{2+} and Hg_0), combined with complex flue gas composition and elevated temperatures, poses substantial challenges to the efficient removal of mercury from cement kiln flue gas. This study introduces zinc sulfide (ZnS) as a novel non-carbon-based adsorbent designed for the synergistic and highly efficient capture of multi-form mercury from cement kiln flue gas. ZnS demonstrates excellent adsorption performance toward both Hg^{2+} and Hg_0 across the temperature range of 140-200 °C. Under optimal adsorption conditions, its saturated adsorption capacities reach up to 417.2 $\text{mg}\cdot\text{g}^{-1}$ for Hg^{2+} and 1.3 $\text{mg}\cdot\text{g}^{-1}$ for Hg_0 . These values significantly outperform those of conventional commercial activated carbon. Notably, high concentrations of common flue gas components such as NO_x , SO_2 , O_2 , and H_2O exert almost no noticeable inhibitory effect on ZnS performance, highlighting its strong resistance to competitive adsorption in realistic flue gas environments. Mechanistic investigations reveal that the abundant intrinsic sulfur species (S^{2-} and S_2^{2-}) on the ZnS surface play a critical role in efficiently converting various mercury species into thermodynamically stable HgS . Density functional theory (DFT) calculations further elucidate that adsorbed HgCl_2 undergoes dissociation, inducing the formation of ZnCl_2 on the surface. This process accelerates the simultaneous immobilization of both Hg^{2+} and Hg_0 . In addition, the excellent cement compatibility of ZnS enables the mercury-loaded adsorbent to be directly recycled into cement production through kiln dust shuttling technology, thereby avoiding the generation of hazardous waste. This work provides a promising non-carbon-based alternative to traditional activated carbon sorbents, offering a sustainable and efficient pathway for mercury pollution control in the cement industry.

ABSTRACT ID: OP 204

Title	Measuring What Matters: Evidence-Based Approaches for Tracking Mercury Reduction in ASGM under Article 7 and National Action Plans
Lead Author	Anne Lillian Nakafeero
Co-Authors	Stylo Malgorzata & Thomas Verbaere

ABSTRACT

Uganda's National Action Plan for Artisanal and Small Scale Gold (NAP on ASGM) of 2019 aims at a reducing mercury access, use and release in the sector by 70% by 2024 and complete elimination of mercury (100% elimination) in the ASGM sector by 2030. Subsequent global (through the planetGOLD programme) and national interventions covering legal, institutional and gold marketing incentives have seen the increased formalization and mechanization of ASGMs. However due to limited access to finances by ASGMs to investment into mercury free mechanized technologies, seems to be presenting a shift in mercury use levels from the NAP baseline of 15t/y to planetGOLD Hg baseline of 25.19t/y at planetGOLD sites (Eastern and Central regions of Uganda). UNEP/GEF's support to review country NAPs on ASGM is timely as additional measures to tone down mercury use while increasing mechanization resulting from access to finance by ASGMs will be developed by national stakeholders. Review of NAP on ASGMs will address crosscutting new and emerging issues of global concern including but not limited to: halting further biodiversity loss; Plastic pollution; management of contaminated sites; strengthening involvement of indigenous peoples and local communities; resource use efficiency and gender dimensions.

ABSTRACT ID: OP 205

Title	Eliminating Production and Online Trade in Mercury Added Cosmetics
Lead Author	Elena Lymberidi-Settimo
Co-Authors	

ABSTRACT

Despite being banned globally, mercury-added skin lightening products are produced and marketed worldwide increasingly through online marketplaces. To reduce their proliferation, we will present examples of 1) national enforcement efforts targeting producers and 2) legal, regulatory and voluntary approaches aimed at eliminating online sales of toxic skin lighteners.

Last year, Zero Mercury Working Group and its partners in 8 countries sampled suspect skin lighteners and the results revealed that 60 of 68 contained mercury. ZMWG estimates that more than 66 million mercury-added skin lightening products are produced annually, using over 110 metric tons of mercury compounds, with Pakistan, Thailand, and China together accounting for over half.

While awareness is growing, more concrete steps are needed to curtail production of mercury added skin lightening products and we sought out governments in targeting producers. For example, the Competition Commission of Pakistan recently announced enforcement actions targeting domestic manufacturers of toxic skin lighteners.

Steps are also being taken to assist governments engage online platforms. While some platforms are voluntarily agreeing to screen out toxic skin lighteners, others are being legally challenged to accept responsibility.

A case in point is a recent legal settlement in the U.S. whereby Amazon has agreed, among other steps, to implement a new policy requiring third party sellers to first test skin lighteners for mercury. Similar cases have also been filed against Etsy, Walmart and Ebay.

In summary, this presentation will outline the necessary controls to prevent toxic skin lightening products from being manufactured and offered online.

ABSTRACT ID: OP 207

Title	"Beyond Borders and Beauty: Tackling Mercury in Skin-Lightening Products – Lessons from Sri Lanka in a Three-Country Initiative"
Lead Author	Inoka Kamalinie Suraweera
Co-Authors	Chandanee Withana, Chalani Rubasinghe, Suveendran Thirupathi

ABSTRACT

Introduction

Mercury (Hg) in skin-lightening products (SLPs) is a persistent and a significant public health concern, driven by complex sociocultural influences, strong consumer demand, and increasingly unregulated market channels. As part of a three-country initiative, Sri Lanka implemented and tested a comprehensive approach to address mercury in SLPs, generating critical evidence to inform policy and practice. This presentation highlights Sri Lanka's experience, including key successes, innovations, and emerging challenges.

A central component of the initiative was the strengthening of legislation and regulatory enforcement to restrict the importation and sale of mercury-containing cosmetics. This was complemented by systematic testing of SLPs available in the local market, which provided concrete evidence of mercury content in selected products and strengthened advocacy, regulatory action, and risk communication.

Capacity-building programmes were conducted to equip health professionals with the skills to identify mercury-related health effects, counsel patients, and support surveillance efforts. Public awareness initiatives targeted harmful beauty norms and promoted safer practices. Importantly, a mixed-methods behavioural insights study among healthcare workers explored the drivers, perceptions, and barriers related to SLP use, providing context-specific evidence to guide interventions.

Findings revealed that SLP use is strongly influenced by entrenched sociocultural preferences, perceived social and occupational advantages, and peer dynamics. However, several challenges continue to hinder progress. The rapid expansion of online markets has enabled widespread access to unregulated mercury-containing products, often bypassing national controls. Persistent consumer demand sustains the market, while the influence of social media and digital marketing reinforces unrealistic beauty standards and promotes product use.

Sri Lanka's experience demonstrates that addressing mercury in SLPs requires an integrated and adaptive approach that combines regulatory action, product testing, behavioural insights, and innovative communication strategies. These lessons are critical for strengthening implementation of the Minamata Convention on Mercury and offer valuable guidance for countries facing similar public health challenges.

ABSTRACT ID: OP 208

Title	Human Biomonitoring Reveals High Mercury Exposure in Amazonian Communities Under Emerging ASGM Pressure
Lead Author	Claudia Vega
Co-Authors	Jessica Pisconte, Tatiana Garcia, Luis Fernandez, Claus Garcia

ABSTRACT

Methylmercury (MeHg), one of the most toxic forms of mercury, bioaccumulates in aquatic food webs, posing significant food safety risks for fish-dependent populations. The Loreto region in the northern Peruvian Amazon has the highest fish consumption rates in the country and is experiencing increasing artisanal and small-scale gold mining (ASGM) pressure. This study assesses baseline mercury exposure in riverine populations of Loreto.

We conducted a cross-sectional biomonitoring study in 2024 across nine communities in the Nanay-Pintuyacu and Lower Putumayo basins (n = 439 individuals). Total mercury concentrations were measured in human hair, alongside mercury levels in fish and sediments, using a direct mercury analyzer (DMA-80).

Hair mercury concentrations ranged from 0.59 to 50.33 mg/kg, with a mean of 10.75 mg/kg. Mean levels were significantly higher in the Lower Putumayo (15.67 mg/kg) compared to Nanay-Pintuyacu (8.41 mg/kg). Overall, 97% of participants exceeded the WHO reference value (2.2 mg/kg), indicating widespread chronic exposure. Particularly high levels were observed in women of reproductive age (mean: 14.84 mg/kg), of whom 81% were classified at high risk. Fish analysis identified elevated mercury concentrations in carnivorous species frequently consumed by local populations, suggesting diet as a dominant exposure pathway.

Notably, high human exposure was observed even in areas not yet heavily impacted by ASGM, highlighting a disconnect between environmental measurements and human health risk. These findings demonstrate the value of human biomonitoring as an early warning tool to identify vulnerable populations. This study provides a critical baseline for tracking future impacts of mining expansion and supports targeted interventions, including risk communication and strengthened monitoring, to inform policy responses under the Minamata Convention.



ABSTRACT ID: OP 209

Title	Mercury Monitoring in Japan: Cooperation for Monitoring Capacity Development and the Challenges Thereof in Contribution to the Effectiveness Evaluation of the Minamata Convention
Lead Author	Tatsuya Hattori
Co-Authors	Koki Takaki

ABSTRACT

The national and local governments of Japan continue to conduct mercury monitoring in various media. The Ministry of the Environment conducts atmospheric mercury monitoring (TGM and speciated monitoring) and wet deposition monitoring. Furthermore, the ministry is conducting monitoring of biota (bivalves, fish, and crustaceans) in coastal and offshore areas and human biomonitoring of chemical pollutants, including mercury. These data were submitted to the Minamata Convention Secretariat for effectiveness evaluation.

Additionally, MOEJ conducts various international cooperation programs to develop the monitoring capacity of developing countries in order to support the implementation of the Convention. These programs contribute to filling gaps in global monitoring data and provide information required for mercury management.

This presentation introduces the mercury monitoring program in Japan and the international cooperation programs. Additionally, the challenges revealed in the work of compiling and submitting domestic monitoring data and cooperation programs are introduced.

ABSTRACT ID: OP 213

Title	Low Temperature Thermal Decomposition of Metacinnabar (β -HgS) Nanoparticles to Elemental Mercury in Water and Glycol: Implications for Mercury Management
Lead Author	Gregory V. Lowry
Co-Authors	Chengyi Hong ¹ , Daniel Chinn ² , Evan S. Hatakeyama ² , Thomas Hoelen ²

ABSTRACT

Mercury sulfide nanoparticles (β -HgS) may be present in oil and gas reservoirs and may be co-produced with natural gas and condensate. While these particles are highly stable under ambient conditions, they can potentially thermally decompose to form elemental mercury. This transformation has potential implications for downstream processing equipment, mercury removal units, and exposure to gaseous elemental mercury. In this study, we found that over 70% of the Hg mass in field monoethylene glycol (MEG) is present as stoichiometric 100-200 nm particulate β -HgS. However, thermal decomposition studies in MEG and MEG-water solutions showed that β -HgS decomposition to elemental mercury started at around 100 °C, which is significantly lower than approximately 200 °C required for β -HgS decomposition in an inert gas. Thermal decomposition studies at 130 °C showed that increased water content and decreased β -HgS particle size significantly increased the decomposition rate, while common additives in field MEG did not have a significant effect. The decomposition pathway of β -HgS in MEG/water includes dissolution to form dissolved Hg(II) ions, followed by reduction to form elemental mercury by reaction with MEG. This study highlights the strong effect of solvent on the thermal decomposition mechanism of β -HgS, improving understanding of the fate and speciation of Hg in petrochemical processing and in reservoir fluids.

ABSTRACT ID: OP 214

Title	Evaluating Mercury Impacts on Wildlife: Contributions to the Minamata Convention and Global Biodiversity Framework
Lead Author	Josh T Ackerman
Co-Authors	Claudia Vega, David Evers, Mark Burton, Olha Furman, Karina Miglioranza, Celia Chen

ABSTRACT

Since 2023, the Conference of Parties (COP), the decision-making body for the Minamata Convention on Mercury, has acknowledged mercury pollution as a direct driver of global biodiversity loss and identified opportunities to implement the Minamata Convention and the Kunming–Montreal Global Biodiversity Framework (KMGBF) in a mutually supportive manner.

A core function of the Minamata Convention Open-Ended Scientific Group (OESG) is to examine spatial patterns and temporal trends in mercury emissions, environmental contamination, and exposure in wildlife and humans. In this context, global mercury monitoring data and scientifically robust toxicity benchmarks can contribute to tracking progress against KMGBF Target 7, which aims to reduce the overall risk and impacts of pollution on biodiversity.

This presentation focuses on scientific contributions to the OESG 2026 report, with particular emphasis on the compilation and application of mercury toxicity benchmarks for wildlife. The OESG collated toxicity benchmarks derived using benchmark dose analysis frameworks where possible, supplemented by the most robust benchmarks available from recent peer-reviewed literature. Observed mercury concentrations in tissues of invertebrates, fish, birds and marine mammals were compared against these benchmarks to estimate the proportion of individuals at risk of adverse effects on endpoints including reproduction, behaviour, growth and survival.

This benchmark-based approach provides a consistent framework for evaluating ecological health risks from mercury across regions and taxa. It supports environmental risk assessors and managers in determining whether mercury contamination at a site is likely to affect wildlife, and whether long term monitoring or targeted management actions may be necessary. Integrating long-term concentration trends with benchmark exceedance information also enables assessment of how ecological risks may evolve over time, including in response to mitigation measures and as a result of climate change, thereby helping to align mercury monitoring and management under the Minamata Convention with the objectives of the KMGBF.

ABSTRACT ID: OP 215

Title	Interdisciplinary Approaches to address Mercury Pollution in ASGM: Bridging Environmental Science, Social Research, and Policy Implementation
Lead Author	DOMINIQUE BALLY KPOKRO
Co-Authors	Gavin Hilson

ABSTRACT

Mercury (Hg) amalgamation, a gold-extraction technique with ancient origins, has expanded markedly since the 1980s alongside rising gold prices, making artisanal and small-scale gold mining (ASGM) a dominant anthropogenic source of mercury emissions globally. Decades of environmental research across Latin America, Asia, and Africa consistently show pronounced contamination where amalgamation is widespread, yet policy efforts to curb emissions face a persistent dilemma: mercury remains cost-effective and efficient for miners whose livelihoods depend on ASGM, while its releases to air, soils, waterways, and sediments promote methylation, bioaccumulation, and human health harms. This research seeks to integrate environmental science, social research, and policy analysis to elucidate the persistence of mercury pollution, with a particular emphasis on Sub-Saharan Africa and Côte d'Ivoire. The study aims to produce evidence that can enhance formalization strategies under the Minamata Convention. The methodology involves an analysis of literature and field data concerning: (i) the environmental dissemination of mercury in artisanal and small-scale gold mining (ASGM), (ii) the formalization of the ASGM sector as a mechanism for mercury reduction, and (iii) the impetus provided by the Minamata Convention to address mercury contamination globally within the ASGM sector. Synthesised findings indicate extensive multi-compartment contamination, documented human intoxication in exposed communities, and sustained mercury use despite bans, driven by deep informality shaped by large-scale mining bias, costly and bureaucratic licensing, weak enforcement, and resilient transnational mercury supply networks. The research concludes that technically oriented, top-down interventions and prohibition-centric trade controls are unlikely to succeed without interdisciplinary, stakeholder-centred formalisation that aligns environmental objectives with livelihood realities, improves monitoring capacity, and targets the structural drivers sustaining mercury demand and distribution.

ABSTRACT ID: OP 216

Title	Quantifying mercury pathways in the oil & gas sector
Lead Author	Peter Maxson
Co-Authors	

ABSTRACT

The UNEP Global Mercury Partnership Study report on mercury from oil and gas (Geneva, 2022) confirmed that the oil and gas sector is responsible for a significant portion of anthropogenic mercury emissions and releases. It also highlights the paucity of data on mercury in the sector.

While there can be large variations in the level of mercury contamination even in a single field, this analysis begins with a best estimate of the quantity of mercury mobilized annually during worldwide oil and gas production, both onshore and offshore, by geographical region. Preliminary estimates are on the order of 100 metric tons of mercury in the oil, gas and produced water, and another 10 percent of that quantity mobilized in drill cuttings and related muds.

A mercury balance is then developed, showing how much of the mobilized mercury is emitted to the air via venting, flaring, and regeneration of adsorption systems; discharged in produced water offshore and treated water onshore; captured in filters, sludges, mercury reduction units (MRUs) and refinery waste treatment systems; adsorbed on steel and accumulated in pipelines, separators, vessels, heat exchangers and storage tank sludges; and reinjected as subsurface disposal. Some 25-50% of the mobilized mercury is sent to secure disposal sites.

This presentation also estimates the quantities of legacy or accumulated mercury, especially in pipelines, storage tanks and other infrastructure that must eventually be dealt with in some manner.

The pathways and quantities of mercury mobilized in the oil and gas sector, combined with their varied impacts on human health and the environment, suggest key operational, regulatory, and regional priorities.

ABSTRACT ID: OP 218

Title	Mercury Levels and Fluxes from Major Rivers in Japan
Lead Author	Toshio Sudo
Co-Authors	Kohji Marumoto, Kohki Furusho, Haruto Nakayama, Kosei Endo, Sun Chang, Takaaki Itai

ABSTRACT

Rivers can be an important source of mercury (Hg) to the ocean, but monitoring data on Hg levels and speciation, as well as the understanding on their controlling factors, remain insufficient compared to atmospheric Hg. The Japanese archipelago faces the Sea of Japan and the Northwest Pacific Ocean, both of which are important sources for fishery. Here we show dissolved Hg (DHg), particulate Hg (PHg), and total Hg (THg) levels in 61 major rivers and monomethyl Hg (MeHg) levels in 40 rivers. The Rivers investigated distribute in Honshu, Kyusyu, and Shikoku islands of Japan. Their watersheds cover approximately 40% of Japan land surface. River water samples were collected from the Hokuriku, Tohoku–Hitachi, Tokaido, Sanin, Sanyo, Kyushu, and Shikoku regions during three different seasons. The samples were taken at downstream locations where the influence of seawater intrusion was negligible. The mean value of DHg, PHg, THg, and MeHg concentrations across all samples were 0.71 ± 0.42 ng/L, 1.57 ± 2.41 ng/L, 2.27 ± 2.59 ng/L, and 33.5 ± 24.1 pg/L, respectively (mean $\pm$ 1SD). The THg in Japanese rivers were lower than those in China, the USA, Russia, and Canada. A trend of DHg < PHg was observed in Japanese rivers compared to continental rivers. The mercury flux from all the rivers in Japan to adjacent oceans was estimated at 17.0 kg/yr for MeHg and 1.33 ± 0.50 t/yr for THg. The THg flux was lower than the estimated atmospheric depositions to the lands (wet: 3.8 ± 0.11 t/yr; dry 3.0 ± 1.0 t/yr). This result suggested that most mercury from the atmosphere stayed on land, such as store in soils and uptake by vegetations, or released back into the atmosphere. Comparing these values with other estimates from modeling studies is valuable for constraining mercury dynamics in the northwestern Pacific region.

ABSTRACT ID: OP 219

Title	Individual particle-scale characterization of mercury in sediments can predict mercury bioavailability potential and provenance the source of mercury
Lead Author	Thomas Hoelen
Co-Authors	Gregory V. Lowry ¹ , Adam Dassey ²

ABSTRACT

Mercury may be present in industrial operations and in natural and impacted sediments, often as β -HgS nanoparticles. Nanoparticle-specific properties such as size and chemical speciation can affect both the reactivity of mercury in natural systems (e.g. dissolution or methylation potential) as well as its bioavailability. The properties of populations of individual HgS nanoparticles, including the presence of co-associated elements, can sometimes be used as a forensics tool to assess the provenance of specific particles. Here, terrestrial, river, and marine sediments were size fractionated and characterized to correlate particle-specific properties of mercury-bearing solids with their bioavailability potential and measured biomethylation. Marine sediments contained ~20–50% of the total Hg in the $<0.5 \mu\text{m}$ size fraction, compared to only 0.5% and 3.0% in this size fraction for terrestrial and river sediments, respectively. Glutathione (GSH) extractable mercury was higher for samples containing Hg(SR)₂ species than β -HgS species, and correlated well with the amount of Hg biomethylation. X-ray absorption spectroscopy (XAS) analysis indicated that metacinnabar (β -HgS) was the main mercury species in a marine sediment, whereas organic Hg-thiol (Hg(SR)₂) was the main mercury species in a terrestrial sediment. HgS nanoparticles collected from an industrial facility and from a marine sediment were both β -HgS based on XAS analyses, and indistinguishable. However, using a complimentary technique, single particle inductively coupled plasma time-of-flight mass spectrometer (spICP-TOFMS) analysis, to analyze the elemental composition of individual nanoparticles showed that nanoparticles from the industrial facility contained ~0.08wt% Ag, whereas the marine sediments were largely pure HgS. This suggests that these two sources of HgS particles can be differentiated. This work demonstrates that particle-scale understanding of Hg speciation, elemental composition, and particle size can be used to characterize mercury bioavailability potential and explain heterogeneity in Hg methylation in sediments. It may also identify the sources of β -HgS in a sample.

ABSTRACT ID: OP 220

Title	Comparison and experiences of sampling approaches for mercury in gaseous hydrocarbons
Lead Author	Warren T Corns
Co-Authors	Amauris H Hernandez, Timothy Williams, Matthew Dexter

ABSTRACT

The sampling and measurement of mercury in gaseous hydrocarbons is of prime importance for the oil, gas and petrochemical industries. Trace levels of elemental Hg are known to accumulate during gas processing causing equipment contamination, liquid mercury embrittlement and poisoning of precious metal catalysts. Because of these process related issues mercury is normally removed using mercury removal units down to level below 10 ng/Nm³. Exceeding this level can lead to plant shutdown and crippling financial losses. The sampling of mercury from gaseous hydrocarbons is extremely challenging because it is dependent on the sample matrix, concentration of mercury and process conditions. ASTM 6350 and ISO 6978 are the official methods for Hg in Natural Gas and although these provide some very detailed instructions on how to conduct sampling they are often used outside of the scope, or simply not followed or misinterpreted. The most important aspects of the method such as the use of bypass flows and correct materials to overcome adsorption losses and contamination of mercury, the use of gold sampling tubes in series at elevated temperatures above the dewpoint of the sample gas are not employed this affecting the accuracy of measurements. In this presentation will be critically compare different sampling approaches which are commonly applied to this application such dynamic sampling, sampling in cylinders, Tedlar bags and direct spectrometric measurements. The pros and cons of each sampling approach in relation to sample matrix, process conditions, method compliance and mercury concentration will be reviewed with field experiences and knowledge gained. An expanded uncertainty budget will be presented highlighting the critical aspects of the method that can influence the accuracy.

ABSTRACT ID: OP 221

Title	A behavioural analysis of social, structural and psychological drivers of skin lightening in Gabon, Sri Lanka and Jamaica
Lead Author	Ammaarah Martinus
Co-Authors	Elena Altieri

ABSTRACT

Limited empirical research exists on the behavioural drivers of skin lightening product (SLP) use in the Global South. To address this gap, the World Health Organization (WHO) recently conducted a multi-country evidence review (Williams et al., 2026) examining the prevalence and patterns of SLP use across 43 low- and middle-income countries (LMICs). The review identified widespread but uneven use across regions, including Africa, the Middle East, Asia, the Caribbean, the Americas and Europe. Estimated lifetime prevalence was 27.7%, with substantial cross-country variation (ranging from 89.1% among women in Thailand to negligible prevalence in Turkey). Across contexts, women were consistently more likely to report SLP use than men.

In response to these findings, WHO, in collaboration with the Global Environment Facility (GEF), the United Nations Environment Programme (UNEP), and the Biodiversity Research Institute (BRI), initiated pilot studies in Gabon, Jamaica and Sri Lanka. The research aims to generate context-specific behavioural evidence on SLP use, including user motivations and the social, psychological and environmental factors that drive behaviour.

A central objective is to define and diagnose the problem from the perspective of affected communities, thereby informing the design of context relevant, community-driven interventions to reduce SLP use in an under-researched policy and public health domain.

Given the limited availability of behavioural data in this area, a structured package of tools to assess the drivers of SLP use was developed. These tools, informed by the evidence review, include: (1) an SLP user journey mapping tool; (2) a quantitative survey instrument; and (3) a qualitative research guide.

This session will present key findings from the global evidence review and share early insights from the application of these tools in the three countries. It will highlight emerging behavioural patterns, implications for intervention design, and practical lessons for implementing behavioural research and programming in diverse contexts.

ABSTRACT ID: OP 222

Title	Remote sampling technique for Hg fractionation in ambient air
Lead Author	Warren T Corns
Co-Authors	Tony Rogers, Amauris H Hernandez, Timothy Williams, Teodor Andron

ABSTRACT

The Minamata convention is an international treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds. The treaty states that continuous monitoring and effectiveness evaluation must be attained. In some areas this is problematic due to the lack of infrastructure of placing monitoring equipment to continuously monitor the atmospheric concentrations of mercury. Passive samplers are increasingly being deployed as cost effective sampling approach. Unfortunately, there is a large uncertainty contribution related to the sampling uptake rates of passive samplers. Changes in uptake rates must be corrected according to the meteorological conditions that changed during the sampling period. Even if the meteorological conditions are monitored, the corrections for the sampling rate would not be accurate due to the fact that the sampler are calibrated in laboratory conditions, not in environmental conditions. Long sampling times are also required to ensure that a sufficient mass of mercury is sampled. More importantly passive samplers do not provide any information on the different forms of Hg namely (particulate, oxidized and elemental Hg). Through this work we propose an alternative sampling technique using gold on silica traps through which we reduced the uncertainty of the sampling rate by using a flow calibrated battery operated micropump. A multilayer filter arrangement is employed upstream of the gold trap to selectively collect particulate and oxidized mercury. This sampling device offering higher mass loadings and therefore improved detection limits. The battery pack is recharged with solar energy and can work for 6 days without sun, and requires less than 4 hours to completely charge in dim sunlight. The flow is continuously monitored using an improved data logger which is used to calculate the sampling flow throughout the whole sampling period, as the flow was calibrated against pump revolutions and pump speed.

ABSTRACT ID: OP 224

Title	From transport to transformation: evolving understanding of mercury behavior in a river–reservoir system
Lead Author	Steve Dent
Co-Authors	Jennifer Crawford, Chris Eckley, Todd Luxton (USEPA); Colin Eagles-Smith (USGS); Jason Silvertooth (CDM Smith)

ABSTRACT

Legacy mercury mines often require years of investigation before pathways controlling methylmercury accumulation in fish are fully identified and resolved. At the Black Butte Mine Superfund Site (Oregon, USA), an updated understanding of mercury transport and transformation was developed following remedial investigations. The current study is focused on the downstream impacts to water bodies, including the river corridor and flood-control reservoir, where fish consumption is the primary human-health exposure pathway and a consumption advisory has been in place since 1979.

The updated conceptual site model integrates more than 15 years of multi-media data, including surface water chemistry, discharge, and mercury loading; sediment, riverbank soil, and hyporheic porewater; and biological samples of benthic macroinvertebrates and fish from impacted reaches and unimpacted reference areas. Stable mercury isotope analyses indicate substantial mine-derived contributions to river and reservoir sediments.

Early investigations assumed the river corridor primarily functioned as a transport pathway for inorganic mercury to the reservoir, where methylation was expected to be more prominent. Preliminary data indicate that an additional pathway for methylmercury exposure and transport may exist within the river corridor. Although depositional sediment pockets in quiescent areas remain important methylation zones, methylmercury concentrations in periphyton (biofilms and filamentous algae) on cobbles and bedrock were spatially extensive and quantitatively important. Watershed mercury modeling (WASP8) indicates that periphyton-associated methylmercury production likely account for observed surface water concentrations and provide a direct pathway for food-web uptake, while riparian canopy limits photodemethylation relative to reservoir conditions.

In the reservoir, particulate mercury is sequestered in depositional zones, while flooding of seasonally inundated sediments and wetlands may enhance methylating conditions. During some years, hypolimnetic seasonal anoxia develops primarily over deeper sediment areas, enriching bottom waters in methylmercury. This anoxic water redistributes methylmercury within the reservoir and facilitates downstream transport, linking river-corridor processing to fish exposure.

ABSTRACT ID: OP 226

Title	Multi-stakeholder approaches towards managing mercury-containing cosmetic products in the Philippines
Lead Author	Jashaf Shamir Lorenzo
Co-Authors	

ABSTRACT

BAN Toxics is a Philippine-based non-government organization advocating for the environmentally sound management of chemicals and wastes. The proposed presentation covers the organization's work in the Philippines to address mercury in skin-lightening products.

The case studies that will be presented cover three key work streams. Our Policy Development and Research work focuses on the development of national-level inventories of mercury in the country to identify priority sectors as well as the conduct of market monitoring activities in known hotspots for selling illegal cosmetic products. Both serve as the basis for identifying policy recommendations and assist government efforts in regulating SLPs.

Our Community Development and Capacity-Building work focuses on our partnerships with various youth groups and government agencies. Highlighted in the presentation is BAN Toxics' Toxics-Free Schools Program which allows the organization to work closely with schools in the integration of chemicals and wastes issues in school curricula and in the conduct of school-based educational activities highlighting critical issues such as mercury in cosmetic products.

Finally, our communications and advocacy work highlights the various communications campaigns undertaken by the organization to raise public awareness regarding mercury in cosmetics and how they have shaped policy formulation in the Philippines. If possible, BAN Toxics also proposes the screening of "the Dark Side of Skin-Lightening," a 14-minute documentary on mercury-containing SLPs in the Philippines.

The discussion will focus on the importance of multi-stakeholder approaches in managing mercury, highlighting the unique partnership and coordination roles taken by BAN Toxics with community members, national government agencies, regional government partners, and other relevant stakeholders.



ABSTRACT ID: OP 227

Title	Potential impacts of seafloor mining on the marine mercury cycle: Insights from the GEOTRACES program
Lead Author	Katlin Bowman Adamczyk
Co-Authors	Carl H. Lamborg

ABSTRACT

There is growing global interest in the extraction of seafloor minerals from national and international waters. Seafloor minerals of interest include ferromanganese crust that grow on seamounts, manganese nodules found in abyssal plains, and seafloor massive sulfides found at spreading centers and subduction zones. To date, no mining of seafloor minerals has occurred, however, exploration activities and development of extraction technologies are ongoing. Exploitation activities will disturb seafloor sediments, an important sink for mercury in the ocean, and potentially the water column through waste discharge.

Data and analytical methods produced by the international GEOTRACES program provide a wealth of information useful for predicting impacts of potential seafloor mining on the marine mercury cycle. In addition to establishing baseline concentrations of mercury in remote regions, some overlapping with areas of interest for seabed mining, the GEOTRACES program has progressed our understanding of mercury cycling in the water column. This informs potential risks of extraction technologies on the production of methylmercury in the ocean. This presentation will focus on the collective knowledge and broader impacts of mercury data collected by the GEOTRACES program and highlight Dr. Chad Hammerschmidt's early work on mercury biogeochemical cycling in marine sediments.

ABSTRACT ID: OP 229

Title	Mercury distribution in bottom sediments in a tropical coastal lagoon: Tijuca Lagoon (Rio de Janeiro, Brazil)
Lead Author	Yan Ribeiro de Almeida Fernandes
Co-Authors	Ricardo Gonçalves Cesar, Matheus Teixeira, Gustavo Koifman, Zuleica Castilhos

ABSTRACT

Over the last decades Tijuca Lagoon (TL - Rio de Janeiro, Brazil) has been affected by the discharge of domestic sewage, eutrophication and industrial wastes containing mercury (Hg). This study aims to evaluate Hg contamination and map its distribution in bottom sediments. Sediment samples ($n = 23$; 20 cm depth) were collected across the TL and characterized in terms of grain size, pH, and Total Organic Carbon (TOC). Total Hg concentrations were determined by atomic absorption spectrometry (AAS) coupled with a pyrolysis accessory. The degree of contamination was assessed by (i) comparison with sediment quality guideline values established by the Brazilian law (CONAMA Resolution 454/2012) and (ii) calculation of the Geoaccumulation Index (IGEO) and Enrichment Factor (EF).

Grain size and TOC analyses indicated that samples collected near river mouths, lagoon connections, or areas under stronger marine influence were predominantly sandy and presented lower organic matter content. Sediment pH values were acidic, likely associated with high organic matter content and reduced oxygenation caused by restricted water circulation within the lagoon. Hg concentrations were lower in sandy sediments with reduced organic matter content, with six samples classified as IGEO Class 0 (unpolluted). The average Hg concentration in TL sediments was 0.144 ± 0.089 mg/kg, ranging from 0.003 to 0.336 mg/kg.

Two samples exceeded the sediment quality guideline value (0.3 mg/kg) established by CONAMA Resolution 454/2012 (Level 1), both classified as IGEO Class 3 (moderately to strongly polluted). Only four samples showed $EF < 2$, indicating that most sediments exhibit anthropogenic enrichment by Hg. Hg concentrations tended to increase with decreasing hydrodynamics and increasing distance from the Joatinga Channel, which connects the lagoon to the sea. The results confirm the strong affinity of Hg for fine particles, organic matter, and sulfides, particularly in eutrophic environments such as TL.

ABSTRACT ID: OP 230

Title	Mercury contamination and sediment resuspension: ecotoxicological algae and microcrustaceans in a tropical urban lagoon
Lead Author	Yan Ribeiro de Almeida Fernandes
Co-Authors	Ricardo Gonçalves Cesar, André Salomão, Zuleica Castilhos, Gustavo Koifman

ABSTRACT

Jacarépaguá lagoon (JPAL - Rio de Janeiro, RJ) have been impacted by indiscriminate urban growth, resulting in the discharge of domestic and industrial effluents, containing mercury and other contaminants posing risks to aquatic ecosystems. This study evaluated the spatial distribution of Hg contamination and the potential aquatic ecological risk of metals in surface sediments from JPAL, considering a sediment resuspension scenario.

Surface bottom sediment samples ($n = 16$; 0–20 cm depth) were collected and characterized for grain size, pH and phosphorus, mercury determination. Acute and chronic bioassays tests with *Chlorella vulgaris* and *Ceriodaphnia dubia* were applied to sediment leachates (elutriates) to simulate a resuspension event in the water column. The degree of contamination was assessed by comparison with guideline values established in Brazilian legislation, calculation of the Geoaccumulation Index (IGEO), and Enrichment Factors (EFs). Hg distribution was interpreted using Pearson correlation, PCA, and interpolation maps.

Sediments were predominantly sandy, with higher accumulation of fine particles and organic matter in low-hydrodynamic areas (associated with embayment), where the highest metal concentrations, including Hg, were observed. Overall, Hg concentrations Hg were low, except for three muddy samples that exceeded guideline values, presenting IGEO values between 2 and 3 and geochemical anomalies indicated by EFs. Acute toxicity to *C. dubia* was observed in 10 samples, while chronic effects were detected in 15 samples for *C. vulgaris*. Acute toxicity was correlated with fine sediment content ($R^2 = 0.6$), but not directly with metals. Results indicate potential ecological risk under resuspension scenarios, suggesting the influence of additional contaminants and the need for caution in dredging activities.

ABSTRACT ID: OP 231

Title	Assessment of the mercury stability during the winter period based on its concentrations in atmospheric precipitation and in snow cover in the south of Western Siberia
Lead Author	Eyrikh Stella
Co-Authors	Kolotushkina Lylia

ABSTRACT

In the snowpack, both oxidation and stabilization of mercury species can occur depending on its composition and physicochemical conditions. Reduction to Hg⁰ occurs primarily through photoreduction by UVB radiation at a wavelength of 305–320 nm. Experimental studies of mercury in snow layers in barrels showed that mercury re-emission during the winter period was 57.5%, which is consistent with researches by Dundorf et al. founded that mercury re-emission from snowpack increases with latitude from 39% to 67%. When the layers were shielded from sunlight with opaque plastic circles, re-emission into the atmosphere did not observed and the volume-weighted mercury concentration (VWC) calculated based on its concentrations in snow layers did not differ significantly from the VWC in atmospheric precipitation for the appropriate period.

Mercury concentrations in wet precipitation reflects its direct input from the atmosphere, while its concentrations in snow cover reflect the results of several multidirectional processes: Hg deposition with atmospheric precipitation, local pollution of urban snow cover, re-emission from snow cover under the influence of solar radiation, vertical movement of Hg⁰ and redistribution of mercury forms in the snow cover due to thawing of the upper layers and mercury release from the soil into snowpack. The contribution of each of these processes is difficult to assess, however it's possible to assess the resulting value of these processes, i.e. the proportion of mercury preserved in the snow cover over the winter. Mercury fluxes were calculated based on its concentrations in snow sampled at the time of maximum snow accumulation in Barnaul. These values were 22.3-50.6% lower than fluxes calculated based on its concentrations in atmospheric precipitation during appropriate cold periods (from 2016 to 2024). The average (for the 5 years) Hg loss from urban snow cover was 37.6%.

This work was completed under state contract FUFZ-2026-0006.

ABSTRACT ID: OP 232

Title	Mapping Mercury Contamination Risks to Biodiversity and People in Ecuador's Napo Basin
Lead Author	Allison Aldous
Co-Authors	Mark Burton (2), Pedro Jimenez (1), Korik Vargas (2), Gabriela Echevarría (3), Fernando Sánchez Orellana (3), Jonathan Valdivieso (4)

ABSTRACT

Gold mining using mercury is rapidly expanding in the Ecuadorian Amazon, with severe consequences for human health and biodiversity, including freshwater fish. Because mercury is a potent neurotoxin, it poses a significant risk to the Indigenous communities who rely on fish for nutrition and cultural practices.

To assess the spatial distribution of mercury contamination risk to freshwater fish and to Indigenous communities in the Napo basin in the Ecuadorian Amazon, we used a two part approach combining field sampling and spatial modeling. We sampled fish representing diverse habitats, migratory behaviours, and trophic levels, and analyzed muscle tissue and adjacent sediments for mercury concentrations and mercury stable isotopes. Mercury levels in many fish exceeded thresholds for safe human consumption and wildlife toxicity, with higher concentrations in larger, higher trophic level species. Initial isotope data confirmed gold mining as a primary source, despite significant oil production in the area.

We then downscaled the Global Mercury Threat Assessment (Tear et al., in prep) to develop a Regional Mercury Threat Assessment (RMTA). The RMTA integrates the sensitivity of ecosystems to mercury methylation and the risk of mercury inputs from anthropogenically-driven mercury pollution, to develop a relative threat layer. The RMTA reveals increasing mercury threat from the Andean cordillera toward the Amazon lowlands. Fish with the highest mercury concentrations were found inside protected areas that remain ecologically intact but lie downwind and downstream of mining zones. Habitat sensitivity to mercury methylation showed a stronger correlation with fish mercury levels than proximity to pollution sources.

We are using these field data and the RMTA to guide habitat protection and restoration in partnership with fishing communities. This includes supporting conservation planning, Monitoring and Evaluation frameworks, targeted sampling for early detection of contamination hotspots, and evidence based policies to reduce mercury use and mitigate its impacts.

ABSTRACT ID: OP 233

Title	Primary Mercury Mining Worldwide: Taking Stock of the Situation Ten Years After the Minamata Convention Entered Into Force
Lead Author	Romain Taravella
Co-Authors	Yuyun Ismawati

ABSTRACT

One of the most explicit objectives of the Minamata Convention on Mercury is the ban on new mercury mines and the phase out of existing ones (Article 3). Limiting and reducing the extraction of cinnabar is a key strategy of the Convention to achieve its ultimate goal, protecting human health and the environment from mercury pollution. A decade after the Minamata Convention entered into force, it seems that little progress has been made regarding this strategy. Mines that were inactive ten years ago are being reopened, and several major industrial mines have maintained their production levels.

One of the key factors explaining the persistence—and in some cases expansion—of primary mercury mining in several regions worldwide (including China, Indonesia, and Mexico) is rising demand and higher prices for liquid mercury, driven by the high price of gold and the expansion of artisanal and small-scale gold mining (ASGM). In reality, as shown by multiple enforcement operations in the Amazon, ASGM is a highly organized sector that more often than not relies on access to machines, capital, and chemicals to extract gold, such as mercury and cyanide.

Despite the adoption of the non-binding Bali Declaration on Combating Global Illegal Trade of Mercury, a global network of traffickers has established itself as the intermediary between mercury mines and gold mining sites, allowing it to circumvent the monitoring and control measures that Parties to the Convention are obligated to enforce on the international trade and use of mercury.

Addressing the situation will require a few key steps under the Convention, including prioritizing the closure of mines; acknowledging the illegal nature of a large part of the global mercury trade, rapidly integrating lessons from anti-trafficking and creating new alliances with institutions like Interpol and UNODC; and ultimately prohibiting the use of mercury in gold mining.

ABSTRACT ID: OP 235

Title	Mercury Speciation and Distribution from the US GEOTRACES GP17-ANT Cruise in the Amundsen Sea
Lead Author	Carl Lamborg
Co-Authors	

ABSTRACT



ABSTRACT ID: OP 236

Title	Mercury in the IPBES Nexus Assessment: bridging science, policy, and multilateral environmental conventions
Lead Author	Paula Ribeiro Prist
Co-Authors	

ABSTRACT

Mercury pollution is a critical interconnected crisis bridging biodiversity loss, water degradation, food insecurity, and human health risks. The IPBES Nexus Assessment highlight these issues and emphasizes that environmental pressures are tightly interlinked, with pollution interacting with other direct drivers of biodiversity loss to produce cascading impacts across ecosystems and societies. Land use change, resource extraction and pollutant emissions from mining, agriculture, and fossil fuel activities, when poorly managed, can severely degrade biodiversity and water quality, with direct consequences for food systems and human health. These impacts are particularly evident in Indigenous Peoples and Local Communities. In the Amazon, elevated mercury levels have been documented in water, and fish, driven largely by artisanal gold mining. Mercury bioaccumulates in food webs and amplifies risks to biodiversity and human populations reliant on fish-based diets. This leads to a decline in fish diversity, jeopardizes food security, and negatively impacts human health, even in areas far downstream. Some of the documented health effects include neurological disorders and increased child mortality, compounded by deforestation, and consequent increases in infectious disease rates. These dynamics exemplify nexus interlinkages, where pollution, ecosystem degradation, and social vulnerability converge. The IPBES Nexus Assessment propose more than 70 response options that are directly relevant to mercury management, including integrated land- and water-use planning, protection and restoration of wetlands, reduction of pollution at source, and promotion of sustainable food systems. These measures can generate co-benefits across biodiversity, health, and climate, while reducing mercury exposure. Importantly, the assessment underscores the need for cross-sectoral governance, improved monitoring systems, and the incorporation of Indigenous and local knowledge to better understand and manage risks. By situating mercury within broader biodiversity–water–food–health interlinkages, it supports more holistic policy design, helps identify synergies with other multilateral environmental agreements, and enhances the effectiveness of national strategies.



ABSTRACT ID: OP 237

Title	Air mercury surveys at sulfides ore deposits
Lead Author	Alexei S. Rukhlov
Co-Authors	Alexei S. Rukhlov, Nikolay Mashyanov, Alexey Shashko, Vladimir Ryzhov, Ellen Perkins, Wade Barnes

ABSTRACT

Mercury (Hg) is involved in all geological processes, including formation of magmatic-hydrothermal mineralization, which is accompanied by the primary and secondary litho-, hydro-, and atmochemical mercury haloes. Gaseous haloes are formed in soil gas and atmospheric air directly above the source of mercury (e.g., sulphide mineralization) due to the unique physical and chemical properties of mercury. Alexander Saukov defined the state of scattered mercury in the Earth's crust as 'quasi-gaseous' and predicted the existence of a 'mercury atmosphere' of ore deposits, as well as the utility of both lithochemical and gaseous mercury surveys as a pathfinder in mineral exploration (Saukov, 1946). The main mechanisms for the formation of gaseous elemental mercury include its evaporation from mercury-bearing minerals, and chemical and electrochemical reactions in the supergene environment that release bound mercury from sulphides.

A Lumex RA-915M portable analyzer, based on Zeeman atomic absorption spectroscopy (ZAAS), enables direct mercury determination in air at concentrations below the background level of 1 to 2 ng/m³ in real time. Gaseous mercury haloes in near-surface air were studied at sites of Hg, Au, Au-Ag-Cu, polymetallic, and rare-metal mineralization under various geochemical and climatic conditions in polar, temperate, and arid regions. This analytical technique detects weak gaseous Hg emissions directly above sulphide mineralization, including sediment-covered ore bodies and related fault zones.

ABSTRACT ID: OP 239

Title	Review of Implementation of Article 7
Lead Author	Thomas Verbaere
Co-Authors	Malgorzata Stylo

ABSTRACT

The article 7 of the Minamata Convention on Mercury focusing on the Artisanal and Small Scale Gold Mining (ASGM) sector provides under its paragraph 3 (c) that party that developed and submitted their National Action Plan are required to provide a Review of Implementation of Article 7 (RIA) and their NAP every 3 years. The GEF approved the inclusion of a new enabling activity to provide financial support and technical assistance for the first RIA after the submission of the initial NAP, and a RIA guidance was developed by UNEP and the Minamata Convention Secretariat providing parties with technical tools, methodologies and best practices to conduct their RIA. The RIA not only provides an assessment of the implementation of the NAP strategies but also invites countries to reflect on the progress made by the Convention on ASGM crosscutting topics such as biodiversity, indigenous communities, youth, to complement parties' description and understanding of their ASGM sector, while providing an updated implementation plan to achieve their national objectives.

ABSTRACT ID: OP 240

Title	Modeling the role of dimethylmercury on Hg air-sea exchange
Lead Author	Johannes Bieser
Co-Authors	Ari Feinbergq

ABSTRACT

The previously obscure Hg species of dimethyl mercury (DMHg) has long been deemed irrelevant to Hg cycling. Yet, recent progress in analytical methods has drawn a very different picture with DMHg being a relevant or even dominant fraction of total mercury outside the euphotic zone. Despite its rapid photolytic degradation under daylight conditions, DMHg does reach the surface layer where it evades into the atmosphere due to its gaseous state and negligible concentrations in the atmospheric boundary layer. Under certain circumstances, DMHg's physico-chemical properties can lead to significant Hg fluxes out of the ocean. This process is most effective in upwelling regions in the absence of sunlight like for example in the upwelling region at the Antarctic divergence.

Here we use the newly developed ICON-ECOSMO-MERCY global marine Hg model to reproduce observed DMHg concentrations and estimate the annual DMHg evasion fluxes, their seasonality and spatial distribution. The model allows us to constrain this new intercompartmental Hg flux and evaluate the impact of its inclusion on the evasion of gaseous elemental Hg⁰. Moreover, in the course of the MCHgMAP project, we coupled the marine Hg model to the atmospheric chemistry-climate model WACCM to further investigate the impact of DMHg evasion on the Hg deposition to the ocean.

ABSTRACT ID: OP 241

Title	Mercury in the South Pacific Ocean
Lead Author	Lars-Eric Heimbürger-Boavida
Co-Authors	Alina Kleindienst, Eric Achterberg

ABSTRACT

The GEOTRACES programme has significantly expanded observations of mercury (Hg) in the global ocean, with standardized methodologies and intercomparison exercises enhancing data quality and comparability. Here, we present new Hg measurements from the GP21/SO289 oceanographic expedition conducted in the South Pacific Ocean aboard R/V Sonne, along a transect from Valparaíso, Chile, to Nouméa, New Caledonia. The transect encompassed key geological and oceanographic features, including the Atacama Trench, East Pacific Rise, and the Kermadec Trench and arc. Unfiltered total Hg and dissolved gaseous Hg were quantified onboard using cold vapor atomic fluorescence spectrometry, while total methylmercury and monomethylmercury were determined via species-specific isotope dilution inductively coupled plasma mass spectrometry back in the laboratory. Particulate mercury was analyzed using atomic absorption spectrometry on quartz filters collected from discrete depths, including the surface, 50 m, the Chlorophyll maximum, oxygen minimum zone, and hydrothermal plume. Additionally, isotopically labeled incubation experiments were conducted at selected stations to assess in situ Hg methylation and demethylation. Mercury speciation and distribution patterns were broadly consistent with previous observations in the region. Total Hg concentrations, primarily in dissolved and gaseous forms, generally increased with depth, whereas particulate Hg concentrations decreased. Within the hydrothermal plume, total Hg concentrations were not markedly elevated, however, speciation shifted toward higher proportions of inorganic Hg, accompanied by reduced levels of methylmercury and dissolved gaseous Hg.

ABSTRACT ID: OP 243

Title	Mercury cycling within sub-tropical North Pacific Ocean abyssal sediments
Lead Author	Marissa C. Despins
Co-Authors	Katlin Bowman Adamczyk, Hope Ianiri, Kira Mizell, Carl Lamborg

ABSTRACT

With increasing interest in deep-sea mining for polymetallic nodules from abyssal plains, understanding mercury (Hg) cycling within off-shelf sediments and potential responses to disturbance are becoming pertinent. Here we present porewater and sediment Hg data from the abyssal plains of the sub-tropical North Pacific Ocean, near the Clarion Clipperton Zone, the region under the highest consideration for seafloor mining in the ocean. Across all sediment cores, elemental Hg (Hg₀), dimethylmercury (DMHg), monomethylmercury (MMHg), and total Hg (Hg_T) were quantified in porewater and Hg_T and MMHg were measured in sediments. Incubation experiments using isotopically labeled Hg were conducted to assess Hg cycling rate potentials within sediment. Other ancillary data was collected that will help inform Hg data including dissolved oxygen, total inorganic carbon (TOC), and sediment mineralogy. Porewater Hg_T concentrations were higher at the core top compared to 15 – 22 cm below the surface. Hg₀ was present in porewater across all stations but distributions of Hg₀ within each sediment core differed. Hg₀ was a source of Hg to the overlying water with a diffusive flux ranging 7.3 – 64.6 pmol m⁻² d⁻¹. In contrast to Hg₀, DMHg was degraded within sediments and below detection limit (3 fM DMHg), suggesting net demethylation of DMHg. MMHg gradients within the porewater are predicted to correlate with oxygen and TOC, with MMHg being produced within redox transition zones. MMHg and Hg_T sediment concentrations are hypothesized to follow the same distribution as MMHg and Hg_T in porewater. This data suggests that Hg₀ and DMHg could play a more important role in Hg cycling within sediments than previously believed and that disruption of abyssal sediments could impact the distributions of methylated Hg in the deep ocean.

ABSTRACT ID: OP 245

Title	Speciation and Distribution of Mercury in Soils from a Coal Mining Region in Northeast India
Lead Author	Bhargov Mudhukailya
Co-Authors	Prantik Sharma Baruah, Asif Qureshi, Jagannath Biswakarma, Farishta Yasmin

ABSTRACT

Mercury (Hg) contamination in coal mining environments represents a significant environmental challenge due to its persistence, mobility, and transformation into highly toxic forms such as methylmercury (MeHg). The Ledo coal mining region in Assam, Northeast India, is an ecologically sensitive and geochemically dynamic system where Hg behaviour in soils remains poorly constrained. This study aims to investigate the concentration and speciation of mercury in soils from active and abandoned mining areas in Ledo.

Soil samples were collected from three depths (0-9 cm, 10-25 cm, and 26-50 cm) at several locations using the transect method. Total mercury concentrations are being measured using Direct Mercury Analysis (DMA), while mercury speciation, including elemental Hg(0), inorganic Hg(II), and methylmercury, is being assessed using established thermodesorption analysis. In addition, soil properties such as pH, organic matter content, and particle size distribution are being characterised to evaluate their influence on Hg partitioning and transformation.

This study seeks to enhance the understanding of Hg cycling in tropical soils affected by mining by correlating Hg speciation with soil geochemical characteristics. The findings are expected to provide insights into Hg mobility, thereby informing the development of effective remediation and land management strategies in similar environmental contexts.

ABSTRACT ID: OP 247

Title	Revisiting Mercury Use in Indian Traditional Practices under the Minamata Convention Framework
Lead Author	Satish Sinha
Co-Authors	

ABSTRACT

Mercury has long been regarded as a key ingredient in certain traditional medical practices in India. In Ayurveda and Siddha, particularly, it is associated with Rasashastra - a specialized branch, which literally translates to the “science of mercury,” underscoring its centrality in these formulations. While these traditions acknowledge the inherent toxicity of raw mercury, they prescribe elaborate processes of purification (Shodhana) and incineration (Marana) to convert it into therapeutically usable forms. The Indian Ayush market is projected to grow to US\$ 200 billion by 2030. The regulatory framework governing traditional medicines in India is rooted in the Drugs and Cosmetics Act, 1940 and the Drugs and Cosmetics Rules, 1945, which oversee the manufacturing, sale, and distribution of Ayurvedic, Siddha, and Unani (ASU) drugs. Specific provisions, including Rule 170, mandate labelling requirements with cautionary declarations for formulations containing poisonous substances like mercury. The Pharmacopoeia Commission for Indian Medicine & Homoeopathy establishes pharmacopeial standards, Good Manufacturing Practices, and permissible limits for heavy metals in ASU&H drugs. India became a Party to the Minamata Convention on Mercury in 2018, committing to global efforts to protect human health and the environment from mercury pollution. However, the convention explicitly excludes mercury use in traditional practices, including Indian systems of medicine. India has notified the Prior Informed Consent (PIC) for mercury trade, however there are concerns with the large scale unlicensed or informal practitioners, inadequate monitoring oversight and reporting mechanism on the end of use of mercury. There are also issues of environmental sound disposal of mercury, occupational exposure, environmental contamination, and risks to end users need to be addressed considering the human health. Thus, given the global recognition of mercury as a hazardous pollutant, there is an urgent need to promote safer, viable alternative in the traditional medicine practices.

ABSTRACT ID: OP 248

Title	Occurrence of Mercury and Trace Elements in Tea Leaves from a Coal Mining Region in Northeast India
Lead Author	Prantik Sharma Baruah
Co-Authors	Bhargov Mudhukailya, Asif Qureshi, Jagannath Biswakarma, Farishta Yasmin

ABSTRACT

Tea, obtained from the leaves of *Camellia sinensis* (L.) Kuntze of the family Theaceae, is a widely consumed beverage and a major agricultural product of Assam, India. However, tea plantations located in proximity to coal mining areas may be exposed to elevated levels of heavy metals and metalloids through multiple environmental pathways. This study aims to assess the occurrence and concentration of mercury (Hg) and other trace elements in tea leaves collected from the Ledo coal mining region in Northeast India.

Tea leaf samples were collected from plantations situated within and around mining-affected areas to depict potential variability in environmental exposure. Total mercury concentrations are being determined using Direct Mercury Analysis (DMA), while additional elemental analyses are being conducted to quantify the presence of other heavy metals and metalloids. The study is designed to provide a baseline dataset on trace element occurrence in tea leaves from this region.

Potential sources of metal accumulation in tea leaves may include atmospheric deposition from mining activities, soil geochemistry, irrigation water quality, and local environmental conditions. However, this study primarily focuses on quantifying elemental concentrations in plant tissues rather than attributing specific uptake mechanisms. By generating reliable data on contaminant levels in tea leaves, this work addresses an important gap in understanding environmental exposure in mining-impacted agricultural systems.

The findings will contribute to food safety assessments and provide a basis for future investigations into the pathways and controls governing trace element accumulation in crops grown near mining environments.

ABSTRACT ID: OP 249

Title	Strengthening the Minamata Convention for the Effectiveness of Ending Mercury Use in the Artisanal and Small-scale Gold Mining Sector
Lead Author	Yuyun Ismawati
Co-Authors	Lee Bell, Gilbert Kuepouo

ABSTRACT

The Minamata Convention on Mercury is currently undergoing its first effectiveness evaluation to assess which sectors have seen the prescribed measures effective and to what extent. The Convention has been effective in some areas, notably the significant reduction in intentional mercury use in products and industrial processes, mainly due to hard phase-out dates and time-limited exemptions. While this is commendable, the same cannot be said for the treaty's effectiveness on mercury use in artisanal and small-scale gold mining (ASGM), the world's largest source of mercury emissions. Available data indicates that the volume of mercury used in ASGM has remained relatively constant, or may even have increased, since the treaty came into force.

The effectiveness of the Minamata Convention in dramatically reducing mercury use in products and industrial processes has largely been due to hard phase-out dates. Although parties are encouraged to set their own phase-out date in their National Action Plans, there is currently no global phase-out date for ASGM as an allowable use of mercury. This gap provides an incentive for both legal and illicit primary mercury mining and trade, exacerbated by the recent high price of gold.

To enhance the effectiveness of the Convention's implementation, the treaty requires amendments to strengthen its measures on primary mercury mining, its trade and use in the ASGM sector. Specifically, amendments should create a phase-out date within the next decade for ASGM as an allowable use of mercury, prohibit national imports and exports of mercury except for environmentally sound disposal, and accelerate phase-out timeframe for primary mercury mining to 2030. The cost of not strengthening the convention will be high, as environmental and human health impacts on over 20 million people in the Amazon, Africa, and Southeast Asia hotspots continue to grow, and mercury contamination proliferates.

ABSTRACT ID: OP 250

Title	Strengthening Health Aspects of the Minamata Convention on Mercury
Lead Author	Yuyun Ismawati
Co-Authors	Yune Eribowo, Anantka Annisa, Panca D. Astuti

ABSTRACT

The Minamata Convention on mercury is to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

Almost 10 years after the Minamata Convention on mercury entered into force, global trade in mercury has already declined. Mercury is already being phased out. Moreover, mercury emissions and releases from processes that use mercury also declined. However, mercury impacted human health and biodiversity for a long time, even after mercury use ended.

Articles 16 and 17 of the Convention provided pathways to address health issues associated with mercury exposure, including toxicological, ecotoxicological, and safety information. This information is needed to inform policymakers and serve as a reference for shaping the country's national implementation or action plans in particular sectors.

Over 130 parties have already submitted their short reports to the Secretariat on their Convention-relevant initiatives. However, not all countries, especially those engaged in Artisanal and Small-scale Gold Mining, where mercury is used intensively, have implemented proper health screening and biomonitoring.

Furthermore, monitoring total mercury concentrations in human biomarkers, such as hair, blood, urine, and nails, has been widely recognised and used to determine the extent to which pollution affects public health. Mercury and methylmercury pollution and threats in ASGM countries will persist even after mercury is replaced with other chemicals or a non-mercury gold extraction method. More studies have revealed the extent of mercury poisoning in populations in vulnerable situations and indigenous peoples in ASGM hotspots. However, there is very limited information and few lessons learned to prevent further mercury poisoning and to guide health treatment.

Capacity building and programmatic information exchange could help parties to advance the effective implementation of the Minamata Convention and improve health care interventions in ASGM countries.

ABSTRACT ID: OP 251

Title	Mercury isotopic signature in blood and hair: a study in Amazonian populations
Lead Author	Zoyne Pedrero Zayas
Co-Authors	Gabriel N. Cezarette†, §, Juliette Esplugas†, Pascale Louvat†, Warren T. Corns□, Fernando B. Junior§, Maité Bueno†

ABSTRACT

Amazonian riverine populations are chronically exposed to methylmercury (MeHg) through the consumption of local fish and provide a relevant model for investigating mercury (Hg) fate in humans. Hg isotopic compositions are effective tracers of Hg sources and transformations, yet studies in humans are still scarce and Hg isotope data in human blood remain unavailable. Here, we report Hg isotopic signatures in blood and hair from 107 individuals living in the Tapajós region of the Brazilian Amazon. Blood and hair showed similar odd-MIF signatures ($\Delta^{199}\text{Hg}$; median $\sim 0.54\text{‰}$), with no significant seasonal variation. By contrast, hair was systematically enriched in heavier MDF ($\delta^{202}\text{Hg}$) compared with blood, resulting in positive within-individual offsets ($\epsilon^{202}\text{Hg} = \text{Hair}\delta^{202}\text{Hg} - \text{Blood}\delta^{202}\text{Hg}$) of up to $\sim 1.5\text{‰}$. Blood Se concentration was negatively associated with $\epsilon^{202}\text{Hg}$, suggesting that this essential element, which has long been proposed to reduce Hg toxicity despite mechanisms still unresolved in humans, may influence internal Hg fractionation and/or detoxification via hair excretion. Overall, this study presents the first Hg stable isotope measurements in human blood and highlights new perspectives on Se–Hg interactions beyond the Amazonian context.

ABSTRACT ID: OP 253

Title	The Intersection of Global Biodiversity Conservation Prioritization Areas and Mercury Threat
Lead Author	Mark E.H. Burton
Co-Authors	Timothy H. Tear, David C. Evers

ABSTRACT

Pollution and climate change are increasingly recognized as interconnected with biodiversity loss in what has become known as the “Triple Planetary Crisis.” To better understand their spatial patterns, we implemented a data-driven prioritization framework integrating biodiversity significance, unique ecological features, habitat condition, conservation management, and ecosystem services (providing a direct link to climate change) using transparent weighting functions. This framework incorporated 34 drivers across terrestrial, freshwater, and coastal marine realms to identify globally significant biodiversity conservation priority areas. The analysis highlighted the Coral Triangle in Southeast Asia and the Pacific and the Mesoamerican Reef region in the Caribbean as overlapping priorities across all three realms, while the Amazon Basin and central Africa emerged as regions of overlapping terrestrial and freshwater priorities. To assess the potential impacts of mercury, a pollutant of global concern, on biodiversity, we overlaid these identified biodiversity priority areas onto an existing global mercury threat map combining ecosystem sensitivity to mercury contamination and anthropogenic mercury pollution risk. Global (realm overlap) and realm biodiversity priorities exhibited significantly higher mercury sensitivity, risk, and overall threat than non-priority areas, with 81% of grid cells falling into the highest threat category. We illustrate these patterns through regional case studies in the Amazon and East Africa, exploring how identified priorities translate into tangible biodiversity risks at regional- and national-scale intersections of mercury threat and conservation. These spatial patterns highlight global biodiversity priorities and areas of greatest potential mercury impact and provide a framework for targeting future biomonitoring, conservation interventions, and policy development aimed at mitigating impacts on biodiversity.

ABSTRACT ID: OP 255

Title	Stable isotopes and mercury in the trophic niche of the 'Lesser Goa Mustard Tarantula' <i>Thrigmopoeus truculentus</i> (Pocock, 1899), Goa, India
Lead Author	Manoj Borkar
Co-Authors	K Srikanth, Asif Qureshi

ABSTRACT

The Lesser Goa Mustard Tarantula (*Thrigmopoeus truculentus* Pocock, 1899) is an endemic mygalomorph of the Western Ghats. However, its trophic ecology and contaminant exposure remain poorly understood. Here, we combined stable isotopes ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) and trace element (Mercury, Hg) analysis to elucidate diet–consumer linkages, trophic positioning, and intra-individual biochemical partitioning. Tarantula specimens, associated prey taxa, vegetation, and soil were collected across ten locations, with adult and juvenile spiders analysed separately. $\delta^{13}\text{C}$ values revealed that tarantula carbon sources varied spatially, with individuals at some locations assimilating carbon predominantly from soil-based pathways, while others incorporated both soil- and vegetation-derived carbon. $\delta^{15}\text{N}$ enrichment confirmed that tarantulas occupy high trophic positions, with intraguild predation on other arachnids—particularly Lynx spiders (*Oxyopes* sp.), jumping spiders (*Plexippus paykulli*), and Giant Orb-Weaver spiders (*Nephila pilipes*)—constituting the dominant dietary component. Gastropods, such as brown slugs (*Mariaella dussumieri*), contributed minimally to the diet. Within-individual analyses revealed compartment-specific patterns: the opisthosoma exhibited the lowest $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values but the highest Hg concentrations, whereas legs displayed inverse patterns. These observations indicate tissue-specific isotopic fractionation and preferential mercury accumulation, likely influenced by lipid content, metabolic routing, and protein/lipid turnover rates. Mercury bioaccumulation patterns highlight the potential for trace element transfer through trophic interactions in soil–plant–arthropod food webs. Collectively, these results demonstrate that *T. truculentus* functions as a 'mesopredator' with selective intraguild predation, integrates energy from multiple basal pathways, and exhibits complex intra-individual biochemical partitioning. This study underscores the utility of integrating stable isotopes and trace elements to resolve cryptic trophic relationships and contaminant dynamics in terrestrial invertebrate predators, providing a baseline for future ecological and conservation research in the Western Ghats. This is the first isotope-based trophic investigations in the Western Ghats theraphosid ecology.

ABSTRACT ID: OP 258

Title	Advances in the global multimedia modelling of mercury: model improvements and constraining of inputs using MCMC
Lead Author	Asif Qureshi
Co-Authors	Vikas Meena

ABSTRACT

Multimedia mass balance models are effective tools to understand large spatial and temporal changes in flows and transformations of chemicals, including mercury. Simpler level of details in atmosphere, land, oceans, vegetation mean all compartments can interact and exchange mercury with each other in real-time, without the need to specify boundary conditions. Here, we will show the progress and new capabilities included in one of the first global multimedia model on mercury (WorM3). Model improvements include coupling of deep ocean compartments up to approximately 4000-5000 m, inclusion of methylation and demethylation, and a better constrained atmosphere (using Geos-Chem as benchmark). Further, using gridded and unit-world versions of the model and Markov Chain Monte Carlo analysis, we will attempt to better constrain the uncertainties around important process parameters such as rate constants for mercury reduction and oxidation.

ABSTRACT ID: OP 261

Title	Training Tomorrow's Policymakers in Science-Informed Environmental Governance
Lead Author	Svetoslava Todorova
Co-Authors	

ABSTRACT

Syracuse University has sustained long term engagement with the Minamata Convention on Mercury through participation as an observer in meetings of the Intergovernmental Negotiating Committee and continued involvement in the Conferences of the Parties (COPs). Building on this engagement, from 2014 to 2021 junior level environmental engineering students participated in a structured simulation addressing mercury contamination at global, regional, and local scales. Entering the experience with no prior background in mercury science or policy, students conducted in depth interdisciplinary research and engaged in mock international negotiations aimed at improving existing treaty text. Through this process, students developed a practical understanding of mercury cycling, the scientific basis for policy decisions, and the challenges of translating technical evidence into negotiated international agreements.

This experiential framework was expanded in 2019 into a specialized course, The Role of Science in Environmental Governance, which examines international policymaking with a focus on chemicals, waste, and pollution. A defining component of the course is direct exposure to multilateral environmental negotiations, enabling students to observe real time interactions among scientific experts, policymakers, and stakeholders. Now institutionalized and offered biennially in alignment with the COP cycle, the course emphasizes the integration of scientific, social, economic, and ethical perspectives in environmental decision making. Students gain critical insight into the role of science in treaty development, the dynamics of consensus building, and the complexities of implementing global environmental agreements, preparing them to effectively contribute to science informed environmental governance.

The presentation will share pedagogical approaches and outcomes from this experiential learning model, offering insights transferable to other programs seeking to prepare students for science-based international environmental decision-making.

ABSTRACT ID: OP 264

Title	Field Lab for Mercury Analysis of Amazonian Indigenous Hair, Brazil
Lead Author	ZULEICA CARMEN CASTILHOS
Co-Authors	JESSICA Z. RAMOS, THAINÁ FARINCHON, LÍLLIAN M. DOMINGOS, THAÍS K. QUEIRÓZ; LORENA C. MENDES

ABSTRACT

Field Lab for Mercury Analysis of Amazonian Indigenous Hair, Brazil

Yanomami lands have been invaded by thousands of illegal gold miners who use mercury in their processes and contaminate rivers and fish. Total Hg in the hair of fish eaters correlates with Hg in the target tissue, the brain. Exposure to methylmercury, a risk factor for neurodevelopmental toxicity, has been assessed by using hair mercury analysis. Although there are laboratories in the country that could perform these analyses, the Yanomami indigenous culture requires that all indigenous biological material remain in their territory. In deference to their culture, the Environmental Mercury Speciation Laboratory of CETEM—Center for Mineral Technology was implemented in a field, a non-conventional laboratory space, inside the indigenous territory of CASAI—Casa de Saúde Indígena (Indigenous Health House) in Boa Vista, Roraima. The sampling and analysis protocols were also adequate since all unused biological material and even wastes must be returned to each donor. Therefore, the implementation of the atomic absorption spectrometry (AAS) with pyrolysis accessory and the quality management system of the LEMA/CETEM lab at CASAI were performed. Method validation and limit of detection and limit of quantification were performed. Twenty non-indigenous volunteers donated hair, and the samples were standardized to up to 3 cm from the root. A mercury proficiency test with the National Institute for Minamata Disease was performed with satisfactory results. Then, the implementation of the LEMA/CETEM at CASAI was successful. Mercury was quantified in 290 indigenous hair samples, and results are now available to physicians of the Brazilian Health Care Universal System (SUS).

ABSTRACT ID: OP 269

Title	Mercury Monitoring in the Caribbean Region
Lead Author	Dr Linroy Christian
Co-Authors	

ABSTRACT

Antigua and Barbuda acceded to the Minamata Convention on Mercury in September 2016 and remains committed to its implementation. Financial support received through the Specific International Programme (SIP) of the Convention enhanced analytical capacity to meet national priorities and obligations under the Convention.

The Caribbean Region Mercury Monitoring Network (CRMMN) was initiated in 2022 during the SIP project and has been officially endorsed by eight (8) countries within the wider Caribbean Region. Since its inception, the Network has established air monitoring sites in member countries and has been engaged in mercury monitoring in fish, birds, bats, human hair, and cosmetics.

In partnership with Environment and Climate Change Canada, atmospheric air monitoring was established in 2022 to provide trend data for total mercury concentration in air. The main objective is to establish temporal trends to facilitate national action, reporting, and to support the effectiveness evaluation process of the Convention.

The assessment of mercury concentrations in atmospheric air is particularly important for Antigua and Barbuda and other jurisdictions, as a means of providing national data on pollutant sources. Also, dietary exposure through fish consumption remains a priority, along with the potential health impacts from the use of skin-lightening creams.

The CRMMN continues to encourage and facilitate monitoring in the Caribbean region to address data gaps and provide regionally and globally comparable data. Furthermore, the network recognises the need to collaborate with other networks and entities to strengthen global mercury monitoring.

ABSTRACT ID: OP 270

Title	Environmental monitoring of Yanomami Land and the Upper Amazonas network
Lead Author	ZULEICA CARMEN CASTILHOS
Co-Authors	ROMÉRIO BRIGLIA, LILLIAN M. DOMINGOS, THAÍS K QUEIRÓZ, JOSUÉ SOUZA, THAINÁ FARINCHON, GUSTAVO TEIXEIRA, YAN FERNANDES, RICARDO SIERPE, RICARDO CESAR

ABSTRACT

The main objective is to implement a system for monitoring the environmental quality of drinking water, freshwater rivers, and sediments. This will involve analyzing several physical and chemical parameters, including inorganic and organic contaminants such as mercury and methylmercury. This was carried out across 26 sites within the Yanomami Indigenous Land and 15 sites within federal conservation areas located downstream in the state of Roraima. This multi-ministry project forms part of the Brazilian Federal Government's Action Plan for the Yanomami Emergency. This plan was triggered by the invasion of Yanomami land by over 20 thousand illegal gold miners, who use mercury in their processes and thereby contaminating rivers and fish, potentially endangering human health. The first phase (2024–2025) was funded by the Ministry of the Environment and Climate Change (MMA). The second phase (2025–2027), which is currently underway, is funded by the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA). Both phases have been carried out by CETEM (Centre for Mineral Technology) researchers and technicians. In the federal conservation areas CETEM and ICMBio are collaborating institutions. Over the course of a year, approximately 200 environmental samples were collected and 190 parameters quantified, including total mercury and methylmercury. Total mercury was also analyzed in 390 fish. Over 12,000 results were organized into a database to enable spatial analysis of the river basin. Implementing and maintaining this environmental monitoring system is essential for understanding the levels of these contaminants and creating a reference database for the Amazon region. The database will also serve as a basis for assessing the effectiveness of mechanisms to achieve national targets under the Minamata Convention in areas where artisanal and small-scale mining, including illegal activities, is present and on the rise.

ABSTRACT ID: OP 271

Title	Hemp cultivation reduces mercury volatilization but increases solubility and leaching potential in contaminated soils
Lead Author	Antoine Delemazure
Co-Authors	Razieh Khorabloo, Erik Meers , Filip M.G. Tack

ABSTRACT

Preventing contaminant migration is a key aspect of phytomanagement projects. Crops can help reduce mercury evaporation from the soil, but they could also induce volatilization through the transpiration flux. Besides, rhizosphere activity may either promote the precipitation or solubilization of trace metals. This greenhouse experiment evaluated mercury volatilization, solubility and leachability in soils cultivated with industrial hemp (*Cannabis sativa* L.), a crop that demonstrated phytomanagement potential for other trace elements. Volatilization was measured in a dynamic flux chamber coupled to a mercury vapor analyzer, while the soluble and leachable fractions were measured via saturated paste extraction and synthetic precipitation leaching procedure, respectively. The two contaminated sandy soils (61 and 6.3 mg Hg kg⁻¹) were both rich in organic carbon (3.3 and 3.4%) but exhibited distinctly different pH levels (3.2 and 7.5). Hemp cultivation significantly reduced Hg volatilization by 51-53% compared with non-planted conditions. In contrast, soluble mercury almost quadrupled (371-372%), accompanied by a substantial rise in dissolved organic carbon (DOC), a well-known driver of mercury solubility. The leachable fraction also increased significantly, more so in the near-neutral soil (205%) than in the acidic soil (152%). Cultivation did not affect DOC in the leachates but significantly raised the pH in both the near-neutral soil (+0.6) and the acidic soil (+0.4), suggesting that pH was a controlling factor for leachability. In conclusion, hemp cultivation can reduce mercury volatilization from contaminated croplands, especially late varieties that shade the soil over a longer timeframe. On the contrary, the higher solubility and leaching potential indicate a risk of increasing mercury bioavailability and migration, and should therefore be carefully monitored. Aided phytomanagement with soil amendments could help alleviate these risks, especially by reducing DOC and, possibly, pH.

ABSTRACT ID: OP 272

Title	Spatial and temporal trends of mercury in sediments off Goa, central West Coast of India
Lead Author	Krushna Vudamala
Co-Authors	Subha Anand S1, A.K. Sudheer2 and Arubam Khelen Chanu1

ABSTRACT

India's rapid economic growth and industrialization have likely increased metal inputs into the marine environment, with mercury (Hg) of particular concern due to its toxicity, persistence, and bioaccumulation potential. However, its impact on marine sediments along the west coast of India remains insufficiently understood. To reconstruct historical Hg contamination and assess long-term environmental risks, gravity sediment cores were collected from three stations (G-5, G-7, and G-8) off Goa, spanning a coastal to offshore gradient. Sediment chronology for the recent ~100–150 years was established using ²¹⁰Pb geochronology, while deeper sediments were constrained using previously developed age models. Cores were subsampled at 1 cm intervals up to 100 cm to capture recent variations, and at 10 cm intervals below 100 cm to examine long-term trends.

Median Hg concentrations in G-5, G-7, and G-8 were 11.25, 10.25, and 7.65 µg/kg, respectively, showing a decreasing trend from nearshore to offshore. Concentrations ranged from 6–43.81 µg/kg in G-5, 5.6–39.56 µg/kg in G-7, and 1.94–15.94 µg/kg in G-8. Elevated Hg levels at the nearshore station (G-5) suggest stronger anthropogenic influence, likely linked to the Mandovi and Zuari rivers. Both G-5 and G-7 showed increasing Hg concentrations toward the surface within the upper 100 cm, followed by lower and relatively stable concentrations at depth, while G-8 exhibited a similar recent enrichment trend. These spatial and temporal patterns indicate enhanced Hg inputs in recent decades, likely associated with growing industrialization, and highlight the value of sediment records in tracing historical contamination in the eastern Arabian Sea.

ABSTRACT ID: OP 273

Title	Global use of mercury in Ayurvedic medicine
Lead Author	Peter Maxson
Co-Authors	

ABSTRACT

Geographically, Ayurvedic medicaments are most prevalent in India, where Ayurveda constitutes a significant component of the healthcare system, but they are also widely used in Nepal, Sri Lanka, and among diaspora populations in United States and United Kingdom. While precise user numbers are difficult to quantify, Ayurveda is utilized by hundreds of millions globally.

The intentional incorporation of mercury into certain Ayurvedic medicaments is most prominently associated with Rasa Shastra, which encompasses a wide pharmacopeia of formulations collectively termed rasaushadhi. These include preparations such as bhasmas (calcined metal powders), kajjali (mercury–sulfur complexes), and compound formulations combining mercury with herbs and other minerals or metals. Such medicaments are manufactured and consumed, particularly in South Asia, and are also exported globally through online and diaspora markets.

Empirical analyses indicate substantial variability in mercury content across these products. In rasa shastra formulations, high mercury concentrations have sometimes been reported, far exceeding levels found in non-metallic preparations. Broader surveys suggest that approximately 20 percent of Ayurvedic medicines contain detectable heavy metals.

Estimates of total mercury consumption in Ayurvedic medicine are uncertain, but reliable sources suggest that in India alone, tens of tons of mercury appear to be allocated annually to medicinal production. Extrapolated globally, this represents a nontrivial contribution to anthropogenic mercury use.

This presentation will draw on diverse sources to:

- describe the range of Ayurvedic medicaments in use that contain intentionally added mercury;
- assess the typical mercury content of various Ayurvedic medicaments
- identify the countries where Ayurvedic medicaments are particularly prevalent;
- estimate the number of persons in each of these countries taking Ayurvedic medicaments that contain intentionally added mercury;
- determine the quantity of mercury consumed worldwide annually in Ayurvedic medicaments;
- venture as to whether Ayurvedic medicaments that contain intentionally added mercury are adequately regulated and monitored.

ABSTRACT ID: OP 274

Title	Assessing Biodiversity Impacts from Mercury Release in Artisanal Small-Scale Gold Mining Using Birds as Indicators
Lead Author	David Evers
Co-Authors	Kevin Regan, Korik Vargan, Billi Krochuk, Ed Jenkins

ABSTRACT

The relationship between the Minamata Convention on Mercury and the Convention on Biological Diversity presents significant scientific and policy challenges that demand immediate and thorough evaluation. This assessment is critical for understanding the diverse impacts of mercury pollution on global biodiversity. Recent global meta-analyses highlight that nearly half—45%—of the 131 vertebrate families studied, including more than 300 bird species, surpass recognized reproductive health thresholds for mercury exposure. This finding underscores the widespread threat posed to birds by mercury contamination. Among the sources of mercury pollution, releases from artisanal small-scale gold mining (ASGM) have emerged as the most extensive global contributors. The urgent need to evaluate the impact of these mercury releases is evident, particularly in those habitats that have an ability to methylate mercury inputs. Quantifying the effects of mercury, using birds as indicators, is essential for understanding the potential harm to biological diversity. In response, this presentation introduces a methodology designed to assess biodiversity impacts resulting from mercury release associated with ASGM, using birds as ecological indicators. Two case studies, conducted in Equatorial Guinea and Colombia, illustrate the practical application of this methodology. These examples show how the effects of mercury can be systematically evaluated in relation to biodiversity. Species monitoring is facilitated through the deployment of autonomous recording units, which collect audio data in the field. This audio information is then processed with machine learning techniques to enable automated species identification, providing an efficient and scalable approach for tracking bird populations in impacted areas. The integrated assessment framework developed in this study offers a global model for evaluating mercury-related impacts on biodiversity at other ASGM sites. By applying this template, researchers and policymakers can better understand and address the consequences of mercury pollution on biodiversity.

ABSTRACT ID: OP 275

Title	Mercury–biodiversity risk landscapes in artisanal gold mining systems of the Peruvian Amazon
Lead Author	Luis E. Fernandez
Co-Authors	Claudia M. Vega, Jessica Pisconte, Liz Huamani, Tatiana Garcia, Miles R. Silman

ABSTRACT

Artisanal and small-scale gold mining (ASGM) is a leading source of mercury (Hg) emissions in tropical regions, yet its implications for biodiversity remain poorly integrated across taxa, trophic levels, and policy-relevant monitoring frameworks. In the Peruvian Amazon, ASGM landscapes represent coupled systems of habitat transformation and contaminant release, linking aquatic and terrestrial environments.

We synthesize field-based evidence from multiple Wake Forest University / CINCIA mercury studies conducted between 2016 and 2026 in ASGM-affected regions, integrating Hg contamination in aquatic systems, bioaccumulation in fish, exposure in higher trophic-level species, and biodiversity responses in birds and bats. Using a trophic and landscape framework, we compare Hg exposure and biodiversity responses across aquatic–terrestrial linkages and gradients of mining disturbance. Across these systems, we observe higher Hg exposure in upper trophic levels and associated community-level responses in ASGM-impacted environments.

Building on emerging mercury threat assessment frameworks, we examine mercury–biodiversity risk landscapes as a way to connect field evidence from ASGM systems with global monitoring and policy needs. By linking mercury exposure, trophic pathways, ecosystem sensitivity, and biodiversity responses across taxa, this synthesis helps identify indicators that can strengthen global mercury assessment, support biodiversity-sensitive implementation of the Minamata Convention, and improve governance of mercury risks in mining-affected landscapes.

ABSTRACT ID: OP 276

Title	Converting marine methylmercury science to decision-grade evidence: an evidence-to-action framework for Minamata Convention implementation
Lead Author	Luis E. Fernandez
Co-Authors	

ABSTRACT

Methylmercury bioaccumulation in marine and coastal food webs is extensively documented, yet its translation into actionable policy remains uneven, particularly in seafood-dependent regions. This gap reflects a structural mismatch between how marine mercury science is produced and the evidentiary requirements of governance instruments.

We present an evidence-to-action framework that links biomonitoring design, exposure and risk characterization, and uncertainty management to the specific needs of three Minamata Convention applications: fish consumption advisories, spatial hotspot designation, and effectiveness monitoring. Drawing on the marine mercury literature and governance use-cases, we show that conventional scientific outputs—mean tissue concentrations, regionally aggregated contamination maps, and heterogeneous time series—often fail to meet decision-grade requirements, including population-representative exposure distributions, bioavailability-linked indicators, biodiversity-relevant sentinel taxa, and trend-detection capacity.

The framework reorients monitoring and analysis around defined governance endpoints, emphasizing species selection aligned with exposure pathways, sampling designs powered to characterize high-exposure tails, and risk outputs expressed in decision-relevant terms. In coastal and small island contexts, this approach can support advisory development, biodiversity-relevant biotic monitoring, and Convention reporting even under constrained capacity. This framework offers a practical architecture for converting marine methylmercury science into decision-grade evidence for Minamata implementation.

ABSTRACT ID: OP 280

Title	Atmospheric mercury monitoring to support international priorities
Lead Author	Alexandra Steffen
Co-Authors	Geoff Stupple, Katrina MacSween

ABSTRACT

Atmospheric mercury has been measured and studied for several decades by Environment Climate Change Canada (ECCC). Canada has boasted a long-term atmospheric monitoring program using active sampling since 1995 and has been able to observe changes in regulatory actions from various regions around the world by looking at in situ mercury levels. These measurements have also been used by many modelers to investigate mercury source regions from, deposition into Canada and has been used to predict mercury levels based on regulatory projections. With changes in regional mercury emissions, the need for enhanced spatially representative monitoring is critical to assess impacts of control measures such as the implementation of the Minamata Convention on Mercury. To address this issue, Canada introduced the ECCC – Global Mercury Passive Network (GHgP) pilot program to demonstrate an effective method for sampling atmospheric mercury on a scale that has not been previously done. The program employs the MerPAS® system that is now commercially available and simple to use. The program began in 2019 and has been running for 6 years measuring mercury every 3 months at approximately 100 sites. The preliminary data have been included in the science report for the first effectiveness evaluation cycle. Updates on results from the ECCC-GHgP implementation and a discussion on the impact of this measurement style will be presented.

ABSTRACT ID: OP 421

Title	Early-life invisible exposure: mercury in breastmilk and neonatal vulnerability in the Brazilian Amazon
Lead Author	Marta Turull
Co-Authors	Mônica Cunha ^{2,3} , Montse Marquès ¹ , Jean R. D. Guimarães ⁴ , Rejane C. Marques ⁵ , Sergi Díez ¹

ABSTRACT

Human breast milk (HBM) is recognized as a complete source of nutrition, providing essential macronutrients, micronutrients, and biologically active compounds that support infant survival, growth, immune function, and neurodevelopment. Current public health guidelines recommend HBM as the exclusive source of nutrition for infants during the first six months of life and as a complementary source of nutrition up to two years of age or beyond. In this context, HBM is considered the global gold standard for infant feeding. However, HBM may also represent a potential route of exposure to environmental contaminants, including toxic elements, which can pose risks to infant health. Therefore, understanding the factors influencing the presence of contaminants in HBM is of critical importance. This study aimed to assess variability in mercury (Hg) concentrations in HBM and to explore their associations with sociodemographic characteristics and perinatal outcomes.

A total of 293 HBM samples were collected from both urban and rural areas across seven health regions in Rondônia, Brazil, namely: Zona da Mata, Central, Vale do Jamari, Café, Cone Sul, Vale do Guaporé, and Madeira-Mamoré. The samples included different stages of lactation, including colostrum (1-5 days postpartum), transitional milk (5-15 days postpartum), and mature milk (from day 16 up to 15 months postpartum). In addition, participating mothers completed a comprehensive questionnaire with maternal and infant characteristics, as well as household demographic and socioeconomic factors.

The median Hg concentration in HBM was 0.77 µg/L, with similar levels in colostrum (0.79 µg/L) and transitional milk (0.63 µg/L), and higher levels in mature milk (1.11 µg/L). This presentation will explore the associations between Hg concentrations and sociodemographic, environmental, and lifestyle variables. Infant health characteristics, such as prematurity and congenital malformations, were also considered. In addition, a risk assessment was conducted to evaluate potential health risks related to infant exposure through breastfeeding.

ABSTRACT ID: OP 1051

Title	Mercury in avian ecosystems in India
Lead Author	Mahendiran M
Co-Authors	Asif Qureshi

ABSTRACT

Although India is one of the top three global mercury emitters, information on mercury accumulation in India's ecosystems is extremely limited. Assessment and monitoring of Mercury contamination levels in top-level predators, such as birds, are vital to develop an understanding of the range of mercury contamination and to assess its correlation with other environmental gradients. Also, chronic mercury exposure has been shown to be toxic to birds. Our past and ongoing work has focused on assessing avian populations, their habitat, and impacts on climate in several ecosystems in India: namely the Bonal Bird Community Reserve, Palk Bay, Kanyakumari area, west coast in Maharashtra, and coastal Kerala. These ecosystems range from remote locations (e.g. Bonal reserve) to urban proximity (e.g. Maharashtra). In this work, we will present results of mercury in soil, sediments and avian feathers (where possible with permissions) from several of these ecosystems. In particular, we will attempt to co-relate the mercury contents with extent of anthropogenic influence, proximity to sources, and their correlation with our data such as on abundance, reproductivity and the like. The field work is ongoing at the moment, and the results will be available in the next 2-3 months. Overall, these will help in filling important data gaps in mercury (and possible other chemicals related) pollution in areas with rich biodiversity.

ABSTRACT ID: OP 1056

Title	Mercury in Biota – global synthesis of monitoring data for Effectiveness Evaluation
Lead Author	Mark Burton
Co-Authors	Olha Furman, Josh Ackerman, Paco Bustamante, Jess Brandt, Celia Chen, John Chetelat, Marlene Evans, David Evers, Nadia Facciola, Tatsuya Hattori, Magali Houde, Kimmo Kahilainen, Eva Kruemmel, Yanju Ma, Aourell Mauffret, Marianna Pinzone, Heli Routti, Claudia Vega, Simon Wilson, Pianpian Wu, Eisaku Toda, Terry Keating, Alexandra Steffen, Dominique Bally Kpokro

ABSTRACT

Mercury remains a pollutant of global concern due to its persistence, long-range transport, and biomagnification. This presentation highlights scientific contributions to the Open-Ended Science Group (OESG) report supporting the Effectiveness Evaluation of the Minamata Convention. The OESG comprises experts nominated by Parties and supported by a broader network of international scientists contributing data, analyses, and expertise. Within the effectiveness evaluation framework, the OESG synthesized biota monitoring data on total mercury collected through 2024 to assess spatial coverage, current exposure levels, ecological and human health implications, and temporal trends. The assessment draws primarily on datasets submitted directly to the OESG, complemented by select peer-reviewed studies. While these data enabled local- and regional-scale analyses in North America, Europe, Australia, and Japan, geographic coverage remains uneven. Substantial data gaps persist in Africa, Latin America, South Asia, and parts of the Pacific, limiting global-scale assessments. Common matrices include fish (muscle), birds (feathers, blood, eggs), invertebrates (soft tissues), and mammals (liver and muscle), with concentrations spanning several orders of magnitude. In invertebrates, THg concentrations in bivalves ranged from 10.2 to 2,070 ng g⁻¹ dw, with most oysters and mussels exceeding regional background levels, but below food safety thresholds. Fish muscle THg ranged from <0.1 to 16,400 ng g⁻¹ ww, indicating widespread contamination. Marine mammals exhibited the highest Hg concentrations, with liver THg levels up to 5,962,000 ng g⁻¹ dw and over 40% of the assessed species with individuals in high-to-severe risk categories, particularly among top predators. Comparisons with toxicity benchmarks indicate widespread contamination, suggesting potential risks to reproduction, behaviour, growth, and survival. The findings highlight the need to strengthen systematic, long-term, spatially representative monitoring, particularly in artisanal and small-scale gold mining (ASGM) regions, and for better integration of Indigenous knowledge to enhance the relevance, equity, and inclusivity of future assessments.

ABSTRACT ID: OP 1057

Title	Levels, Trends, and Spatial Patterns Across Environmental Media and Natural Archives: Insights from the First Synthesis Supporting the Minamata Convention Effectiveness Evaluation
Lead Author	Svetoslava Todorova
Co-Authors	Adrien Mestrot,</br>Anne Sørensen,</br>Jane Kirk,</br>Una Jermilova,</br>Taylor Luu,</br>Vivien Taylor,</br>Chris Eckley,</br>Manuel Gabriel Velasquez Ramirez,</br>Sylvain Bouchet,</br>Larissa Schneider,</br>John Munthe,</br>Valentin Mansanarez,</br>Semia Gharbi,</br>Chuxian Li,</br>Luis Ángel Ancco Pichuilla,</br>Jacqueline Gerson

ABSTRACT

Mercury (Hg) in oceans, freshwater, and soils are critical pathways linking atmospheric Hg to biota. Yet globally-harmonized assessments of Total-Hg (THg) and Methyl-Hg (MeHg) across these matrices remain limited by sparse monitoring and methodological heterogeneity. Here we present a first attempt to synthesize trends, spatial patterns and covariation across oceanwater, freshwater, soil, dated lake sediment cores, and natural archives (peat cores, ice cores, and tree rings). For the ocean, 60 datasets of THg and MeHg were compiled (2005–2024). For freshwater, seven national submissions from four continents were evaluated; data quality varied widely. For sediments, 488 cores were synthesized globally, analyzing THg concentrations, fluxes, and pre-industrial- enrichment factors. For soil, submissions spanned six continents but were dominated by the USA (14,571 sites) and Australia (2,401), with Africa and Asia largely absent. Global median THg in unimpacted lake sediments (1990–2020) was significantly lower than at impacted sites. THg co-varied with %LOI in unimpacted cores, while fluxes co-varied strongly with aluminum, suggesting mineral sediment delivery is an important control on depositional Hg fluxes. In soils, THg appeared associated with surface organic matter and metallic oxides at depth, but high intrinsic spatial variability obscured background-versus-anthropogenic contrasts. Ocean, freshwater, and soil datasets lack sufficient spatial coverage and representativeness to resolve global temporal trends. Natural archives extend the temporal record substantially: 116 peat cores (4650 BC–2018 AD), 10 ice records (670050 BC–2017 AD) concentrated in Canada, Greenland, and Antarctica, and 62-tree-ring record (1550–2020) spanning remote and point-source-impacted sites. However, the Southern Hemisphere coverage is sparse across all three archival media. The synthesis demonstrates measurable Hg enrichment above pre-industrial baselines, persistent regional disparities in data availability and quality (Africa, Oceania, parts of Asia and the Mediterranean are critically under-sampled), and a pressing need for standardized methods and sustained monitoring to support the Minamata Convention.

ABSTRACT ID: OP 1058

Title	Effects of an Extreme Drought Event on Mercury Biogeochemistry in Central Amazon Sediments
Lead Author	Gabriela Santos Caldeira
Co-Authors	David Amouroux, Tereza Cristina Souza de Oliveira, Alina Kleindienst, Emanuel Tessier, Pascale Louvat, Pedro Costa Evangelista, Fernando Barbosa Egreja Filho, Naziano Pantoja Filizola Junior, Ednaldo Bras Severo, Cláudia Carvalhinho Windmüller

ABSTRACT

The Amazon Basin has been increasingly affected by recurring extreme climatic events, with recent droughts exposing extensive areas of previously submerged river sediments ¹. However, the effects of these hydrological extremes on mercury (Hg) biogeochemistry in tropical blackwater systems remain poorly understood. To address this knowledge gap, we investigated Hg biogeochemistry in preserved and urban Negro River sediments exposed during the unprecedented 2023 Central Amazon drought. Bed sediments and drought-exposed sediment profiles were collected from preserved environments (Anavilhanas Archipelago and Lake Cabeçudo) and an urban sector near Manaus. Sediments were analysed for total Hg (THg), total organic carbon (TOC), major and trace elements, and Hg stable isotopes. The Potential Ecological Risk Index (PERI) was calculated to assess the ecological risk associated with Hg in this blackwater system. THg concentrations strongly covaried with total organic carbon (TOC) and particle-reactive elements, supporting previous observations that sediment composition and organic matter are important controls on Hg accumulation in Amazonian blackwater system ^{2,3}. All sediment samples displayed negative Hg isotope compositions ($\delta^{202}\text{Hg} = -2.24$ to -1.55‰ ; $\Delta^{199}\text{Hg} = -0.72$ to -0.19‰), consistent with values previously reported for Amazonian soils and sediments ^{4–6}. However, drought-exposed sediments from the urban sector of Manaus exhibited less negative odd-mass-independent fractionation ($\Delta^{199}\text{Hg}$ and $\Delta^{201}\text{Hg}$) than sediments from preserved environments, indicating differences in Hg isotope compositions between urban and preserved settings during the 2023 extreme drought. Higher Hg enrichment factors, less negative Hg odd-mass-independent fractionation, and considerable ecological risk were observed in drought-exposed urban sediments from Manaus compared with preserved environments. Together, these findings highlight differences in Hg biogeochemistry between preserved and urban environments of the Negro River basin during the unprecedented 2023 Central Amazon drought. These findings provide new insights into the effects of extreme drought on Hg biogeochemistry in Amazonian blackwater systems.

1. Espinoza, J.-C. et al. *Sci Rep* 14, 8107 (2024).
2. Bisinoti, M.C. et al. *J Braz Chem Soc* 18, 544–553 (2007).
3. Marinho, R.R. et al. *Earth Surf. Process. Landf.* 47, 1108–1123 (2022).
4. Araujo, B.F. et al. *Limnol Oceanogr* 63, 1134–1145 (2018).
5. Nitschke, N. et al. *ACS EST Water* 4, 3443–3452 (2024).
6. Garnier, J. et al. *J Hazard Mater* 498, 139892 (2025).

ABSTRACT ID: OP 1059

Title	A scoping initiative of the Arctic Monitoring and Assessment Programme (AMAP) to advance mercury monitoring in the Arctic using mercury stable isotopes
Lead Author	Sofi Jonsson
Co-Authors	Sofi Jonsson,</br>Rune Dietz,</br>Simon Wilson,</br>Marina Arregui,</br>Niladri Basu,</br>Bridget Bergquist,</br>Eva Cecilie Bonefeld-Jørgensen,</br>João Canário,</br>Eva Kruemmel,</br>Miling Li,</br>Melissa McKinney,</br>John Munthe,</br>Michelle Nerentorp,</br>Tove Petersson,</br>Marianna Pinzone,</br>Henrik Skov, J</br>ens Søndergaard

ABSTRACT

The Arctic Monitoring and Assessment Programme (AMAP) has been reporting on mercury contamination of the Arctic environment and human exposure to mercury since the 1990s due to elevated risk for some wildlife and human populations. Over the last decade, a new measurement tool, mercury stable isotope analysis, has become available to better understand the mercury cycle. Thus, AMAP conducted a scoping initiative to evaluate the potential for mercury isotopes to be incorporated into AMAP activities and contribute new policy-relevant science on mercury contamination in the Arctic. Published measurements were compiled on mercury isotopes in Arctic abiotic matrices and in biota to identify strengths and gaps, and to provide supporting data for future studies. Currently, few mercury isotope measurements are available for the Arctic, and most data have limited geographic coverage. Only one Arctic human biomonitoring study has been published using mercury isotopes to assess dietary exposure pathways. Mercury isotope applications were examined through existing studies for the Arctic and, in some cases, exemplary studies in other regions. Mercury isotopes hold promise for generating new information on transport processes, exposure pathways, and climate change effects on mercury in the Arctic. These advances may improve our understanding how human emissions of mercury reach the Arctic and how the mercury cycle will respond in the future to environmental changes and regulatory actions under the United Nations Minamata Convention. However, it is not currently feasible to use mercury isotopes for identifying specific anthropogenic mercury emission sources that reach the Arctic through long-range transport. Through this scoping initiative, knowledge gaps and recommendations were developed to support future incorporation of mercury isotopes in AMAP activities. These recommendations aim to strengthen policy-relevant science on mercury contamination in the Arctic and to align AMAP activities with global monitoring and effectiveness evaluation under the Minamata Convention.

ABSTRACT ID: OP 1063

Title	Mercury Removal Through Adsorption with Coal Fly Ash and Bottom Ash: Analysis Using Box-Behnken Design
Lead Author	Fuzi Suciati SASTRAATMAJA
Co-Authors	Fuzi Suciati SASTRAATMAJA ^{1,2} , Dwindrata B. AVIANTARA ² , Rochmad Onig WITAMA ² , Susi SULISTIA ^{1,2} , Muhammad Ihsan SOFYAN ^{1,2} , Esti Mega MULIDAYANTI ^{1,2} , Agus SUDARYANTO ² , Shohei NISHIHAMA ³ , Yasuhiro ISHIBASI ¹ , Tetsuro AGUSA ^{1*}

ABSTRACT

The utilization of coal combustion residues as low-cost adsorbents offers a sustainable approach for wastewater treatment while promoting waste valorization. This study investigated the adsorption performance of coal fly ash and bottom ash (particle size of 150 μm) for the removal of mercury (Hg) from aqueous solutions at an initial concentration of 2 ppm. Optimization was conducted using a three-factor, three-level Box–Behnken Design integrated with Response Surface Methodology to evaluate the effects of temperature (25–45°C), adsorbent dosage (0.1–1.0 g), and contact time (30–180 min) on Hg removal efficiency. Quadratic regression models were developed to describe the adsorption behaviour and identify the optimal operating conditions. For fly ash, the developed model achieved an R^2 value of 88.5%, indicating a satisfactory fit to the experimental data. Contact time significantly influenced removal efficiency ($p < 0.05$), while the interaction between adsorbent dosage and contact time exhibited the strongest effect on system performance ($p = 0.019$). The optimum conditions predicted by the model were 25°C, 1.0 g adsorbent dosage, and 30 min contact time, yielding a predicted removal efficiency of 60.7%. In contrast, bottom ash demonstrated superior adsorption performance, achieving a maximum predicted removal efficiency of 86.9% at 45°C, 1.0 g adsorbent dosage, and 180 min contact time. Statistical analysis revealed the temperature–dosage interaction was the dominant factor governing adsorption by the bottom ash ($p = 0.019$), suggesting a stronger dependence on thermally enhanced mass transfer and surface accessibility. Comparative analysis indicated distinct adsorption mechanisms of which the fly ash exhibited relatively rapid adsorption with limited temperature dependence, whereas bottom ash required elevated temperature and prolonged contact time to maximize contaminant uptake. These findings demonstrate the potential of coal combustion residues as effective low-cost adsorbents and provide valuable insights into optimization and mechanism-driven design for sustainable water treatment applications.

ABSTRACT ID: OP 1064

Title	Dimethylmercury contributes to mercury burdens in the California Current System
Lead Author	Erik T. Paulson
Co-Authors	Johannes West, Julia M. Diaz, Amina T. Schartup

ABSTRACT

The entry of mercury (Hg) into marine food webs is assumed to be controlled by the accumulation of both monomethylmercury (MMHg) and inorganic divalent Hg (HgII) in primary producers, with MMHg efficiently biomagnifying up the food chain. At the same time, uptake of dimethylmercury (DMHg) has been overlooked despite emerging data suggesting that DMHg may dominate the marine methylated Hg pool. For instance, we measured DMHg concentrations as high as 1.2 pM in the California Current System (CCS), accounting for up to 100% of total Hg. In this region, elevated DMHg concentrations are upwelled to the euphotic zone alongside nutrients that drive phytoplankton blooms, with unknown implications for Hg bioaccumulation.

Using isotopically labeled DMHg, we quantified its accumulation in three phytoplankton taxa at sub-picomolar concentrations. Additional uptake experiments using isotopically labeled MMHg and HgII were conducted to enable direct comparison across Hg species under similar conditions. Experimentally derived uptake dynamics were then incorporated into a closed-box model to estimate Hg species-specific contributions to phytoplankton Hg burdens in a CCS phytoplankton bloom. Our findings point to an unrecognized pathway by which methylated Hg can enter marine food webs.

ABSTRACT ID: OP 1065

Title	Human biomonitoring of mercury exposure in a vulnerable population: Levels, trends, sources, and economic impacts.
Lead Author	Brij Mohan Sharma
Co-Authors	Brij Mohan Sharma, Sona Smetanova, Jiri Kalina, Jan Kuta, Petra Pribylová, Pavel Piller, Lenka Andryskova, Martin Scheringer, Jana Klanova, Klara Komprdova

ABSTRACT

UNEP's Global Mercury Assessment suggests that all humans on planet Earth are exposed to some amount of mercury. Mercury, even at low-level exposure, poses serious health risks, especially in vulnerable groups such as pregnant women and children. Human biomonitoring (HBM) of mercury is therefore critical for assessing exposure patterns, identifying sources, and informing public health and policy responses. However, comprehensive mercury HBM data on vulnerable populations, including source attribution and economic implications, still remain limited. In this study, we assessed mercury exposure in a background population from a longitudinal Central European Cohort CELSPAC:TNG in the Czech Republic. We measure total mercury concentrations in maternal blood, cord blood, and urine from more than 600 pregnant women, alongside the collection and analysis of detailed data on their anthropometry, lifestyle, and socioeconomic characteristics. Detectable mercury levels were observed in all participants, although concentrations remained below guideline values established by the USEPA and German HBM thresholds. We also observed that over the last 20 years, mercury exposure levels in the Czech population have declined noticeably. Key determinants of exposure were found to be fish consumption, use of dental amalgam, and higher education, highlighting the role of both dietary and socioeconomic factors in shaping exposure variability. Despite relatively low exposure levels, the estimated lifetime economic cost of prenatal mercury exposure in children ranged between €15,000 to € 18,000 per capita, which is approximately 1 – 2 years of median income in the Czech Republic. Findings of our study demonstrate that even low-level mercury exposure in background populations has measurable health economic implications, underscoring the need for continued mercury monitoring and targeted strategies under the guidance of the Minamata Convention and regional and national environment health policy on mercury.

ABSTRACT ID: OP 1066

Title	The Global Chemicals Monitoring Programme (GCMP) and its Contributions to the Effectiveness Evaluation of the Stockholm and Minamata Conventions.
Lead Author	Brij Mohan Sharma
Co-Authors	Victor HE Schulze, Haosong Jiao, Kenneth Davis, Mihaela Paun, Jitendra Sharma, Ludovic Bernaudat

ABSTRACT

The Global Chemicals Monitoring Programme (GCMP) is a Global Environment Facility (GEF)-funded and UNEP-led global initiative to strengthen capacity building and generate high-quality, harmonized, and globally comparable monitoring data on persistent organic pollutants (POPs) and mercury in developing countries and countries with economies in transition. The programme supports the effectiveness evaluation processes of the Stockholm Convention on POPs and Minamata Convention on Mercury, while ensuring continuity of the UNEP/GEF-coordinated Global Monitoring Plan (GMP) on POPs through extended temporal coverage and the integration of mercury monitoring. The programme comprises six child projects, including one global coordination project and five regional projects across Africa, Asia, Pacific, Latin America, and the Caribbean, to be implemented over a five-year period (2026–2031). The global coordination project of the GCMP has three key components: (i) establishing sustainable capacity for global chemicals monitoring, (ii) generating high-quality and globally comparable data, and (iii) enhancing knowledge management and stakeholder engagement. Scientifically, the programme seeks to harmonize methods for sampling, analysis, data collection, and reporting of POPs in core environmental and human matrices, including ambient air, water, and human milk, while also supporting harmonized global mercury monitoring in ambient air. By generating spatially and temporally comparable and reliable data, the programme aims to improve understanding of the occurrence, long-range transport, and environmental fate of POPs and mercury, particularly in regions where monitoring capacity remains limited. In parallel, the programme aims to promote knowledge exchange between regional projects and science-policy bodies and foster collaborations among Conventions secretariats, their regional centres, multilateral organizations, academia, civil society, and other key stakeholders. Through these interventions, the GCMP will provide robust scientific basis for ongoing and future projects on chemicals and waste management, improve data availability to informed policy making, enhance regional and global cooperation, and support implementation of the Stockholm and Minamata Conventions.

ABSTRACT ID: OP 1067

Title	Eliminating mercury from pore characterization using eutectic gallium-indium porosimetry
Lead Author	Stefan Stauder
Co-Authors	Martin Thomas, Francisco Sotomayor, Alyssa Henderson

ABSTRACT

Mercury intrusion porosimetry (MIP) has been the reference method for pore characterization since the mid-twentieth century and remains indispensable in applications including batteries, pharmaceuticals, and petroleum research. Its unique measurement range and robustness have made it the standard for characterizing porous materials. However, the method relies entirely on elemental mercury, resulting in exposure risks, hazardous waste generation, and significant environmental impacts throughout the mercury life cycle.

Despite the objectives of the Minamata Convention and European mercury legislation to eliminate the use of mercury wherever feasible, MIP has remained one of the few laboratory applications for which no technically equivalent alternative was available. Consequently, the absence of a substitute has prevented a complete phase-out of the technique and necessitated its continued exemption from broader mercury restrictions.

This work presents eutectic-gallium-indium (eGaln) porosimetry as the first available mercury-free alternative capable of reproducing the performance of conventional MIP. The method retains the established principle while completely eliminating the use of mercury. Measurements performed on certified reference materials demonstrate that pore characteristics are fully comparable to those obtained by MIP. These results demonstrate that mercury can be replaced without compromising data quality or applicability in established industrial and research workflows.

Beyond its analytical performance, the environmental significance of this development is substantial. Routine MIP consumes considerable quantities of mercury, and the global installed base of instruments accounts for hundreds of tons of mercury use annually. By providing an equivalent mercury-free alternative, eGaln porosimetry removes the principal justification for the continued use of mercury in pore characterization. The availability of this substitution therefore establishes the technical basis for a future regulatory phase-out, and potentially the prohibition, of MIP. As such, eGaln porosimetry represents an important contribution to the implementation of the Minamata Convention by enabling mercury source reduction through substitution rather than emission control alone.

ABSTRACT ID: OP 1070

Title	From Emissions to Metabolism: Addressing Gaps in National Mercury Accounting
Lead Author	Yvonne Ryan-Fogarty
Co-Authors	Lynch, D.

ABSTRACT

The Minamata Convention on Mercury requires nations to identify and reduce anthropogenic mercury emissions and releases. While international policies have successfully reduced transboundary air and water emissions, tracking mercury through waste management systems remains underexplored. This study evaluates the efficacy of inventory tools in identifying waste mercury sources to assist environmental policymakers and enforcement agencies in building risk profiles. Using Ireland as a case study, indicative Substance Flow Analyses (SFA) were constructed using the UNEP Mercury Inventory Toolkit alongside national registries (PRTR, UNECE) and waste collection data. The SFA reveal significant challenges and opportunities for national waste accounting to close the gap on mercury metabolism models. Concerns remain around historical Mercury-Added Products (MAPs), unmanaged waste, and novel products to Ireland, in addition to a heavy reliance on exporting hazardous waste for treatment. The findings suggest that while current inventory tools effectively track air and water emissions, mercury metabolism accounting must be implemented at a regulatory level to adequately capture legacy wastes and prepare for future emissions. Ultimately, improving these accounting methods directly supports the effectiveness evaluations of the Minamata Convention and regional environmental policies.

ABSTRACT ID: OP 1212

Title	Accelerating the Transition to Mercury-Free Healthcare: WHO Leadership, Global Partnerships, and Implementation of the Minamata Convention
Lead Author	Elena Jordan
Co-Authors	Country focal points from Albania, Burkina Faso, India, Montenegro, and Uganda.

ABSTRACT

Medical devices over a decade. Key milestones include the development of WHO policy guidance advocating the replacement of mercury thermometers and sphygmomanometers with validated mercury-free alternatives; support for the inclusion and implementation of mercury-containing medical devices under the Minamata Convention on Mercury; adoption of World Health Assembly Resolution WHA67.11; establishment of global partnerships with UNEP, governments, and healthcare institutions; development of technical guidance on procurement, mercury spill prevention and response, healthcare waste management, and, most recently, implementation of a multi-country GEF-supported programme demonstrating practical pathways for transitioning health systems to mercury-free healthcare. To accelerate implementation of the Convention, WHO, in partnership with the United Nations Environment Programme (UNEP) and with support from the Global

Environment Facility (GEF), is leading a global initiative to phase out mercury- containing measuring medical devices in Albania, Burkina Faso, India, Montenegro, and Uganda. The project supports countries in addressing regulatory, manufacturing,

procurement, training, and waste-management challenges associated with the transition to mercury-free healthcare. A new WHO online course strengthens safe and sustainable health-care waste management.

WHO's technical leadership spans the full lifecycle of phase-out, including national assessments, development of country roadmaps and strategies, procurement guidance, technical specifications for mercury-free devices, training of healthcare workers, communication campaigns, mercury spill-response procedures, interim storage solutions, and approaches for environmentally sound management of mercury-

containing waste. The initiative has established national stakeholder mechanisms, supported policy development, strengthened health-care waste systems, and advanced replacement planning in pilot healthcare facilities. More than 1,300 mercury-containing medical devices have already been identified for phase-out and replacement in Albania, Burkina Faso, Montenegro, and Uganda, representing over 112 kg of mercury that will be removed from use. In addition, demonstration activities planned in seven states in India will support the replacement of approximately 2,211 mercury sphygmomanometers and 510 mercury thermometers across selected districts, significantly expanding the scale and impact of the transition to mercury-free healthcare. This experience demonstrates how WHO's normative leadership, technical expertise, and convening power can translate global commitments into practical action, protecting human health, reducing mercury pollution, and advancing implementation of the Minamata Convention worldwide.

ABSTRACT ID: OP 1213

Title

mercury in traditional medicine in South Africa

Lead Author

Renee Streets

Co-Authors

ABSTRACT



ABSTRACT ID: OP 1214

Title	Rethinking Future Mercury in Fish: Bridging Model Predictions with Observations Under Global Emission Scenarios
Lead Author	Henna Gull
Co-Authors	Ju Hyeon Lee ² , Hoin Lee ¹ , Hélène Angot ³ , and Sae Yun Kwon ¹

ABSTRACT

Mercury (Hg) poses a global environmental threat because it can be transported over long distances through the atmosphere and, once deposited in aquatic ecosystems, converted into methylmercury (MeHg), a potent neurotoxin that bioaccumulates in food webs. Despite international efforts to curb anthropogenic Hg emissions through policies such as the Minamata Convention, uncertainties remain regarding how emission reductions will influence future Hg deposition and fish MeHg concentrations. This study synthesizes published modeling studies and compares their projections with observational evidence to evaluate future fish Hg responses under different emission scenarios through 2050. Model output consistently indicates a strong relationship between Hg emissions and atmospheric deposition ($R^2 = 0.8$), and a moderate relationship between deposition and fish MeHg concentrations ($R^2 = 0.6$). However, these modeled trends differ from observations, which often reveal nonlinear responses and substantial variability among ecosystems. The analysis suggests that this consistency across models largely reflects shared assumptions, including the dominant role assigned to atmospheric deposition and relatively rapid ecosystem responses to changing Hg inputs, while the influence of legacy Hg stored in catchments and sediments is only partially represented. Atmospheric deposition and lake area emerged as the strongest predictors of modeled fish MeHg, with smaller lakes generally exhibiting higher concentrations. These findings highlight the importance of incorporating legacy Hg dynamics, ecological complexity, and climate-driven processes into next-generation models to improve projections and strengthen scientific support for future implementation of the Minamata Convention.

ABSTRACT ID: OP 1215

Title	Mercury and its speciation in a few traditional formulation
Lead Author	Asif Qureshi
Co-Authors	Shrutee Jain, Azhar Hashmi

ABSTRACT

It is understood that many traditional formulations contain mercury. In this work, 22 formulations will be analyzed for mercury contents, and selected formulation will be analyzed for their speciation (i.e. whether mercury is bound to sulphur, is in free elemental form, or is in organic form). The 22 items are broadly classified into the following: those related to skin care (dermal application or oral ingestion), wellness tablets and food (rice) preservatives. This information is important, as some of the formulations could be widely used and information on speciation will better drive discussions on bioavailability, but also on downstream post-ingestion releases.

ABSTRACT ID: OP 1216

Title	High lead and mercury exposure related to intake of Ayurvedic pharmaceuticals.
Lead Author	Marcial Velasco Garrido
Co-Authors	Stephanie Selke ¹ , Volker Harth ¹ , Alexandra M. Preisser ¹

ABSTRACT

A 47-year-old woman presented to the environmental medicine outpatient clinic of the Institute for Occupational and Maritime Medicine in 02/2023 after a two-month stay in an Ayurvedic clinic in India. After her stay at the clinic, during which she had undergone Ayurvedic therapy, she imported various products to Germany and continued to take them. In the meantime, she was concerned about possible exposure to heavy metals. The medical history revealed no evidence of manifest heavy metal intoxication. As a precautionary measure, we carried out human biomonitoring (HBM) for arsenic (As), lead (Pb) and mercury (Hg). In addition, we analysed the pharmaceutical products brought by the patient. The heavy metal content of the products was determined by Inductively Coupled Plasma Mass Spectrometry after aqua regia digestion and incubation in dilute nitric acid, dilute hydrochloric acid and thiourea. Lead levels were 713 µg/L (Ref. = 30 µg/L) in blood and 88.8 µg/L (Ref. = 30 µg/L) in urine. Mercury was slightly elevated in urine 1.49 µg/L (Ref. = 1.0 µg/L). Mercury blood levels and arsenic urine levels were within their respective reference values. The blood count showed mild anaemia (Hb 11.9 g/dl). Serum creatinine, glomerular filtration rate and liver enzymes were within normal range. We recommended immediate discontinuation of the ayurvedic medication and further regular control of lead blood levels. The analysis of the ayurvedic products brought by the patient (n= 6) revealed that the maximum level according to EU 2023/915 ('Contaminants Regulation') for lead (3.0 µg/g) was exceeded in three of the products: 'Stresan' (pill) = 3.04 µg/g, 'Ashwaganda Pak' (granulate) = 2703.9 µg/g and 'Maanasa Mithra-Vatakam' (pill) = 78.47 µg/g. The maximum level for mercury (0.1 µg/g) was exceeded in 5 of the 6 preparations (Hg content between 0.14 µg/g and 1096 µg/g).

Despite public warnings about the hazards associated with Ayurvedic pharmaceuticals, these products continue to be consumed. In this case, the patient's initiative to seek advice and evidence-based counselling prevented the development of a symptomatic intoxication with lead.

ABSTRACT ID: OP 1217

Title

Science Policy Interface on Chemicals, Waste and Pollution: A New Intergovernmental Panel

Lead Author

Sandra Averous-Monnery

Co-Authors

ABSTRACT



ABSTRACT ID: PP 13

Title	Mercury concentrations in the surface bottom sediments eastern Arctic seas
Lead Author	Ivanov Maksim
Co-Authors	

ABSTRACT

Mercury concentrations were detected in 527 surface bottom sediments and 15 cores (multi-cores) with undisturbed surface. To determine mercury, an RA-915M+ mercury analyzer with a PYRO-915 pyrolytic attachment was used. The lower detection limit was 0.5 ng/g. The analysis error was 2-3%. GSO 7183-95, SPDS-1,2,3, HISS-1, MESS-4, and PACS-3 served as reference materials for mercury.

The data processing revealed that the mercury concentration changed with bathymetric level. The study area was characterised by a selection of 527 samples of surface bottom sediments (0 to 5 cm), which were divided into two groups: 1) to a depth of 100 m (n=395) and 2) within the depth range from 100 to 260 m (n=132). Mercury concentrations for this area varied from 3 to 95 ppb, with mean and median concentrations of 33 and 30 ppb, respectively. The median value served as the background concentration, which was well correlated with the previously determined background of 28 ppb for the bottom sediments of the Chukchi Sea and the adjacent area of the Arctic Ocean.

The presence of oxidized or reduced sediments is the main factor that determines the variability of mercury concentrations in the bottom sediments. The twofold excess over the background is typical of the deep part (depth 100 to 2600 m) where oxidized sediments are widespread. In the shallow part (0 to 50 m) of the Laptev Sea, where reduced sediments with various compositions are widespread, the mercury concentrations were much lower, but there was also the influence of the Lena River. It is necessary to take into account that the products of thermal and wave abrasion of the material from the nearshore ice complex determine the influx of terrigenous organic matter to the sea.

This work was supported by the Russian Science Foundation (RSF; project no. 25-27-00443).



ABSTRACT ID: PP 17

Title	Mercury in Drinking Water in a Historically Contaminated Mining Area: Integrated Assessment, Isotopic Evidence and Human Health Risk Evaluation in Idrija, Slovenia
Lead Author	Jože Kotnik
Co-Authors	T. Kanduč, P. Vreča, I. Živković, U. Blaznik, V. Golja, N. Šimac, B. Miljavac, M. Horvat

ABSTRACT

The Idrija region in Slovenia represents one of the world's most historically significant mercury (Hg) mining areas, where more than five centuries of mining and ore processing have resulted in elevated Hg levels across environmental compartments. This study presents a comprehensive assessment of mercury occurrence in drinking water systems supplying the Municipality of Idrija, combining chemical, isotopic, hydrogeological, and health-risk evaluation approaches.

The project integrated dispersed historical and monitoring datasets with newly collected field samples from all major water supply systems. A unified database was established to enable systematic long-term evaluation of drinking water quality. Multi-element chemical analyses were performed alongside measurements of physicochemical parameters and stable isotopes of hydrogen and oxygen ($\delta^2\text{H}$, $\delta^{18}\text{O}$) and dissolved inorganic carbon ($\delta^{13}\text{C_DIC}$) to identify water sources and potential contamination pathways.

Measured mercury concentrations in all drinking water samples were significantly below the regulatory limit of 1 $\mu\text{g/L}$ defined by national and European legislation. Detectable Hg levels occurred only sporadically and remained several times lower than guideline values. Isotopic signatures confirmed that drinking water originates predominantly from local precipitation feeding karstic and fractured aquifers, with no evidence of influence from historical mining waters or contaminated flows. Elemental composition and seasonal variability reflect natural geochemical conditions rather than anthropogenic inputs.

Human health risk assessment demonstrated that chronic mercury intake through drinking water represents only a minor contribution to total Hg exposure across all population groups, including sensitive subpopulations such as infants. Estimated exposure levels remain well below internationally accepted health-based guidance values.

The study further highlights critical challenges related to fragmented environmental data management and proposes the development of a centralized digital monitoring platform. The results confirm that drinking water in Idrija is chemically stable, compliant with regulatory standards, and safe for human consumption, while providing a transferable framework for risk assessment and water quality management in legacy mining regions worldwide.

ABSTRACT ID: PP 22

Title	Mercury in gas and oil deposits
Lead Author	Vladimir Ryzhov
Co-Authors	Nikolay Mashyanov, Sergey Sholupov, Sergey Pogarev

ABSTRACT

Mercury concentrations in gas and oil deposits range from background levels up to 5 mg/m³ in natural gas and up to 600 mg/kg in crude oil. According to N. Ozerova, Hg-bearing ore, coal, oil, and gas deposits are connected to mantle tectonic structures at the intersection of deep faults and transcontinental lineaments. Mercury in hydrocarbons poses a number of technological and environmental problems, including human exposure, environmental contamination, and an increased risk of accidents due to corrosion of processing equipment.

We studied the Hg content in approximately 80 European and Asian oil and gas deposits using a Lumex RA-915 analyzer. This instrument, based on Zeeman atomic absorption spectroscopy, allows for direct mercury determination in gaseous, liquid, and solid media. Long-term measurements at various gas deposits revealed substantial year-to-year variability in the average mercury content from producing wells, with fluctuations ranging by a factor of 1.5 to 15. This variability must be considered when assessing total Hg reserves in a deposit.

Furthermore, short-term, regular variations in Hg concentrations in produced gas were discovered, with periods ranging from 0.3 to 25 hours. A relatively low-frequency oscillation with a period of 25 hours coincides with the calculated lunar tidal cycle. The magnitudes of these oscillations range from 10% to 80% of the average mercury content in the gas. Mercury in natural gas is present mainly as elemental Hg(0), which is also adsorbed by host rocks. We hypothesize that these regular variations are caused by the release of adsorbed Hg(0) into the gas phase due to mechanical disturbance of the solid rock matrix.

ABSTRACT ID: PP 28

Title	Key requirements and best practices for measurement comparability in marine mercury speciation analysis
Lead Author	Igor Živković
Co-Authors	Jože Kotnik, Lars-Eric Heimbürger-Boavida, Mariia V. Petrova, Aurélie Dufour, Ermira Begu, and Milen

ABSTRACT

Accurate and comparable measurements of mercury (Hg) species in seawater are essential for understanding marine Hg cycling and for evaluating global trends in response to emission controls. However, trace-level concentrations, species instability, and methodological differences among laboratories often limit the comparability of Hg speciation data. This study investigates the key factors controlling measurement comparability in seawater Hg speciation and evaluates their implications for sampling design and data interpretation. A metrological approach was applied to assess the influence of natural environmental variability, analytical measurement uncertainty, and interlaboratory variability on the determination of total Hg (THg), dissolved gaseous Hg (DGM), and methylated Hg species in seawater. Using a case study from the Central Adriatic Sea, statistical analyses were performed to estimate sample sizes required to detect significant spatial and temporal differences in Hg concentrations under different environmental conditions. Sample size calculations incorporated within-laboratory measurement uncertainty and variability observed in interlaboratory comparison exercises. Results show that natural variability represents the dominant contributor to overall uncertainty in coastal environments, whereas analytical uncertainty and interlaboratory differences become critical in low-variability systems such as open-ocean waters and depth profiles. Accounting for measurement uncertainty and interlaboratory variability increases the required sample size for detecting small concentration differences, highlighting the importance of rigorous experimental design in marine Hg monitoring programs. The study also identifies limitations related to sample preservation, calibration strategies, and the availability of suitable certified reference materials, which can further affect data quality and comparability. Based on these findings, recommendations are provided for improving Hg measurement harmonization, including standardized sampling protocols, implementation of metrological traceability, optimization of calibration procedures, and routine participation in interlaboratory comparisons. The proposed framework supports the generation of comparable Hg datasets and strengthens the scientific basis for assessing global marine Hg trends and evaluating the effectiveness of international environmental policies.

ABSTRACT ID: PP 36

Title	Climate Controls on Holocene Mercury Dynamics Across Alaskan Arctic Terrestrial and Marine Systems
Lead Author	Masao Uchida
Co-Authors	K. Mantoku, C. L. Ping, G. Iwahana, H. Kajita, A. Yamakawa, S. Rella, C. Amano, K. Yoshikawa

ABSTRACT

Mercury (Hg) dynamics in the Arctic are strongly influenced by interactions among permafrost thaw, organic carbon (OC) cycling, and long-term climate variability. Accelerated Arctic warming mobilizes Hg previously stored in permafrost, enhancing its transfer from terrestrial reservoirs to aquatic systems. However, the long-term evolution of Hg accumulation and release across Arctic environments remains poorly constrained. In this study, we reconstruct the Holocene history of terrestrial Hg accumulation (source) and aquatic Hg release (sink) using multiple environmental archives from the Alaskan Arctic and adjacent seas. The dataset includes a Denali peat (DHP) core, two marine sediment cores (PC1 and PC2) from the Beaufort Sea, and lake sediment and permafrost soil profiles from the North Slope of Alaska (Toolik Lake, Howe Island, Sagwon, Kougarkok, and Anaktuvuk). This spatially distributed dataset enables evaluation of coordinated Hg responses to climate change across terrestrial, lacustrine, and marine systems.

During the Early Holocene (12,000–10,000 cal yr BP), rapid post-Younger Dryas warming triggered pronounced Hg mobilization. Toolik Lake sediments record a sharp Hg concentration peak of $280.5 \mu\text{g kg}^{-1}$ at 12,125 cal yr BP, coinciding with elevated Hg levels in the DHP peat. These synchronous signals suggest enhanced Hg sequestration associated with vegetation establishment as well as substantial Hg release driven by widespread permafrost thaw.

During the Mid-Holocene (5,000–2,500 cal yr BP), relatively stable climatic conditions favored tundra soil development and Hg accumulation, particularly at Sagwon. Concurrently, sustained high Hg fluxes in marine core PC2 between 3,700 and 2,400 cal yr BP indicate stable transport of Hg-rich sediments from terrestrial soils to the Arctic Ocean.

From the Medieval Climate Anomaly (900–1300 cal yr BP) to the present, renewed warming caused large-scale Hg remobilization. Overall, Arctic Hg dynamics evolved from early Holocene geomorphic instability to mid-Holocene transport stability, followed by renewed remobilization during late Holocene and modern warming.

ABSTRACT ID: PP 40

Title	Simultaneous Measurement Using Gold Amalgamation Enrichment Mode and Direct Mode: A Creative Way Using Atomic Fluorescence Analytical Method for Mercury Analysis in Environmental Waters
Lead Author	Yumi Shimozuru
Co-Authors	Akihiro Mitsui, Ryuta Kurokawa, Naoko Hishida, Alvin Chua, Hazumu Kinoshita, Yasuyuki Yamada

ABSTRACT

Mercury concentrations in environmental samples are often unknown prior to analysis and can vary in concentrations, therefore making efficient and reliable analytical workflows is essential. In this study, a simultaneous-acquisition atomic fluorescence spectroscopy (AFS) approach incorporating automated pretreatment was applied to mercury determination in environmental waters, including seawater, river water, snow, and spring water.

The analytical system is based on reduction vaporization coupled with atomic fluorescence detection at 253.7 nm and is equipped with an autosampler integrating automatic digestion, together with a gold amalgamation enrichment unit. This configuration enables the simultaneous acquisition of two complementary measurement data within a single analytical sequence: a Direct mode measurement based on reducing vaporization and a high-sensitivity measurement using Gold amalgamation enrichment mode. The two modes can be evaluated independently or in combination, allowing flexible data collection according to sample characteristics and regulatory requirements without repeated measurement.

Environmental water samples collected across Japan were subjected to pretreatment and analyzed using both measurement mode. The results demonstrate that Gold amalgamation enrichment mode provides robust sensitivity for ultra-trace-level mercury, while Direct mode supports efficient analysis of samples containing relatively higher mercury levels. By combining automated digestion with simultaneous acquisition of Gold amalgamation enrichment mode and Direct mode, the workflow reduces the need for repeated measurements, improves laboratory throughput, and provides reliable mercury monitoring for samples with unknown concentrations.

ABSTRACT ID: PP 41

Title	Study on the Development of an Automated Cold-Vapor Atomic Fluorescence Spectrometry (CV-AFS) Analysis System for USEPA Method 1631E
Lead Author	Naoko Hishida
Co-Authors	Da-Wei Lin, Ling-Rong Liao, Alvin Chua, Yasuyuki Yamada, Ryuta Kurokawa, Akihiro Mitsui, Yumi Shimoz

ABSTRACT

To resolve the global mercury pollution problem and access the effectiveness of the Minamata Convention on Mercury, it is essential to understand mercury concentrations and its long-term dynamics in the environment. Many research and institutions have been conducting monitoring on atmospheric mercury concentrations and mercury concentrations in environmental water. Especially in environmental water, concentrations are normally in the ultra-trace levels of low or sub parts per trillion (ppt), therefore, analytical methods suitable for ultra-trace analysis must be carefully selected to use for the measurement, with utmost care and precaution to contamination. So, environmental water measurements are often conducted following USEPA Method 1631E guide. This study is to evaluate the automated measurement procedures in accordance with USEPA Method 1631E.

The automated analysis system combines a detection unit (CV-AFS) and a sample changer unit that performs automatic reagent dispensing and purging. The sample changer can accommodate up to 80 test tubes and is equipped with three peristaltic pumps for reagent dispensing. Conventional method following USEPA Method 1631E procedure involves manually adding reagents after oxidation and decomposition, followed by measurement using an analyzer. The developed system automates the process from the addition of hydroxylamine hydrochloride solution to measurement. The effectiveness of this automated system is evaluated by comparing measurement results with the same set of samples results obtained using the conventional procedure following USEPA Method 1631E. The environmental water used in this test and evaluation is rainwater samples.

In addition, under USEPA Method 1631E, it includes quality control parameters. The automated analysis system developed and used in this study incorporates customized USEPA 1631E QC software to process the results. The results obtained satisfy all quality control standards criteria, including the method detection limit (≤ 0.2 ng/L). The developed automated system has demonstrated to be suitable for measuring environmental water, comparable to conventional methods.

ABSTRACT ID: PP 44

Title	From Regional Background to Global Signals: A Long Term Record of Atmospheric Mercury Concentrations and Wet Deposition at the Iskrba Regional Background Station (Slovenia)
Lead Author	Jože Kotnik
Co-Authors	Ermira Begu, Igor Živkovič, Tanja Koleša, Milena Horvat

ABSTRACT

Robust evaluation of global mercury (Hg) mitigation efforts requires sustained, high-quality observations at regional background stations capable of resolving long-term trends from episodic variability. The Iskrba regional background observatory (southern Slovenia), operated within the national monitoring programme coordinated by the Slovenian Environment Agency, provides one of the longest continuous atmospheric Hg datasets in South-Eastern Europe. Since 2008, monthly integrated measurements of total gaseous mercury (TGM) in ambient air and Hg in precipitation have been performed at this remote forested karst site, minimally influenced by local anthropogenic sources.

Mean annual TGM concentrations during the 2008–2025 period typically range between 1.4 and 1.6 ng m⁻³, consistent with Northern Hemisphere mid-latitude background levels and comparable to other European regional stations within EMEP/GMOS frameworks. Temporal variability is modest and primarily driven by synoptic-scale air mass transport, seasonal boundary-layer dynamics, and oxidation chemistry rather than local emissions.

Mercury concentrations in precipitation and associated wet deposition fluxes indicate low-to-moderate deposition characteristic of continental background environments. Interannual variability is strongly controlled by total precipitation amount and air mass origin, while long-term behaviour suggests stabilization following earlier European emission reductions. The coherence between atmospheric concentrations and deposition fluxes supports the interpretation of Iskrba as a receptor site integrating regional-scale signals.

The extended observational record spans the period before and after entry into force of the Minamata Convention on Mercury, providing valuable baseline information for evaluating policy effectiveness in Central and South-Eastern Europe. Continued operation of Iskrba is critical for detecting emerging influences of climate-driven changes, including altered atmospheric oxidation capacity, increased legacy re-emissions, and shifts in deposition regimes.

This dataset strengthens the observational foundation required for model evaluation, source attribution, and assessment of global Hg mitigation strategies under evolving environmental conditions.

ABSTRACT ID: PP 45

Title	"Food of the future": mercury determination in microalgae-based supplements by direct analysis
Lead Author	Valentina Carrara
Co-Authors	

ABSTRACT

Microalgae-based food supplements are increasingly recognized as a sustainable nutritional resource and have been described as a potential "food of the future" due to their high content of proteins, vitamins, and antioxidants. However, these organisms can accumulate heavy metals from their aquatic environment, including mercury, through functional groups present on their cell walls that promote metal binding and bioaccumulation. Monitoring mercury levels in these products is therefore important to ensure consumer safety. Direct Mercury Analysis (DMA) provides a rapid approach for the determination of total mercury without the need for acid digestion or extensive sample preparation. The technique involves thermal decomposition of the sample, catalytic removal of interferences and mercury chemical conversion, amalgamation on a gold trap, and quantification by atomic absorption spectrometry. In this study, several commercial microalgae-based supplements (Spirulina, Chlorella, Klamath AFA, Kelp, and Fucus) were analyzed directly after homogenization. Method accuracy was assessed using a certified reference material with similar matrix (IAEA-450), while spike recovery experiments showed recoveries above 95%, confirming the reliability of technique for mercury determination in complex organic matrices.

ABSTRACT ID: PP 50

Title	A geographic assessment and representation of mercury (Hg) concentrations in selected South African freshwater environments from 2022-2025
Lead Author	Vernon Sydwill Somerset
Co-Authors	Chavon Walters

ABSTRACT

Mercury (Hg) is known to be a persistent and toxic heavy metal that can bio-accumulate in the aquatic environment and lead to serious human health effects. Hg is released into the atmosphere from both natural and anthropogenic sources, where in the atmosphere it can be present in a gaseous phase or in particulate matter [1].

It is also known that aquatic ecosystems have been affected by various types of contaminants in recent decades. Various anthropogenic activities can be attributed to this. The concern is the release of these contaminants from multiple regulated and unregulated sources. As for many heavy metals, once they are released into rivers, they may dissolve to form ions or complexes, suspended as particulate matter, or settled down as bed sediments. Through bioaccumulation they may enter the food chain and lead to human health issues [2].

Spatial assessments and GIS-based story maps will be used to visualize trends to inform the status of Hg concentrations between the 2010 and 2022/25 assessments in surface water and sediment in the Breede-Gouritz and Berg-Olifants water management areas (WMAs). This will be the first data since 2010 for the WMAs involved. The 2022 to 2025 assessments will include soil concentrations as well. It is hoped that evidence will be provided as to whether Hg concentrations in the freshwater ecosystem remain the same or to suggest which factors are responsible for possible changes observed.

ABSTRACT ID: PP 51

Title	Department of Energy Savannah River Site Mercury Legacy: Progress in addressing Technical Challenges
Lead Author	Christopher J. Bannochie
Co-Authors	B. B. Looney, H. H. Vermeulen, A. J. Boggess, T. L. White, V. R. Amiri, C. Fewox

ABSTRACT

For over 60 years, the Department of Energy's Savannah River Site (SRS) has utilized Hg as a catalyst in the acid dissolution of aluminum cladding for reactor targets and fuels, aluminum alloy fuels, and uranium-aluminum cermet. An estimated 60 metric tons of Hg have been used in processing and then released to the SRS Tank Farm waste tanks. Eleven years ago, the presence of organomercury, particularly methylmercury, in the liquid waste system prompted increased monitoring and investigations into the source(s) of alkylation. Since this time, the Savannah River National Lab (SRNL) has continued to pursue various projects related to analysis and speciation of mercury in various media, monitoring mercury in the waste tanks, and modelling. In-house methods for methyl- and ethylmercury (2017), elemental mercury (2018), inorganic mercury (2019), soluble and particulate mercury (2019) were developed. Adsorbents for Hg (0) and organomercury for use with a direct mercury analyzer (2020 - 2023) and multispecies methods by LC-QQQ and GC-MS (2025) have been explored. Most recently, SRNL has examined the Picoyune MA-1, a new commercial mercury analyzer for Industrial Hygiene purposes which utilizes a gold nanoparticle plasmonic sensor, for its ability to measure both organomercury as well as elemental mercury. Picoyune and SRNL are collaborating to assess the potential for using a silver nanoparticle plasmonic sensor to differentiate elemental from organomercury. SRNL also initiated updates to the OLI Systems, Inc. process modeling software to include updated mercury species and thermodynamic data as well as the addition of equilibrium data for the reduction of mercuric oxide in its Mixed Solvent Electrolyte (MSE) database for use in modeling SRS waste tank systems and predicting impacts to facility such as the SRS Salt Waste Processing Facility (SWPF).

ABSTRACT ID: PP 53

Title	Automated, dynamic, SI-traceable field calibration of atmospheric elemental and oxidized mercury
Lead Author	Seth Lyman
Co-Authors	Colleen Jones, KarLee Zager, Trevor O'Neil

ABSTRACT

Most atmospheric chemical measurements systems are routinely calibrated against traceable standards, and uncalibrated measurements are usually considered inferior, if not suspect. Atmospheric elemental mercury (Hg) measurements are typically calibrated by manual injection of Hg from a saturated vapor source, but manual injections are challenging, and competing vapor pressure equations differ by about 10%. Oxidized Hg measurements are almost never calibrated at all.

Efforts to develop Hg calibration methods have been undertaken for several decades, but no traceable, field-deployable method has yet been established other than elemental Hg manual injections. We have developed a permeation tube-based, field-ready calibration system that is able to output concentrations of elemental and oxidized Hg that are relevant to the ambient atmosphere (100 to 1,000 pg/m³ for oxidized Hg; 0.5 to 10 ng/m³ for elemental Hg) and demonstrated the functionality of this system in lab and field settings. The standard deviation of HgBr₂ output from the calibrator depends on the generated concentration, varying from 3% to 7% of the measured mean for concentrations from 310 to 550 pg/m³. Permeation rates of elemental mercury and mercury compounds used in the system are traceable to SI gravimetric standards. The system incorporates an inert dynamic dilution process that allows for rapid variation of the output concentration. Changing from one concentration to another requires an equilibration time of about 10 minutes, allowing for multi-point calibration of elemental and oxidized mercury. This automated system allows for routine, independent, SI-traceable checks on atmospheric Hg instrumentation in real field conditions.

ABSTRACT ID: PP 57

Title	Climate-driven variability in the global mercury cycle: long-term warming and ENSO effects in a coupled atmosphere–ocean–land mercury model
Lead Author	Toru Kawai
Co-Authors	

ABSTRACT

Understanding climate-driven variability in the global mercury cycle is important for interpreting future environmental mercury changes under ongoing emission controls. Previous studies have suggested that climate change can affect mercury cycling, but long-term warming and internal climate variability have rarely been examined systematically within a single coupled modeling framework. Here we investigate both effects using the coupled global atmosphere–ocean–land mercury model that we have developed, driven by CMIP6 climate fields.

The model simulates three-dimensional mercury transport in the atmosphere and ocean, mercury speciation and transformation, air–surface exchange, terrestrial recycling linked to soil organic carbon decomposition, and oceanic methylmercury formation, uptake by particulate organic matter, and biologically mediated vertical transport. Long-term warming impacts were evaluated by comparing simulations under contrasting CMIP6 scenarios. ENSO-related variability was analyzed using the Oceanic Niño Index derived from model sea surface temperature and a newly introduced Mercury Anomaly Index for simulated mercury.

Our analyses indicate that climate forcing modulates mercury cycling on both multi-decadal and interannual timescales. The magnitude, timing, and spatial expression of the long-term warming response appear to depend on terrestrial process representation, as indicated by sensitivity experiments, which identify terrestrial carbon decomposition as one of the key factors controlling the simulated warming-driven increase in mercury burden. ENSO exerts limited influence on globally integrated mercury burden but produces regionally coherent positive and negative anomalies in lower-atmospheric mercury over individual ocean basins, implying substantial spatial compensation at the global scale.

These results highlight the importance of considering both long-term warming and interannual climate variability when interpreting future mercury changes and evaluating the environmental response to emission reductions.

ABSTRACT ID: PP 63

Title	Arctic Permafrost as a Millennial Mercury Sink: Records from St. Lawrence Island, Bering Strait
Lead Author	Masao Uchida
Co-Authors	Masao Uchida, Go Iwahana, Kanako Mantoku, Josephine Galipon, Akane Yamakawa, Kumiko Nakano

ABSTRACT

Permafrost soils in the Arctic represent one of the largest terrestrial reservoirs of mercury (Hg), which has accumulated through long-term atmospheric deposition and strong associations with organic carbon. Accelerated Arctic warming and permafrost degradation may remobilize this stored Hg, potentially enhancing Hg fluxes to aquatic systems and the atmosphere. However, the long-term variability of Hg accumulation in Arctic permafrost environments remains poorly constrained due to the scarcity of millennial-scale records. In this study, we reconstruct the Holocene history of Hg storage in Arctic permafrost using multiple frozen soil cores collected from St. Lawrence Island in the southern Bering Strait region. St. Lawrence Island represents one of the last exposed remnants of the land bridge that connected Asia and North America during the Pleistocene. Two well-preserved permafrost cores, G2 (4 m long), which contains massive ice layers, and G4 (2.6 m long), are used as the principal archives for reconstructing long-term Hg dynamics. These cores contain continuous frozen sediment sequences characterized by variations in lithology, grain size, ice content, and organic matter accumulation. Geochemical and sedimentological analyses were conducted for all cores, including radiocarbon dating, stable carbon isotope analysis, lithofacies descriptions, and cryostructure observations. Mercury concentrations will be measured throughout the cores to evaluate temporal variations in Hg accumulation. Chronological control will be established using radiocarbon dating of organic materials, allowing reconstruction of Hg accumulation rates over approximately the past 10,000 years. The key cores G2 and G4 provide continuous archives that enable high-resolution reconstruction of Hg sequestration in Arctic permafrost. These records will improve our understanding of the coupling between mercury cycling, organic carbon dynamics, and permafrost stability during the Holocene and provide an important baseline for evaluating future Hg mobilization under ongoing Arctic warming.

ABSTRACT ID: PP 64

Title	Impact of the U-768 wreck on mercury concentrations in sediments, bottom waters, and marine organisms
Lead Author	Roksana Malec
Co-Authors	A. Popławska, A. Zarzeczańska, J. Beldowski, M. Beldowska, M. Sapota, A. Dziubińska

ABSTRACT

Military activities conducted in the first half of the 20th century have left a lasting mark on the marine environment. The Baltic Sea, due to its specific characteristics (low average depth and limited water exchange with the ocean), is particularly vulnerable to pollution. Military operations led to the sinking of thousands of vessels, often with fuel, ammunition, and supplies. Over time, the structural components of these objects undergo corrosion, which may result in the gradual release of hazardous chemical substances into the marine environment, including mercury (Hg).

Mercury is of particular importance in the context of potential contamination. It was used, among others, in detonators and ammunition fuses in the form of compounds such as mercury fulminate. Mercury accumulated in sediments may, under appropriate conditions, be remobilized into the water column. As a consequence, it can become incorporated into the marine trophic web.

The aim of this study was to estimate the potential impact of the wreck of U-768 on mercury concentrations in sediments and bottom water. Additionally, mercury concentrations were determined in the muscles and liver of the fish species *Myoxocephalus scorpius* feeding in the vicinity of the wreck.

Samples were collected during a research cruise on board the R/V Oceanograf in August 2025. Total mercury (THg) concentrations in sediments and fish tissues were determined using a DMA-80 mercury analyzer. THg concentrations in water were measured using a MERX-T analyzer.

In most cases, higher THg concentrations were recorded in sediments and bottom water at stations located approximately 5 m from the. Muscle and liver tissues of *Myoxocephalus Scorpius* collected near the wreck showed nearly twofold higher mercury concentrations than those from fish caught in a less contaminated area.

The research was funded by the Interreg South Baltic program as part of the BaltWreck project no. STHB.02.02-IP.01-0009/23.

ABSTRACT ID: PP 66

Title	Mercury concentrations in feathers, guano, and eggshells of <i>Pygoscelis</i> penguins from Admiralty Bay (Antarctica)
Lead Author	Roksana Malec
Co-Authors	Anna Panasiuk, Kinga Hoszek-Mandera, Robert Bialik, Katarzyna Fudala, Magdalena Beldowska

ABSTRACT

Mercury (Hg) is a highly toxic neurotoxic element that occurs naturally in the environment; however, anthropogenic activities have significantly altered its global biogeochemical cycle. In marine ecosystems, mercury is readily taken up by organisms and is characterized by its ability to bioaccumulate in tissues and biomagnify along the food web, leading to higher concentrations in top predators.

Although Antarctica is geographically remote, it remains vulnerable to contamination through long-range atmospheric and oceanic transport of pollutants from other regions of the world. In addition, local anthropogenic sources such as shipping, research stations, and tourism, as well as natural geothermal processes, may contribute to the introduction of contaminants into the Antarctic environment.

In the Southern Hemisphere, penguins of the genus *Pygoscelis* are among the most abundant top predators. These birds can eliminate contaminants, including mercury, through several biological processes such as molting, egg laying, and guano excretion, which may influence mercury cycling within the Antarctic ecosystem. Therefore, the analysis of mercury concentrations in penguin feathers, eggshells, and guano is important, as these materials may represent secondary sources of contamination.

The aim of this study was to determine total mercury concentrations in feathers, guano, and eggshell samples collected from Adélie, gentoo, and chinstrap penguins. Samples were collected during two field seasons (2023/2024 and 2024/2025) in the Admiralty Bay region.

Preliminary results indicate that molting plays a significant role in mercury elimination in *Pygoscelis* penguins. Mercury concentrations were highest in feathers compared with guano and eggshells. Furthermore, guano contained higher mercury levels than soils from penguin colony areas, suggesting that penguins may act as an important secondary source of chemical contaminants in the Antarctic environment.

ABSTRACT ID: PP 77

Title	Development of a Hg flux prediction model from unsaturated soils: An approach considering multiple Hg species and their potential of volatilization
Lead Author	Monami Kondo
Co-Authors	Yasuhide Sakamoto, Junko Hara

ABSTRACT

Mercury (Hg) released into the environment circulates globally, and artisanal and small-scale gold mining (ASGM) activities have been reported as one source of emissions. From the perspective of suppressing and reducing Hg releases into the environment, safety education is necessary for workers handling Hg without sufficient understanding of the associated exposure risks. Therefore, we aim to construct a long-term assessment model for residual Hg discharged at ASGM sites to visualize the invisible Hg exposure risks based on the numerical modeling for the transport phenomena inside unsaturated soil.

Hg dissolved in rainwater and soil pore water exists in various dissolved forms, and the transformation process from dissolved Hg to volatile Hg is complex and insufficiently understood. Furthermore, since Hg toxicity varies significantly depending on its chemical form, the consideration of Hg dynamics is essential for assessing human health risks. We had previously developed the Geo- Environmental Risk Assessment System (GERAS), capable of simulating the transport behavior of substances such as heavy metals, VOCs, and mineral oil between soil, pore water, and groundwater media. In this study, we expanded our system to construct a prediction model of Hg flux from the ground surface, considering not only single Hg species with volatile but also the complexity of dissolved Hg in soil. We virtually introduced the existence of chloride ions (Cl-) to model the distribution into volatile Hg species (Hg₀) under specific environmental conditions of oxidation reduction potential and pH. In addition, the methylation reaction of Hg was treated using reaction kinetics rather than equilibrium theory because it occurs ecologically and irreversibly. As a result, for example, as the chlorine concentration decreased, the distribution into Hg₀ tended to occur even at relatively low pH levels. This presentation introduces some of these results and discusses parameter determination toward future environmental prediction.

ABSTRACT ID: PP 81

Title	Development of a Diagnostic Method for Prioritizing Remediation Measures for Residual Mercury in Mercury-Contaminated Areas
Lead Author	Kohji Marumoto
Co-Authors	Yuya Tada, Masumi Marumoto, Takashi Tomiyasu, Hitoshi Kodamatani, I Gusti Made Kusnarta

ABSTRACT

To contribute for eliminating environmental risks to humans and ecosystems in mercury-contaminated areas, the research project focuses on predicting the fate of residual mercury primarily at artisanal-small scale gold mining (ASGM) sites and their abandoned areas. This project will clarify the volatilization flux of mercury from residual slag in soil and artificial ponds, as well as the water penetration flux due to precipitation and other factors. It will track changes in concentration and chemical form during mercury diffusion and migration processes, focusing on the soil environment. Furthermore, metagenomic analysis of soil and soil pore water will yield data on the volatilization potential of inorganic and organic mercury by microorganisms, as well as the methylation potential of inorganic mercury. Based on these data, we expect to propose criteria for determining priorities when implementing mercury contamination countermeasures at ASGM sites. In the preliminary surveys at actual abandoned ASGM sites, soil volatile mercury was measured using simple devices, revealing that higher soil mercury concentrations correlated with higher volatile mercury. Thus, this technology is useful for survey of contaminated Hg sites. While some locations exceeded 100 µg/kg of total mercury concentration in soil, DNA analysis revealed that DNA quantity became extremely low at concentrations above 20 µg/kg. Furthermore, locations with higher DNA quantity exhibited higher methylmercury concentrations. This indicates that DNA analysis is also useful for finding out the mercury methylation potential by microorganisms in soil. This study has been financially supported by the Environment Research and Technology Development Fund (5MF-2506, JPMEERF20255M06) of the Environmental Restoration and Conservation Agency in Japan.

ABSTRACT ID: PP 83

Title	DIRECT MERCURY SPECIATION IN SOLID SAMPLES USING THERMAL RELEASE COUPLED TO ELECTROTHERMAL ATOMIC ABSORPTION SPECTROMETRY
Lead Author	Dmitrii Yur'evich Troitskii
Co-Authors	Olga V. Shuvaeva, Ivan A. Bekesha

ABSTRACT

The development of methodology for mercury speciation in natural and man-made media is of particular value, since it is the chemical form of an element that determines its migration routes, bioavailability and toxicity. Wherein, the solid samples are the most problematic in terms of speciation. Traditionally used conventional analytical procedures include the extraction of the species followed by their subsequent separation and element-selective detection. Herewith the stage of extraction is the most critical one, which can be accompanied by the transformation of analytes.

In present work the most promising methodology of the direct mercury speciation in solid samples using thermal separation in combination with electrothermal atomic absorption detection (TR-ETA-AAS) is presented. It is based on the successive thermal release of mercury species using a commercial device RA-915+ with RP-91C attachment (Lumex Instruments, Russia) modified by addition of a module allowing of separation and atomization zones as well as continuous temperature increase with a subsequent stop until the thermal peak of the species is formed in argon atmosphere. This procedure allows avoiding a loss of the analytes during their isolation in the solid samples. More over this method provides a determination of insoluble mercury species such as sulfide and easily hydrolysable sulfate.

The problem of eliminating the influence of the matrix was overcome by dilution of the sample with aluminum oxide. The developed method allows determination of mercury(II) chloride, methylmercury chloride, mercury sulfide and sulphate at the level of 0.3, 0.05, 0.03 and 0.20 μg (as mercury) with a reproducibility of 20, 15, 10 and 25%, respectively. The accuracy of the proposed assay has been confirmed using certified reference material ERM CE464 as well as a spiking method.

ABSTRACT ID: PP 85

Title	Variability in mercury and dissolved organic matter quality in relation to catchment-lake processes: a spatiotemporal analysis in two deep oligotrophic lakes of Northern Patagonia (Argentina)
Lead Author	Rizzo Andrea
Co-Authors	Queimaliños C, Arcagni M, Soto Cárdenas C, Reissig M, De Stefano L, Fernandez Z, Diéguez MC

ABSTRACT

This study addressed seasonal and spatial dynamics of Hg in the water column and sediment porewater in two deep Andean Patagonian lakes in relation to the concentration and quality of dissolved organic matter to trace terrestrial Hg-DOM contributions and sediment influence. We analyzed DOM and Hg in sediment porewater of two deep, interconnected oligotrophic lakes (Moreno Este-ME and Moreno Oeste-MO) across littoral, sublittoral, and deep zones. Samples were collected in early autumn and spring, representing contrasting hydrological seasons (low and high water levels) and thermal scenarios (stratification vs. mixing). Water samples were collected every 10 m from surface to bottom, and porewater was extracted from mini-sediment cores in all the sampling points. Total Hg concentration [THg] was measured by cold vapour atomic fluorescence spectrometry (CV-AFS). DOM pools were characterized by dissolved organic carbon concentration [DOC], and by the absorbance at 350 nm normalized by [DOC] (a^*_{350}), a tracer of terrigenous DOM. Across seasons and sampling sites, porewater samples exhibited higher [THg] and [DOC] than overlying water, suggesting diffusion from the sediments. In early autumn, when the lake was stratified, water [THg] ranged from 0.3 to 89 ng L⁻¹ in MO and from 2 to 58 ng L⁻¹ in ME. Higher [THg] were recorded in porewater from the deep zones of both lakes, coinciding with less oxidized conditions. In spring, when the lake was mixed, [THg] ranged from 2 to 99 ng L⁻¹ in both lakes, with higher concentrations in the littoral and sublittoral zones associated with high values of terrigenous DOM (a^*_{350} : 5.1–47.35 L mg C⁻¹ m⁻¹), indicating terrestrial inputs. Hg-DOM co-dynamics indicate the importance of terrestrial inputs as a source of Hg for the lakes, while high [THg] in porewater and in deeper zones suggest diffusive fluxes of Hg stored in the sediments, favored by particular redox conditions.

ABSTRACT ID: PP 86

Title	Rapid Combustion and Trap Method for Concurrent Determination of Total Mercury and Sample Preconcentration for Stable Isotopes Analysis
Lead Author	NIMELAN VEERASAMY
Co-Authors	Nicolas V. Ortiz, Jeroen E. Sonke, David S. McLagan

ABSTRACT

Precise mercury (Hg) stable isotope measurement in low concentration (<10 ng) environmental matrices is often hindered by Hg mass limitation. Acid digestion followed by purge and trap (AD+P&T) requires strong acids and sample-to-acid ratios prevent Hg isotope analyses of low concentration matrices. Existing combustion and trap (C&T) methods for concentrating Hg from low concentration matrices vary among laboratories and typically require P&T for matrix purification. We tested a rapid C&T method using the Nippon MA3000 solid phase, total Hg (THg) analyzer due to the unique analytical cell bypass applied during combustion. This prevents combustion by-products (matrix) from entering the 40% (v/v) inverse aqua regia acid (iAR) trap connected to analytical cell outlets. Consequently, only gas-phase elemental Hg (and O₂ carrier gas) released after amalgamator heating enters the iAR trap potentially eliminating the need for the P&T step. THg in iAR trap was measured using Nippon MA-3000 liquid phase analyzer to calculate trapping efficiency before direct isotope analysis of iAR trap (diluted to 20% v/v) using MCICPMS. Testing applied Hg standard solution and Coal, Fish, Apple Leaves, Loam Soil, Marine Sediment, and Wood Biomass CRMs. The trapping recoveries ranged from $84 \pm 2\%$ to $91 \pm 5\%$ across all matrices, within acceptable ranges. ICP-MS was used to assess matrix purity of the iAR trap and results indicated no significant difference between traditional AD+P&T vs the Nippon C&T method. Similarly, there was no significant difference between AD+P&T and the Nippon C&T method for Hg isotopes ($\delta^{202}\text{Hg}$ and $\Delta^{199}\text{Hg}$) of all CRMs yielded $p > 0.05$. Moreover, Nippon C&T method demonstrated better precision (2SD) for both $\delta^{202}\text{Hg}$ ($\pm 0.26\%$) and $\Delta^{199}\text{Hg}$ ($\pm 0.15\%$) across all CRMs. Therefore, the Nippon C&T method enables a more efficient preparation of solid samples for Hg isotope analysis (<10mins) with simultaneous THg measurement for true recovery assessment.

ABSTRACT ID: PP 89

Title	Legal and illegal gold mining in the Amazon: mercury species distribution and stable isotopes discrimination in a gold mine
Lead Author	Naomi NITSCHKE
Co-Authors	Stéphane GUEDRON, Jennifer HARRIS, Emmanuel TESSIER, Sylvain CAMPILLO, Elaheh LOTFI, David AMOUROUX

ABSTRACT

Artisanal and small-scale gold mining (ASGM) in the Amazon region leads to the contamination of surrounding ecosystems with both anthropogenic and geogenic mercury (Hg) originating from gold amalgamation and soil reworking, respectively. To investigate the storage and transfer of Hg between compartments on a restored gold mining site, as well as the suitability of indicators in assessing sources and transfers, Hg concentrations and speciation were measured in various compartments (soil, sediment, vegetation, atmosphere) on and around a legal mining site with past illegal mining activities. Additionally, Hg stable isotope compositions were measured in soil, sediment and vegetation. Using a binary mixing model, the Hg stable isotope compositions highlighted an important dissemination of anthropogenic Hg in mining pond sediment and soil in illegal mining areas (3 – 82 %), as well as its incorporation in the surrounding vegetation (roots and leaves). Anthropogenic Hg contamination was restricted to illegal mining areas, with no visible impacts on legally mined soils (using gravimetric methods without Hg amalgamation). Atmospheric Hg concentrations directly measured during the sampling campaigns by active sampling were slightly above levels observed in remote areas, and did not reflect past illegal mining activities. Three months integrative measurements using passive samplers showed a seasonal trend, with increasing concentrations during the dry season. High concentrations of dissolved gaseous mercury (DGM) found in some mining ponds, support stagnant water as a source of elemental Hg to the atmosphere through volatilisation. These results show that while anthropogenic Hg contamination is localised, it can be fixed by the vegetation or be concentrated in mining ponds. Anthropogenic Hg thus remains a potential source to the environment either through soil erosion/remobilisation to the surrounding hydrosystems, or through direct emission to the atmosphere from the mining ponds or from the soils.

ABSTRACT ID: PP 91

Title	Presence of mercury in archaeological sites: The Tartessian sanctuary of La Bienvenida, adjacent to the Roman town of Sisapo (Ciudad Real province, Spain).
Lead Author	Mar Zarzalejos
Co-Authors	O.A. Ávalos, G. Esteban, P. Hevia, L. Mansilla, P. Higuera

ABSTRACT

The old Sisapo Roman city, located near the La Bienvenida site (Almodóvar del Campo, Ciudad Real, Spain), and mentioned by Pliny the Elder, was considered as the main supplier of cinnabar (HgS) to Rome. Adjacent to the ruins of this town it has been located a Tartessian sanctuary dating back to the 6th century BC. The site is located some 30 Km to the SE of the World's prime producer of mercury (Hg), Almadén.

Archaeological pieces from this site have been analysed for Hg, using Zeeman effect atomic absorption spectrometry, following pyrolysis of the samples. Together with the pieces, their earthy cover was also analysed.

The results demonstrate that Hg is present in the detrital materials constituting the earthy cover, reaching concentrations of up to 350 mg kg⁻¹. These concentrations constitutes a clear indication of the widespread distribution of the element in the environment of the area, as it corresponds to the adhesion of local soil to the pieces, due to the collapse and burial of the buildings.

In conclusion, we can deduce that, during the corresponding historical period, Hg extracted from the Almadén mine was processed in this locality.

ABSTRACT ID: PP 96

Title	Mercury dynamics in shallow, pristine lakes of the Patagonian Andes (Argentina): climate influence on terrestrial inputs and internal processes
Lead Author	Zaida Fernandez
Co-Authors	Carolina Soto Cárdenas, Marina Arcagni, Mariana Reissig, Andrea Rizzo, María C. Diéguez

ABSTRACT

Natural hotspots of mercury (Hg) in pristine regions are suitable systems for assessing climate and environmental controls of Hg cycling. This study addressed Hg dynamics in a cold-temperate, oligotrophic lake draining a forested catchment of Andean Patagonia impacted by volcanic eruptions and devoid of anthropogenic disturbances. Hg concentration, partitioning, and availability were studied in the water column of Lake Pire during a hydrological cycle, and assessed also in sediment porewater. Water samples were collected along the lake depth profile and were analyzed for total (THg), filtered (FHg), particulate Hg (PHg), and physicochemical variables, including quantitative and qualitative analyses of dissolved organic matter (DOM). Porewater samples were extracted from sediment cores and analyzed for THg and DOM characterization. THg was measured by CV-AFS and DOM was characterized through absorbance and fluorescence spectroscopy. Hg concentration was related to DOM quality, indicating terrestrial inputs during wet and snowmelt periods, and diffusion from the sediments during dry periods. The co-transport of Hg, DOM, and particulate matter from the catchment was restricted to periods of high hydrological connectivity, when relatively homogeneous Hg concentrations were recorded in the lake profile (wet: up to 82.42 ng/L; snowmelt: up to: 73.4 ng/L). Hg availability (THg:DOC ratio) ranged from 1.1 to 178.57 ng/mg, displaying greater values and spatial variability during the dry period (49.15 ± 52.26 ng/mg). High PHg concentrations coincided with chlorophyll *a* peaks, suggesting accumulation in phytoplankton and incorporation in the pelagic food web.

Compared to the water column, THg and DOC concentrations were much higher in porewater ranging from 18.2 – 4281 ng/L and from 125.7 - 275.1 mg/L, respectively, and showed an increasing/decreasing pattern with sediment depth.

Terrestrial Hg inputs and sediment contributions were effectively tracked through quality proxies of lake water/sediment DOM pools.

ABSTRACT ID: PP 100

Title	Performance Evaluation of a Novel Screening Tool for Mercury in Skin-Lightening Creams to Overcome Analytical Burden
Lead Author	Sora Yasumatsu
Co-Authors	Kitichai Suwan, Tan Mei Shin, Hazumu Kinoshita, Alvin Chua, Tomoaki Watanabe

ABSTRACT

Mercury is a highly toxic element with a historical record of diverse usage. Lately, in the cosmetics sector, there have been reported cases of mercury added into products such as skin-lightening creams and lotions for its effect, raising public health concerns. Under the Minamata Convention on Mercury, mercury in cosmetics was regulated with a threshold of 1 ppm; however, this threshold was removed at COP5, clarifying that no allowable mercury level in cosmetics will be set from 2025 onward. Furthermore, COP6 highlighted the continued presence of mercury-added cosmetics in international trade and emphasized the need to strengthen enforcement and market surveillance.

Mercury concentrations in cosmetics span a broad range, from sub-ppb levels in products without intentionally added mercury to percentage levels in products suspected to contain intentionally added mercury. This wide dynamic range presents an analytical challenge for measuring instruments, which must be capable of quantifying it effectively. The challenge is particularly acute for high mercury levels, as these often require extensive dilution prior to measurement to avoid contamination. As a result, sample preparation for screening purposes is a significant burden and a key barrier to rapid market surveillance. Therefore, the key objective of this study is to develop and evaluate the performance of an easy-to-use device with reliable detection technology (atomic absorption spectrometry) that enables rapid decision-making for primary screening of skin-lightening creams by personnel at all levels in laboratories, customs inspections, and other related fields. The screening device consists of a portable gaseous mercury meter (NIC EMP-3) as the detector, coupled with a heated sample chamber. Using 1 mg/kg threshold as a guideline, it will determine the presence of mercury in skin-lightening products during screening.

ABSTRACT ID: PP 102

Title	Immune Toxicity of Methylmercury Following Oral Exposure at Environmentally Relevant Levels Involves Myeloid HIF-1 α Regulation
Lead Author	Guangbo Qu
Co-Authors	Ziniu Wang, Linlin Yao, Guibin Jiang

ABSTRACT

Methylmercury (MeHg) is a ubiquitous environmental pollutant whose neurotoxicity has been well documented, yet its immunotoxic effects remain insufficiently understood. Here, we combined in vitro cell line experiments with in vivo mouse studies to characterize immune perturbations induced by MeHg at environmentally relevant exposure levels and to examine the role of myeloid HIF-1 α using a myeloid-specific knockout (Lyz2cre Hif1af/f) mouse model. Significant changes in both lymphoid and myeloid cell populations were observed in the spleen, liver, and bone marrow following oral exposure to MeHg. Specifically, splenic B cells and bone marrow neutrophils were markedly reduced, whereas hepatic dendritic cell populations were significantly increased. In contrast, myeloid HIF-1 α deficiency substantially altered these immunotoxic responses, leading to increased splenic B cells, preservation of bone marrow neutrophils, and a broader expansion of multiple hepatic myeloid cell subsets beyond dendritic cells. In addition, under conditions of this deficiency, MeHg exposure was also associated with pronounced disturbances in bone marrow hematopoiesis. These results indicate that environmentally relevant MeHg exposure induces systemic immune alterations associated with myeloid HIF-1 α -dependent regulation, thereby broadening current understanding of the health impacts of environmental MeHg exposure.

ABSTRACT ID: PP 108

Title	Distribution of Total and Organic Mercury Concentrations in Soils from an Artisanal and Small-Scale Gold Mining Area and Mercury Elution from Contaminated Soils
Lead Author	Takashi Tomiyasu
Co-Authors	

ABSTRACT

Takashi Tomiyasu¹, Reiji Koga¹, Yuta Nakamori¹, Shusei Takeda¹, Hitoshi Kodamatani¹, Ryo Kanzaki¹, Kohji Marumoto², Kusnarta IGM3, Suwardji³, Fahrudin³, Zuhdiyah Matienatul Lemaaniah³

1: Graduate School of Science and Engineering, Kagoshima University, Japan

2: National Institute for Minamata Disease, Japan

3: Faculty of Agriculture, University of Mataram, Indonesia

Soil samples were collected from three sites in the artisanal and small-scale gold mining (ASGM) village. At each site, samples were taken at 2 cm intervals from the surface to a 10 cm depth at three points around an abandoned workplace. The samples were air-dried for several days before analysis. Total mercury (T-Hg) was measured using cold vapor atomic absorption spectrometry (CVAAS) after digestion with nitric, perchloric, and sulfuric acids. Organic mercury (org-Hg) was extracted from the soil with hydrochloric acid/toluene/L-cysteine and measured by CVAAS after mixed acid digestion, as performed for T-Hg.

For the leaching experiments, 5 g of each soil sample was mixed with 12.5 g of pure water in a centrifuge tube, shaken by hand, and allowed to stand for 30 minutes. After measuring pH, the samples were centrifuged and the supernatant filtered through a 0.45 µm membrane. The mercury concentration in the water phase was determined as described for soil T-Hg.

The average T-Hg concentrations for the three sites were 4.3 mg kg⁻¹, 0.11 mg kg⁻¹, and 23.6 mg kg⁻¹, while org-Hg concentrations were 5.5 µg kg⁻¹, 0.8 µg kg⁻¹, and 5.0 µg kg⁻¹, respectively. No clear relationship was found between T-Hg and org-Hg levels. T-Hg concentrations in the leachates ranged from <0.28 µg L⁻¹ to 35 µg L⁻¹, and higher soil T-Hg corresponded to higher leachate T-Hg. It was observed that 0.1–0.2% of soil Hg readily leached into water. Discarded mining waste in ASGM areas may pose a risk of groundwater pollution; detailed investigations of mercury distribution and leaching behavior are needed.

ABSTRACT ID: PP 111

Title	High-Frequency Observations of Dissolved Gaseous Mercury (DGM) in Korean Coastal Waters: Environmental Controls and Lagged Photochemical Responses
Lead Author	Huu-Viet Nguyen
Co-Authors	Seunghye Han

ABSTRACT

High-frequency observations of dissolved gaseous mercury (DGM) along the eastern coast of Korea in June 2025 revealed distinct environmental controls during daytime and nighttime periods. DGM concentrations were measured at 5-min intervals together with meteorological and hydrographic variables, including solar radiation, water temperature, air temperature, salinity, fluorescence, humidity, and wind speed. Statistical analyses showed that different environmental factors influenced DGM under daytime and nighttime conditions. Partial least squares regression identified salinity and solar radiation as the most important predictors of daytime DGM variability, whereas fluorescence, salinity, and humidity were more strongly associated with nighttime conditions. Multiple linear regression further indicated that daytime DGM variability was moderately explained by salinity and solar radiation ($R^2 = 0.20$), while nighttime variability exhibited stronger relationships with fluorescence, salinity, and humidity ($R^2 = 0.57$). Lagged correlation analysis revealed a delayed response of DGM to solar radiation, with the negative correlation strengthening from $r = -0.24$ to -0.37 at a lag time of approximately 80 min. This delay suggests that photochemical processes influencing DGM production operate on hourly timescales in coastal waters. Overall, these results indicate that short-term DGM variability in coastal marine systems is jointly controlled by photochemical processes, hydrographic mixing, and biological activity.

ABSTRACT ID: PP 123

Title	Air mercury monitoring in the Baikal Lake region, Siberia
Lead Author	Dr. Nikolay Mashyanov
Co-Authors	Sergey Sholupov, Sergey Pogarev, Vladimir Obolkin, Tamara Khodzher, Evgeniy Lutskin, Vladimir Ryzhov

ABSTRACT

Air mercury monitoring at the Baikal Lake region included long-term (2011-2026) observation within the GMOS and GOS4M networks at the Listvyanka background station, cruises over Lake Baikal, automobile surveys, and snow sampling. Air mercury measurements were conducted using a fully automated RA-915AM mercury monitor and portable RA-915M analyzer, both based on differential atomic absorption spectroscopy with Zeeman background correction.

The data obtained indicate a clear seasonal variation in the background mercury concentration in air. The concentration increases during the cold seasons (November-February) with an average GEM of 1.74 ng/m³, and decreases during the warm seasons (June-September) with an average of 1.44 ng/m³. Short-term anomalies up to 5-20 ng/m³ are associated with winds directions from industrial areas where coal combustion plants, chemical and metallurgic production are located. The areas of mercury emissions were revealed by HYSPLIT trajectories and concentration-weighted trajectory (CWT) modeling. The location of the Hg emission sources was confirmed by continuous automobile surveys and snow cover sampling. In the most polluted sites, the Hg content in snow was 100-2000 ng/L, compared to a background value of 5 ng/L.

The mean mercury concentration measured over Lake Baikal during the cruises was significantly lower than the mean value obtained at the onshore Listvyanka GMOS station during the same periods. This suggests that Lake Baikal may act as a sink for atmospheric mercury, potentially due to air temperature inversions during the warm season. Elevated air mercury concentrations, reaching 2.0–2.5 ng/m³, were observed during cruises in the southern part of the lake. This is associated with local industrial sources, a conclusion supported by a positive correlation between Hg concentrations and the acid gases SO₂ and NO_x.

The study of Limnological Institute SB RAS was supported by project FWSR-2026-0017.

ABSTRACT ID: PP 128

Title	Concentration, distribution, and speciation of mercury in hydrothermally altered ground from the Lakki Plain (Nisyros Island, Greece)
Lead Author	Federica Meloni
Co-Authors	Cabassi, Jacopo 2 , Vougioukalakis, Georgios 3 , Vaselli, Orlado 1,2

ABSTRACT

Nisyros Island (Dodecanese, Greece), located in the South Aegean Active Volcanic Arc, hosts a vigorous and hydrothermal system that produced several phreatic vents in the 19th century. This study investigates the concentration, vertical distribution, and speciation of mercury (Hg) within the Nisyros caldera (Lakki plain), comparing hydrothermally altered areas with non-altered background sites. A total of 40 soil profiles were analyzed, with samples collected at systematic intervals ranging from the surface (2 cm) down to a maximum depth of 1 m. Mercury determinations, performed via Lumex-pyro 915+, revealed significant Hg enrichments across the study area. In the hydrothermal zone, Hg concentrations ranged from 0.25 mg/kg, notably higher than the average upper continental crust value (0.056 mg/kg), up to 4.3 mg/kg. A consistent trend was observed since an increase in the Hg content with depth was evidenced, suggesting a primary geogenic input derived by hydrothermal fluids rather than atmospheric deposition. To further understand the geochemical trapping mechanisms, X-ray diffraction (XRD) and Hg speciation (where the concentrations were found > 3 mg/kg) were also carried out. XRD results indicated the presence of various hydrothermal clay minerals (e.g., nontronite, saponite), sulfates (e.g., alunite, jarosite, natrojarosite), zeolites, native sulfur, quartz, tridymite, and cristobalite. Speciation characteristics suggested that Hg is mainly trapped within the clay minerals and/or zeolites. Despite the sulfur-rich environment in the

hydrothermal zone, cinnabar and metacinnabar were found only scarcely recognized as well as HgCl₂. This suggests that the adsorption onto secondary clay minerals, formed during hydrothermal alteration, is likely the most dominant process for Hg retention in the Lakki Plain.

ABSTRACT ID: PP 134

Title	Mercury in fur of some pinniped's species from different regions of Russia
Lead Author	Yuri G. Udodenko
Co-Authors	Maria A. Solovyeva, Viatcheslav V. Rozhnov

ABSTRACT

The fur of these mammals can be informative for assessing the accumulation of toxic compounds, including mercury, in their bodies.

Mercury content in the fur of 4 seal species from different regions of Russia was studied: 1) Caspian seal (Caspian Sea); 2) Baikal seal (Lake Baikal); 2) spotted seal (southern coast of Kamchatka); 4) insular seal (Bering Island and Medny Island).

The average mercury content in Caspian seal fur was 2.895 ± 1.961 $\mu\text{g/g}$ ($n = 111$), with a minimum concentration of 258 $\mu\text{g/g}$ and a maximum of 10.285 $\mu\text{g/g}$. Mercury concentrations in fur showed a weak significant correlation with body length and weight ($rS = 0.41$ and 0.48 , $p < 0.05$).

The average mercury content in Baikal seal fur was 2.645 ± 1.937 $\mu\text{g/g}$ ($n = 81$) and ranged from 0.314 to 11.760 $\mu\text{g/g}$. Mercury concentrations in Baikal seal fur were positively correlated with the animals' length and weight ($rS = 0.79$ and 0.81 , $p < 0.05$).

Mercury content in spotted seal fur ranged from 2.111 to 8.254 $\mu\text{g/g}$ ($n = 19$). The mercury content in the fur of mature animals (5.246 ± 1.447 $\mu\text{g/g}$) was significantly higher ($p = 0.022$) than that of immature animals (3.440 ± 1.295 $\mu\text{g/g}$).

The average mercury content in fur of the insular seal from Bering Island was 5.749 ± 1.885 $\mu\text{g/g}$, while that of the Medny Island insular seal was 9.375 ± 4.950 $\mu\text{g/g}$ ($n = 13$ and 24 , respectively). The observed differences were significant ($p = 0.025$).

No sex differences in fur mercury content were observed for studied pinniped species.

The work was funded by The Lake Baikal Foundation for Environmental Applications and Research, by North Caspian Operating Company and Kazakhstan Agency of Applied Ecology and the Interdepartmental Integrated Program for Scientific Research of the Kamchatka Peninsula and Adjacent Waters in 2024-2026 under the State Assignment of IEE RAS (FFER-2024-0032).

ABSTRACT ID: PP 140

Title	Methylmercury formation in Hg ²⁺ -spiked paddy soils: Relationships with soil composition, temperature, and microbial communities
Lead Author	Miku Bono
Co-Authors	K. Nishimura 1, H. Kodamatani 1, M. Yamamoto 2, Y. Takaki 2, R. Kanzaki 1, T. Tomiyasu 1

ABSTRACT

In recent years, it has become evident that rice is one of the major sources of human exposure to methylmercury (MeHg), and therefore the mechanisms of MeHg formation in paddy soils have attracted considerable attention. In particular, it is important to understand the impact of new Hg contamination by ASGM activity. The aim of this project is to clarify the relationship between soil composition and MeHg formation. 11 types of paddy soil were used. For each soil type, 20 g of soil was mixed with an Hg²⁺ solution to achieve a soil Hg concentration of 10 mg/kg. Twenty replicates of each soil sample were prepared in 50 mL brown centrifuge tubes. These tubes were incubated under static conditions in an incubator. At set intervals, two tubes were collected, freeze-dried, and prepared for analysis. MeHg concentrations peaked 7–14 days after waterlogging at 35 °C, then decreased. However, the maximum percentages of MeHg relative to total Hg varied by soil type, ranging from 0.33% to 2.3%. When the soil temperature was lowered to 25°C and 15°C, MeHg production decreased accordingly. Furthermore, since the production of MeHg in soils has been reported to be due to anaerobic bacteria such as sulfate-reducing bacteria, we conducted leaching experiments to investigate changes in sulfate ion and dissolved organic carbon (DOC) concentrations. Sulfate ion concentrations showed a marked decrease during the period of MeHg formation, while DOC concentrations increased. However, no correlation was found between these changes and the MeHg concentration in each soil sample. In addition, at the level of major microbial phyla, no relationship was observed between the composition of microbial communities and the MeHg production.

ABSTRACT ID: PP 143

Title	Bedrock-Controlled Mercury Partitioning and Export in Glacier Meltwater River to Arctic Fjords
Lead Author	Hakwon Jeong
Co-Authors	Seunghye Han

ABSTRACT

Although glacial melting is accelerating due to climate change, the physicochemical mechanisms governing mercury (Hg) transport from glacial meltwater systems to Arctic coastal fjords remain poorly constrained. Here, we investigated Hg dynamics in meltwater-fed streams and rivers, including the Bayelva River, and adjacent Kongsfjorden (Spitsbergen, Svalbard) during August 2025. A total of 19 samples of unfiltered and 0.45 μm -filtered water, together with sediments and glacial ice, were analyzed for total Hg (THg), dissolved and particulate Hg, suspended particulate matter, and dissolved organic matter (DOM). In the Bayelva River, THg in proglacial stream water from Vestre Brøggerbreen was ~ 20 pM and increased to ~ 60 pM in a tributary fed by Austre Brøggerbreen, likely reflecting differences in bedrock composition and associated weathering processes, including Fe-rich redbed sandstones in the Austre catchment versus more carbonate-dominated lithologies in Vestre. At the confluence, THg remained ~ 20 pM with 70–90% in the particulate phase, whereas downstream concentrations decreased to ~ 10 pM with $\sim 20\%$ particulate Hg at salinity ~ 20 . This trend indicates substantial Hg removal in the low-salinity mixing zone, likely driven by salinity-induced coagulation and settling of Fe–Hg–DOM colloids. In contrast, glacier-fed streams along the northern and eastern margins of Kongsfjorden exhibited lower THg concentrations (3–6 pM) and higher dissolved fractions (50–80%), consistent with limited Hg transport in catchments dominated by low-Fe lithologies (e.g., limestone and marble). These results demonstrate that bedrock composition exerts a primary control on Hg export pathways from land-terminating glaciers to Arctic fjords. Ongoing laboratory experiments are further evaluating salinity effects on Fe–Hg–DOM colloids formation, combined with particle-scale characterization using field-flow fractionation, scanning electron microscopy with energy-dispersive X-ray spectroscopy, and extended X-ray absorption fine structure spectroscopy.

ABSTRACT ID: PP 144

Title	Mercury in Antarctic vegetation as an indicator of uptake routes and bioavailable forms
Lead Author	Dominika Saniewska
Co-Authors	Aleksandra Cichecka 1, Patrycja Płonska 1, Iga Nehring 1, Piotr Paneth 2, Michał Saniewski 3

ABSTRACT

Mercury accumulation in Antarctic terrestrial ecosystems remains insufficiently resolved, particularly with respect to differences among vegetation types and the relative importance of atmospheric, soil-derived, and biogenic inputs. We investigated total mercury (THg), methylmercury (MeHg), thermally defined Hg fractions, and $\delta^{13}\text{C}/\delta^{15}\text{N}$ signatures in 65 samples of lichens, mosses, vascular plants, and *Prasiola crispa* algal mats collected from coastal ice-free areas of King George Island during the austral summer 2018/19.

Distinct Hg accumulation patterns were observed among taxa. Lichens showed the highest Hg burden (median THg 116.6 ng g⁻¹ dw) and the highest MeHg contribution (17% of THg), together with a dominant HgF2 fraction (92%), indicating strong internalization of Hg and long-term integration of atmospheric inputs. Mosses accumulated substantially less Hg (median THg 31.8 ng g⁻¹ dw; MeHg 8% of THg) and were characterized by predominantly atmospheric exposure with only limited soil-water influence. Vascular plants contained the lowest Hg concentrations (median THg 22.8 ng g⁻¹ dw; MeHg 2% of THg), while significantly higher THg at sites with intense animal activity suggested an important role of ornithogenic soils in Hg supply. *Prasiola crispa* mats exhibited intermediate THg concentrations (median 39.7 ng g⁻¹ dw) and relatively low MeHg contribution (6%), but strong $\delta^{15}\text{N}$ enrichment, consistent with guano-derived nutrient inputs and hydrological transport of predominantly inorganic Hg.

These results demonstrate that Antarctic vegetation records distinct Hg uptake pathways linked to organism ecology and habitat. This highlights lichens, vascular plants, and algal mats as complementary indicators of atmospheric and biogenic Hg inputs in polar coastal environments.

ABSTRACT ID: PP 145

Title	Mercury contamination in polar fish: Bioaccumulation and trophic transfer in <i>Notothenia coriiceps</i> from Admiralty Bay, maritime Antarctic
Lead Author	Dominika Saniewska
Co-Authors	Kacper Jurczyk 1, Mariusz Sapota 1, Piotr Paneth 2, Michal Saniewski 3

ABSTRACT

Understanding mercury transfer in Antarctic coastal food webs remains limited, particularly for fish species that link benthic prey with top predators. We investigated total mercury (THg), methylmercury (MeHg), selenium (Se), and stable isotopes of carbon and nitrogen ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) in muscle tissue of *Notothenia coriiceps* collected from Admiralty Bay, King George Island, maritime Antarctic.

THg concentrations ranged from 100.2 to 670.3 ng g⁻¹ dw, while MeHg accounted for 57–95% of THg, with a mean contribution of 79%. Both THg and MeHg were positively related to $\delta^{15}\text{N}$, confirming trophic biomagnification within the coastal Antarctic food web. The trophic magnification slopes were 0.22 for THg and 0.18 for MeHg, corresponding to an approximately 1.6–1.8-fold increase in mercury concentration per trophic level. Despite the relatively narrow size range of the studied fish, substantial inter-individual variability was observed. Notably, the smallest individuals showed disproportionately high THg and MeHg concentrations, suggesting that feeding niche and habitat use may be more important than body size alone in explaining Hg burdens. $\delta^{13}\text{C}$ values further indicated variability in the relative contribution of benthic versus more pelagic-derived food sources. All fish exhibited Se:Hg molar ratios above 1, indicating a potential protective role of selenium despite elevated Hg exposure.

These findings identify *N. coriiceps* as an important vector of mercury to higher trophic levels in Antarctic coastal ecosystems and demonstrate that integrating Hg speciation with ecological tracers provides a powerful framework for resolving contaminant transfer in polar marine food webs.

ABSTRACT ID: PP 149

Title	Study of mercury–selenium interactions including nanoparticles in Brazilian Amazonian freshwater fish
Lead Author	María Jiménez-Moreno
Co-Authors	Marta Hernández-Postigo ¹ , Amanda Lopes-Araújo ² , Gabriela P. Arrifano ² , Marcus Augusto-Oliveira ² , Leticia Santos-Sacramento ² , Isabela Soares-Silva ² , Caio Gustavo Leal-Nazaré ² , María Elena Crespo-López ² , Rosa Carmen Rodríguez Martín-Doimeadios ¹

ABSTRACT

Understanding the interplay between mercury (Hg) and selenium (Se) is crucial for assessing toxicological vulnerability, as their interactions can modulate methylmercury (MeHg) toxicity. Recently, mercury selenide nanoparticles (HgSeNPs) have gained attention as end-products of MeHg detoxification, yet their formation and accumulation may also pose additional risks, especially in fish, where their biomineralization and physiological effects are not yet well understood. Despite the high Hg exposure in the Brazilian Amazon, the presence of HgSeNPs in its freshwater fish remains largely unexplored.

This study investigates Hg–Se interactions in about 100 freshwater fish samples from up to 10 species (piscivorous and non piscivorous), analyzing muscle and liver from specimens collected in two contrasting Amazonian environments: Belém (non exposed) and Tucuruí (exposed via the hydropower reservoir). A comprehensive analytical approach was applied, including total Hg, total Se, MeHg, Se:Hg molar ratios, Selenium Health Benefit Value (HBVSe), and HgSeNP occurrence.

Total Hg and MeHg proportions varied widely across trophic groups, with piscivores from Tucuruí showing the highest concentrations. Se:Hg molar ratios were markedly lower in Tucuruí samples, often <5, indicating limited protective buffering capacity, while non piscivorous fish from Belém displayed higher ratios. HBVSe values reinforced this spatial gradient, with lower benefit values in Tucuruí individuals.

HgSeNPs were detected for the first time in several Amazonian freshwater fish, with particle number concentrations ranging between 10^6 and 10^8 NPs kg^{-1} , depending on species, tissue, and region. Piscivores exhibited the highest NP levels in both Belém and Tucuruí. Equivalent diameters spanned approximately 110–330 nm across tissues. Notably, NP abundance was not directly related to bulk Hg or Se, suggesting species specific biomineralization pathways.

These findings highlight the need to expand Hg–Se research beyond classical speciation studies, integrating HgSeNPs to better understand detoxification capacity and exposure risk in Amazonian communities that rely heavily on freshwater fish.

ABSTRACT ID: PP 150

Title	Measurements of Ambient PM _{2.5} -Bound Mercury in Windsor, Canada
Lead Author	Xiaohong Xu
Co-Authors	Tianchu Zhang, Yushan Su

ABSTRACT

Measurements of Ambient PM_{2.5}-Bound Mercury in Windsor, Canada

Xiaohong Xu¹, Tianchu Zhang^{1,2}, Yushan Su²

¹ Department of Civil and Environmental Engineering, University of Windsor, Windsor, ON N9B 3P4, Canada, zhang14g@uwindsor.ca, xxu@uwindsor.ca

² Ontario Ministry of the Environment, Conservation and Parks, Toronto, ON M9P 3V6, Canada, Yushan.Su@ontario.ca,

Abstract (193 words)

Windsor (Ontario, Canada) is an industrial city along the Canada-USA border. The city experiences combined effects from local anthropogenic sources and trans-boundary pollution. This study investigated the temporal variability and source impact of ambient PM_{2.5}-bound mercury (Hg) in Windsor. Hourly ambient PM_{2.5}-bound Hg concentrations and hourly wind speed and directions were measured at Windsor West station during April-October 2021. Air emission inventories of point sources for Hg were compiled in both the US and Canada. The hourly Hg concentrations ranged from 0 to 10 ng/m³, with a mean and median values of 0.6 ng/m³ and 0.45 ng/m³, respectively. The daily Hg concentrations ranged from 0.3 to 1.3 ng/m³. Seasonal Hg concentrations were higher in fall (September to October), followed by summer (June to August), and lower in spring (April to May). The diurnal cycle was characterized by a peak in the morning (7:00–10:00), primarily due to diurnal evolution of the atmospheric boundary layer and local anthropogenic activities. The pollutant rose did not exhibit a strong association between Hg concentrations and wind directions, although higher Hg emissions were registered in the south of the monitoring site, suggesting a lack of dominant local sources.

ABSTRACT ID: PP 154

Title	A Two-Step Reversible Model for Hg(II) Photoreduction: The Synergistic Roles of Thiolic DOM and Bicarbonate in Seawater
Lead Author	Seunghye Han
Co-Authors	Sangwoo Eom, Huu-Viet Nguyen, Asif Qureshi

ABSTRACT

While atmospheric Hg is primarily derived from evasion of Hg(0) produced through the photoreduction of Hg(II) in seawater, the mechanisms of Hg(II) photoreduction in seawater, particularly the coupled effects of dissolved inorganic carbon and dissolved organic matter (DOM), remain unresolved. Here, we report the pseudo-first-order rate constants (k_r) for the gross photoreduction of Hg(II) in the presence of thiols in DI water (DIW), phosphate buffer solution (PBS), artificial seawater (ASW), and natural seawater under UV-A irradiation. For aliphatic thiols, k_r was below the detection limit in DIW and PBS but increased to 0.081–0.50 h⁻¹ in ASW, exhibiting a concentration-dependent trend. In contrast, aromatic thiols yielded k_r up to 1.5 h⁻¹ in DIW, PBS, and ASW, with no evident concentration dependence. In the absence of thiols, aromatic DOM decreased k_r possibly by reoxidizing Hg(I) through the production of intermediate oxidants. Notably, k_r for Hg–glutathione in PBS containing NaHCO₃ was comparable to that in natural seawater, whereas other sea salts produced k_r below detection limits, suggesting the critical role of dissolved inorganic carbon to enhance k_r in the seawater. Based on the obtained rate constants, a two-step reversible Hg(II) reduction model, involving oxidation and reduction of Hg(I) intermediate, is proposed to account for the dynamic redox equilibrium of Hg. The results of study underscore the importance of aliphatic thiolic DOM, non-thiolic aromatic DOM, chloride, and bicarbonate in modulating k_r variability in natural seawater.

ABSTRACT ID: PP 161

Title	Assessment of Heavy metal Concentration in the Pra River at the Shama District, Western Region, Ghana.
Lead Author	Winnifred Aku Adotey
Co-Authors	Prof. Benedicta Y. Fosu-Mensah, Prof. Daniel Nukpezah

ABSTRACT

The Pra River supports potable water supply, irrigation, and fisheries, but its gold-rich geology has attracted extensive artisanal and small-scale gold mining. Consequently, the use of mercury in gold amalgamation accounts for the release of metallic mercury (Hg) into aquatic environment. This results in bioaccumulation and biomagnification in aquatic food webs, and increases human exposure through fish consumption, posing serious health risks such as neurological and cardiovascular disorders. This study aims to assess the causes, current state, impacts of mercury on the Pra River, and recommend effective action plans for its management. Water and sediment samples ($n = 108$ each) were collected from six sampling points along the river over six months. Samples were analysed for Hg, alongside copper (Cu), iron (Fe), cadmium (Cd), lead (Pb), chromium (Cr), zinc (Zn), and arsenic (As). Three Hundred and ninety-nine (399) residents were also surveyed to ascertain the responses needed for the management of the river. In sediments Hg ($0.262 \pm 0.013 \text{ mg/kg}$), was above the World Health Organisation (WHO) guideline limit. In water, Cu, Fe, Cd, Pb, and Cr also exceeded the WHO guideline limit. CCME Water Quality Index (WQI) indicated freshwater quality as mostly poor to marginal. Also, Ecological Risk Index confirmed strong ecological risks, primarily from Hg. Again, Pollution Load Index (PLI) and Pollution Indices (PI) indicated moderate sediment pollution from Hg and Nemerow Pollution Index (NPI), Igeo categorized Cu, Fe, and Cd as very strongly polluted. Nevertheless, due to the toxicity, persistence, and bioaccumulative nature of mercury, it still remains a major public health concern. The study suggests implementing an integrated action plan for Pra River management, including promotion of mercury-free gold extraction technologies and continuous monitoring of Hg to inform effective remediation measures. Safeguarding community well-being, and contributing to meeting the Minamata Convention on Mercury objectives.

ABSTRACT ID: PP 165

Title	Synergistic Sulfur-Functionalized Phosphorylated Chitosan Nanocomposite for Enhanced Electrochemical Detection and Adsorptive Removal of Mercury(II) Ions from Aqueous Environments
Lead Author	Michael J. Klink
Co-Authors	Mvula Goci, Puleng Molete, Anny Leudjo Taka, Lynwill G Martin, Vernon Somerset

ABSTRACT

Mercury(II) contamination in water resources remains a critical global concern due to its extreme toxicity, persistence, and capacity for bioaccumulation, necessitating the development of versatile platforms capable of both sensitive detection and efficient remediation. This study presents a dual-functional approach utilizing sulfur-functionalized phosphorylated chitosan-based nanomaterials for electrochemical sensing and adsorptive removal of Hg^{2+} ions from aqueous environments.

For detection, a glassy carbon electrode modified with sulfurised phosphorylated chitosan ($\text{S}_{0.25}\text{pChit}/\text{GCE}$) was developed. The sensor leverages the strong affinity between sulfur moieties and mercury through stable Hg-S bond formation, while phosphate groups provide additional binding sites. Electrochemical characterization using cyclic voltammetry and electrochemical impedance spectroscopy confirmed enhanced electron transfer kinetics, with the modified electrode exhibiting low charge transfer resistance (49.57Ω) and high peak current (0.132 mA). Under optimized conditions, the sensor demonstrated excellent analytical performance with a linear range of $0.1\text{--}100 \mu\text{M/L}$ and a limit of detection of $0.006985 \mu\text{M/L}$ (6.985 nM) well below WHO and US EPA permissible limits for drinking water. The sensor exhibited good reproducibility ($\text{RSD} < 3\%$), excellent stability retaining $\sim 95\%$ activity after 21 days, and high selectivity against common interfering ions, with successful application in tap water samples achieving $98.0\text{--}99.7\%$ recovery. For remediation, a multifunctional phosphorylated chitosan-based nanocomposite doped with sulfur nanoparticles ($\text{pCh-AgTiO}_2@\text{MWCNTs/S}$) was synthesized and comprehensively characterized using FTIR, SEM/EDS, TGA, and zeta potential analysis. The nanocomposite exhibited a smooth, flake-like morphology with dark greenish spherical features, and EDS confirmed the presence of key elements including Si, S, P, and Ag, with Ti and C showing the most intense peaks. TGA revealed major organic decomposition between $210\text{--}630^\circ\text{C}$, while FTIR verified essential functional groups ($-\text{OH}$, $-\text{COOH}$, $-\text{C=O}$). Zeta potential analysis established the point of zero charge at pH 5.4. The adsorption process followed pseudo-second-order kinetics and Langmuir isotherm models, indicating monolayer adsorption on a homogeneous surface.

ABSTRACT ID: PP 177

Title	Sources and cycling of mercury in the Baltic Sea following the entry into force of the Minamata Convention
Lead Author	Magdalena Beldowska
Co-Authors	Dominka Saniewska, Anna Dziubińska, Karolina Gębka, Agnieszka Jędruch, Urszula Kwasigroch, Leszek Łęczyński, Angela Popławska, Mariusz Sapota, Bartłomiej Wilman, Agnieszka Zarzeczańska

ABSTRACT

Following the implementation of guidelines in the 21st century—including those related to the adoption of the Minamata Convention—mercury concentrations in the natural environment of the Baltic Sea region have decreased. We are currently observing the significant role of “new” sources of mercury (Hg), such as: corroding ammunition and shipwrecks on the Baltic seabed; the transport of contaminated suspended matter from the deep caused by inflows from the North Sea; cliff erosion; human interference in river channel regulation; and floods. This last factor is linked to climate change. In addition, it contributes to warmer temperatures during season: late fall -winter - early spring, thereby extending the growing season. As a result, the period during which mercury is introduced into the food web is longer than during a cold winter. In addition, the development of underwater meadows contributes to the remobilization of mercury historically deposited in sediments. The colonization of shipwrecks by benthic organisms also increases the rate at which mercury enters the food chain. Changes in the species composition of dominant groups, whether in the benthos or in the plankton, also significantly affect the amount of mercury that is released into the environment. The study was funded by a research project National Science Centre 2022/45/B/ST10/00368.

ABSTRACT ID: PP 187

Title	The Antarctic Shag (<i>Leucocarbo bransfieldensis</i>) as a bioindicator of mercury and methylmercury contamination in the King George Island (South Shetland Islands, Antarctica)
Lead Author	Maja Kuznik
Co-Authors	Katarzyna Fudala 1, Robert Bialik 1, Dominika Saniewska 2

ABSTRACT

Despite its geographic isolation, the Antarctic marine ecosystem is increasingly threatened by the long-range atmospheric transport of mercury (Hg). As a top predator, the Antarctic shag (*Leucocarbo bransfieldensis*) is a critical bioindicator of this contamination. However, the specific pathways of methylmercury (MeHg) accumulation and the physiological response of these predators to toxic burdens remain insufficiently documented.

This study examined the pathways of mercury accumulation and excretion in Antarctic shags. By analyzing various biological matrices, we sought to quantify the bioaccumulation potential of MeHg and identify the primary detoxification routes used by these birds in their natural habitat.

Research was conducted across four distinct breeding colonies on King George Island. To minimize invasive procedures, samples were collected during bird banding and consisted of regurgitated food, feces, and feathers. Comprehensive laboratory analyses were performed to determine total mercury (THg) concentrations, its chemical fractions, and the specific MeHg content.

Results demonstrate a clear gradient of mercury distribution across the studied matrices. While Hg levels in food reflected local bioavailability within the food web, significantly higher concentrations were found in guano and feathers. Notably, the highest accumulation was recorded in feathers, confirming that molting serves as the most efficient physiological mechanism for mercury elimination.

These results provide essential baseline data for monitoring the impact of climate change on pollutant cycling in polar regions and offer new insights into how top predators manage heavy metal toxicity in this rare environment.

ABSTRACT ID: PP 191

Title	The Minamata Convention on Mercury in Slovenia: An Evaluation of Policy Implementation and Effectiveness in Relation to the Phase-Out of Dental Amalgam
Lead Author	Vanja Usenik
Co-Authors	Adna Alilović Osolin, Dr. Janja Snoj Tratnik, Dr. Marta Jagodic Hudobivnik, Dr. Darja Mazej, Asst. Prof. Dr. David Kocman, Dr. Davor Kontić, Prof. Dr. Milena Horvat

ABSTRACT

The implementation of the Minamata Convention on Mercury relies on robust evidence to assess whether regulatory measures reduce human exposure and environmental releases. In this context, integrating administrative indicators with human biomonitoring (HBM) data provides a valuable framework for evaluating performance under the effectiveness evaluation mandated by Article 22 of the Convention.

Focusing on Slovenia as a case study, this contribution addresses the phase-down of dental amalgam, one of the key mercury-containing products regulated under the Convention and EU legislation. The analysis combines policy-relevant data from the dental sector with long-term HBM evidence to explore how regulatory measures translate into measurable exposure outcomes.

The administrative component is based on a cross-sectional survey of 171 dental professionals, assessing compliance with EU Regulation 2017/852 and its 2024 amendment, as well as alignment with Minamata Convention provisions. The results indicate substantial regional and sectoral variability in amalgam use, with higher compliance observed in paediatric settings and more heterogeneous practices in adult care. Key factors influencing the transition include clinical considerations, patient preferences, reimbursement structures, and the availability of alternative materials. These findings highlight the importance of targeted education, financial incentives, and supportive regulatory frameworks to ensure an effective transition to mercury-free dentistry.

The environmental component draws on data from four national HBM campaigns (2007–2024), covering 1.412 Slovenian children. Urinary mercury (U-Hg) concentrations showed a marked decline over time, coinciding with a reduction in amalgam prevalence. Statistical modelling indicates that decreased amalgam use is a major driver of this trend, while other exposure pathways, particularly fish consumption, become more important as dental sources diminish. Persistently higher levels in historically contaminated areas underline the continued relevance of legacy pollution.

Together, these findings demonstrate how combined administrative and biomonitoring approaches can support the evaluation of mercury policies and provide evidence relevant to the effectiveness evaluation of the Minamata Convention.

ABSTRACT ID: PP 202

Title	Mercury variability in soils of in Arctic valleys in Svalbard
Lead Author	Wiktoria Zawrzykraj
Co-Authors	Juliana Souza-Kasprzyk, Przemysław Niedzielski

ABSTRACT

Arctic regions are experiencing accelerated warming, leading to intensified permafrost, glacier melt and changes in the circulation of surface and groundwater. These processes influence the mobilization and distribution of mercury, whose biogeochemical cycle is closely linked to soil properties and water-ice interactions. However, spatial variability of Hg in Arctic terrestrial valley systems remains poorly constrained.

This study aimed to quantify total Hg content in soils of Ebba (n=10), Elsa (n=9) and Ferdinand (n=6) valleys, in the Petunia Bay region (Svalbard) and to assess the spatial variability in relation to environmental conditions.

These areas are characterized by diverse geomorphological and hydrological conditions, which influence the development of the soil cover and the course of geochemical processes. Soil samples were collected from the surface soil (0–20 cm). were analyzed using a direct Hg analyzer (MA-3 Solo, Nippon Instruments Corporation).

Mercury concentrations varied markedly among valleys, with median values of 6.80 ppb in Ebba, 23.8 ppb in Elsa and 27.9 ppb in Ferdinand. Substantial within-valley variability was observed, indicating heterogeneous local controls. Furthermore, in the Ebba and Elsa valleys, a decrease in Hg concentration was observed with depth, whereas in the Ferdinand valley the trend was the opposite - mercury content increased in the deeper layers of the soil profile.

The observed differences may result from local geochemical conditions, such as organic matter content, redox conditions and moisture, which control Hg mobility. The Ebba Valley is dominated by permeable sandur deposits, the Elsa Valley by finer-grained and wetter deposits conducive to the accumulation of organic matter, whilst the Ferdinand Valley is characterized by the presence of varied glacial deposits with limited permeability, which may favour the retention of mercury in deeper layers. Under ongoing climate change, increased permafrost thaw and water fluxes may intensify Hg mobilization, potentially redistribution this element within valley systems.

ABSTRACT ID: PP 234

Title	Preliminary Results from Monterey Bay Mercury Species Intercalibration
Lead Author	Carl Lamborg
Co-Authors	Amina Schartup, Marissa Despins, Johannes West, Jeannette Calvin, Lars-Eric Heimbürger-Boavida, Emily Seelen, Stephen Kohler, Emma Scott, Kristine Prelich, Peter Weiss-Penzias, Allison Laubach, Alina Kleindienst

ABSTRACT

The community of marine mercury researchers has been doing a good job agreeing on total dissolved mercury in seawater during the GEOTRACES era, but agreement in methylated Hg species has been less good. In an effort to continue to improve, we collected samples of seawater from Monterey Bay in June of 2025 from various depths and shared these samples with various labs worldwide. This comparison is continuing and we will present up-to-date results and insights. During on-site analyses, we found good dimethylmercury analysis agreement, using a few different approaches, when proper calibration with dimethylmercury standards was used.



ABSTRACT ID: PP 252

Title	A Validated Method for Accurate Isotopic Analysis of Total Mercury, Methylmercury and Inorganic Mercury in Environmental Samples.
Lead Author	Elizabeth Crowther
Co-Authors	Dalton Reynolds, Ben Wozniak, Hakan Gurleyuk

ABSTRACT

Accurate total Hg or compound specific mercury (Hg) isotope analysis is essential for tracing biogeochemical processes, identifying contamination sources, and differentiating between methylmercury (MeHg) and inorganic mercury (iHg) cycling in environmental systems. We developed and validated a method for online total Hg and compound specific Hg isotope analysis using the Brooks Rand MERX-T and MERX-III-M automated analyzers coupled to a MC ICP MS. We assessed accuracy, precision, and method robustness across aqueous standards (including NIST 3133, NIST 8610 Almaden, and MeHgCl) and digested sediment and biota reference materials (MESS 4, TORT 3). Using an in house Python data processing workflow, we obtained $\delta^{202}\text{Hg}$ reproducibility of $\sim 0.13\text{--}0.18\text{‰}$ (2SD) and $\Delta^{199}\text{Hg}$ reproducibility of $\sim 0.05\text{--}0.09\text{‰}$ across materials. The method displayed low sensitivity to concentration mismatches between samples and bracketing standards and maintained consistent precision across a range of %MeHg compositions. We also demonstrated that accurate isotope ratios can be achieved with as little as 300 pg of total Hg without any offline separation or preconcentration. The results from various reference materials and client samples, as well as significant analytical characteristics of the method, will be discussed.

ABSTRACT ID: PP 259

Title	Geochemical redistribution of mercury in freshly added and aged mining soil systems
Lead Author	Sandra Carrasco-Gil
Co-Authors	Cristina Ortega-Villasante ² , María-José Sierra-Herraz ¹ , Carolina Escobar ³ , Elena Díaz ⁴ , Rocío Millán ¹ , Luis E. Hernández ²

ABSTRACT

Mercury soil contamination is a persistent environmental issue, particularly in regions affected by historical mining. The Almadén mining district (Spain), one of the largest Hg deposits exploited worldwide, has resulted in extremely elevated Hg concentrations in surrounding soils. Nevertheless, environmental processes can affect Hg redistribution and bioavailability.

Biochar is increasingly investigated as a soil amendment for Hg immobilization because of its porous structure, reactive surface functional groups, and mineral components that may enhance metal sorption. However, its performance can vary depending on the geochemical form of Hg present in the system.

This work evaluates the effect of biochar on Hg fractionation in two substrates representing different contamination scenarios: (i) an inert substrate containing freshly added Hg and (ii) a historically contaminated mining soil. A pot experiment was conducted using sand-perlite (50% v/v) as an inert substrate spiked with soluble Hg²⁺ and a Hg-contaminated soil from the Almadén mixed with perlite (50% v/v). Biochar produced from vineyard pruning residues was applied at 0%, 1%, and 2% (w/w). Hg-fractionation was determined by sequential extraction.

Biochar application markedly reduced the labile Hg fraction in the freshly spiked substrate and promoted its transfer to less mobile mineral-associated fractions. In contrast, Hg in the contaminated soil was largely present in refractory forms, and biochar caused only limited redistribution among stable pools without increasing Hg lability. These results indicate that the effect of biochar depends strongly on Hg geochemical history and suggest that biochar amendments are more effective at stabilizing recently introduced Hg than historically stabilized Hg in mining-impacted soils.

ABSTRACT ID: PP 1071

Title	Mercury concentrations in the muscles and liver of waterbirds from the Curonian Lagoon, Kaliningrad Region (Russia)
Lead Author	Petr M. Glazov
Co-Authors	Julia A.Loshchagina, Tatiana B.Kamshilova, Yuri G.Udodenko

ABSTRACT

Mercury concentrations were determined in the liver and muscles of six species of waterbirds (Black-throated Loon ($n = 6$), Red-throated Loon ($n = 18$), Great Crested Grebe ($n = 44$), Common Goldeneye ($n = 8$), and Goosander ($n = 17$)) incidentally caught as bycatch in fishing nets in the Curonian Lagoon, Kaliningrad Region, Russia.

In muscle tissue, the lowest mercury concentrations were recorded in Common Goldeneye and Great Crested Grebe: 0.402 ± 0.286 and 0.470 ± 0.296 $\mu\text{g/g}$, respectively. The highest concentrations were found in the muscles of Goosander (1.605 ± 0.668 $\mu\text{g/g}$). The observed interspecific differences were statistically significant ($H(4, n = 92) = 44.8, p < 0.001$).

In the liver, the lowest mercury concentrations were also observed in Common Goldeneye and Great Crested Grebe: 1.101 ± 0.584 and 1.485 ± 0.968 $\mu\text{g/g}$, respectively. The highest mean concentration was recorded in Goosander (10.534 ± 5.177 $\mu\text{g/g}$). Mercury concentrations in the livers of both loon species were intermediate, amounting to 2.977 ± 2.240 $\mu\text{g/g}$ in Red-throated Loon and 3.449 ± 3.432 $\mu\text{g/g}$ in Black-throated Loon. The observed interspecific differences were statistically significant ($H(4, n = 92) = 47.4, p < 0.001$).

For all species, mercury concentrations in liver and muscle tissues were positively correlated ($r^2 = 0.58-0.90$; $p < 0.05$). The widest range of mercury concentrations in both muscle and liver tissues was observed in Black-throated Loon.

The relatively low mercury concentrations in the muscles and liver of Common Goldeneye and Great Crested Grebe are likely related to their diet, which consists mainly of aquatic invertebrates, in which methylmercury typically does not exceed 60–70% of total mercury. In contrast, Goosanders feed primarily on fish and therefore exhibit the highest mercury concentrations in their organs and tissues.

The work was supported by the Russian Science Foundation (RSF) project 25-47-00074.

ABSTRACT ID: PP 1072

Title	Mercury concentrations in the organs of waterfowl from Central Yakutia (Russia).
Lead Author	Yuri G. Udodenko
Co-Authors	Julia A. Loshchagina, Evgeniy V. Shemyakin, Tatiana B. Kamshilova, Petr M. Glazov

ABSTRACT

Based on hunter harvests in Central Yakutia (Russia), tissue samples of waterfowl were collected. Mercury concentrations were determined in the muscles, liver, and kidneys of eight species of Anseriformes from central regions of Yakutia: Greater White-fronted Goose (n = 7), Bean Goose (n = 30), Mallard (n = 22), Eurasian Wigeon (n = 7), Eurasian Teal (n = 63), Garganey (n = 10), Northern Pintail (n = 18), and Northern Shoveler (n = 11).

The lowest mercury concentrations in muscle tissue were recorded in Greater White-fronted Goose and Bean Goose (0.009 ± 0.006 µg/g and 0.058 ± 0.100 µg/g, respectively). Among ducks, mean mercury concentrations in muscle tissue increased in the following order: Eurasian Wigeon > Mallard > Garganey > Northern Pintail > Eurasian Teal, ranging from 0.133 ± 0.182 µg/g to 0.315 ± 0.320 µg/g. The highest concentrations were found in the muscles of Northern Shoveler (1.119 ± 0.685 µg/g).

In all species, mercury concentrations in the kidneys and liver were 2–4 times higher than those in muscles. The lowest mean concentrations in liver and kidney tissues were recorded in Greater White-fronted Goose (0.046 ± 0.026 µg/g and 0.051 ± 0.048 µg/g, respectively). The highest concentrations were found in the liver and kidneys of Northern Shoveler (3.507 ± 1.598 µg/g and 2.926 ± 2.220 µg/g, respectively).

Mercury concentrations in muscles, liver, and kidneys were strongly correlated across all species, with Spearman correlation coefficients ranging from 0.70 to 0.91.

The observed interspecific differences in mercury concentrations among Anseriformes are likely related to dietary preferences. Geese primarily consume plant food, which contains minimal mercury concentrations. The diet of Northern Shoveler apparently consists mainly of various groups of invertebrates, in which mercury concentrations are generally higher than in plants.

The study was funded by the Russian Science Foundation (RSF) project 25-47-00074.

ABSTRACT ID: PP 1515

Title	A Novel Device Based on a Polymer Inclusion Membrane for the Monitoring of Hg in a Wastewater-Based Epidemiology. A Preliminary Study In Natural Waters
Lead Author	Marta Turull
Co-Authors	Sergi Diez, Clàudia Fontàs

ABSTRACT

We developed a polymer inclusion membrane (PIM) composed of cellulose triacetate as the base polymer and the task-specific ionic liquid trioctylmethylammonium thiosalicylate (TOMATS). This PIM was specifically designed for the analysis of mercury (Hg) and methylmercury (MeHg) in natural waters [1,2]. Preliminary laboratory experiments were promising, demonstrating the PIM's efficiency in both the uptake and determination of these mercury species. Furthermore, we integrated the PIM as a resin gel into a passive sampling system known as the Diffusive Gradient in Thin-Film (DGT) [3]. This DGT configuration, which also included an agarose diffusive gel, a polyethersulfone membrane filter as the protective top layer, and a plastic support for optimal thickness and functionality, allows for the assessment of the bioavailable fraction of Hg in environmental matrices. The final device was assembled in a plastic mold with a simple, tight-fitting piston mechanism and a 2-cm diameter exposure window. Time-series experiments using Hg²⁺ and MeHg⁺ solutions were carried out under controlled laboratory conditions with PIM membranes and the PIM-DGT system. We demonstrated, for the first time, the effectiveness of the PIM in the uptake of MeHg. Furthermore, initial experiments showed a clear linear relationship for Hg uptake, confirmed by a laboratory calibration curve obtained within 24 hours (Figure c). This finding suggests that Hg concentrations in natural waters can be accurately determined with only a short deployment time. A significant advantage of this membrane is its high stability, allowing for storage at room temperature for extended periods without degradation, making it very practical for field applications.

ABSTRACT ID: PP 1516

Title	Assessment of Bioaccumulation Potential of Selected Heavy Metals through Edible Macrophytes
Lead Author	Thokchom Grebilla
Co-Authors	Wazir Alam

ABSTRACT

The heavy metal (Fe, Mn, Zn, Cu) dynamics study was carried out across the water, sediment and edible macrophytes of Loktak Lake of Manipur, a Ramsar site and largest freshwater lake in North-east India. The studies assessed the ecological risk posed by the heavy metals and human health implications arising from the consumption of edible macrophytes. In the lake sediments, Fe had the highest concentration followed by Mn, Zn and Cu. This high concentration of Fe is due to influx of iron rich soils through surface runoff from the surrounding catchment and feeder rivers draining into the lake. All measured values were below the average shale values and the Interim Freshwater Sediment Quality Guidelines (ISQG) and the metal pollution in the sediments of the lake was low. Heavy metal concentration was found to be highest in plants followed by sediment and lowest in water. *Colocasia esculenta* and *Polygonum perfoliatum* were identified as the most efficient bioaccumulators because of their high BAF values amongst the 10 macrophytes that were studied, making them potential phytoremediators. Health risk assessment revealed that zinc levels are safe but the combined presence of other heavy metals in these plants poses potential health risks. *Polygonum perfoliatum* was noted for having the highest non-carcinogenic health risk on humans from the cumulative effect of the four heavy metals if consumed regularly in larger amounts.

Keywords: Loktak lake,

ABSTRACT ID: PP 1517

Title	Beyond Awareness: Trust, Behavioural Economics, and the Gold Buyer as a Catalyst for Mercury-Free Artisanal Mining in Mali
Lead Author	Albekaye Samake
Co-Authors	

ABSTRACT



ABSTRACT ID: PP 1518

Title	Decadal Variability of Mercury in the Sediments of Kongsfjorden, Svalbard, Arctic
Lead Author	Kannan VM
Co-Authors	Saritha VK, Mahesh Mohan

ABSTRACT

Kongsfjorden, Svalbard, is a dynamic Arctic fjord influenced by glacial discharge, Atlantic water inflow and long-range transport of contaminants. Mercury (Hg) is of particular concern because of its persistence, mobility and toxicity in Arctic environments. Although Hg contamination in Kongsfjorden has been reported previously, information on its temporal variability remains limited. In the present study, total mercury (THg) concentrations in surface sediments collected during the last ten years were compiled to examine temporal variability and spatial distribution within the fjord. Mean THg concentrations showed pronounced variability among sampling periods, ranging from 0.017 to 0.657 mg kg⁻¹. The highest mean concentration (0.657 mg kg⁻¹) was recorded during 2013–14, followed by substantially lower mean concentrations of 0.050, 0.038, 0.050, 0.051 and 0.047 mg kg⁻¹ during 2014–15, 2015–16, 2016–17, 2017–18 and 2018–19, respectively. The lowest mean concentration (0.017 mg kg⁻¹) was observed during 2020–21. The exceptionally high mean during 2013–14 was associated with a limited number of elevated observations, indicating considerable spatial heterogeneity in Hg accumulation within the fjord. The recent observations generally fall within the lower concentration range reported for Kongsfjorden sediments. Previous investigations of the fjord have also demonstrated spatial differences in metal accumulation between the inner and outer regions, reflecting variations in sediment characteristics and the influence of terrestrial and oceanic inputs. The observed multi-year variability highlights the importance of considering temporal fluctuations when assessing Hg contamination in Arctic fjord sediments. Continued and consistent monitoring of Hg concentrations, together with information on sediment characteristics and potential sources, is essential for distinguishing short-term variability from longer-term changes in Hg distribution under rapidly changing Arctic environmental conditions.

ABSTRACT ID: PP 1519

Title	Decoupled Mercury and Methylmercury Dynamics Along a River-to-Terminal-Lake Gradient in the Korgalzhyn Nature Reserve, Kazakhstan
Lead Author	Alisher Alibekov
Co-Authors	Seunghye Han , and Woojin Lee

ABSTRACT

We present preliminary total mercury (THg) and methylmercury (MeHg) data from surface water and sediment at stations spanning this gradient. Aqueous THg (17–32 pM) and MeHg (0.15–0.98 pM) were measured by CVAFS following EPA 1630/1631-consistent methods, alongside trace metals and sediment organic carbon. Aqueous THg, MeHg, and %MeHg all declined progressively from the Nura River inflow (THg 30 pM, MeHg 0.5–1.0 pM, 1.7–3.3%) through the wetlands and intermediate lakes to Tengiz Lake, reaching a minimum in Tengiz (Big) (THg 17.5 pM, MeHg 0.15 pM, 0.84%). This contrasts with sediment THg, which instead increased toward Tengiz, exceeding upstream stations. Manganese, arsenic, zinc, and copper were enriched in Tengiz and Kakai sediments, and sediment organic carbon was elevated at Tengiz and Sultan relative to Nura.

This aqueous-sediment decoupling raises the question of whether Tengiz Lake functions as a net sink for total mercury while suppressing net methylation or favoring demethylation/volatilization in the water column, despite organic-rich sediment that would typically favor methylation. It also raises the question of whether wetland and near-shore stations, rather than the terminal lake itself, are the primary sites of active methylation, given their comparatively higher %MeHg. Whether dilution in a large basin, photodemethylation, or reduced microbial activity drives the observed decline remains unresolved. Addressing these questions will require sediment MeHg quantification, seasonal resampling, and a compartmental mass-balance model of mercury cycling across the system.

ABSTRACT ID: PP 1520

Title	Functional and Structural Dynamics of merA: Molecular Profiling and in Silico Insights Into Hg ²⁺ Reduction and Bioremediation By the MR1_IITISM Strain
Lead Author	Indrani Das
Co-Authors	Manish Kumar Sharma, Rakesh De, Vipin Kumar

ABSTRACT

Mercury contamination poses a persistent environmental risk due to its capacity for transformation and redistribution, which enhances its bioavailability and long-term persistence. Microbial mercury resistance, driven by the mer operon, offers a promising route toward biological detoxification. Within this system, the MerA enzyme plays a central role in converting toxic Hg²⁺ to volatile elemental Hg⁰, a process that has been investigated through both in vivo and in silico approaches. Since the MerA–NADPH–FAD complex is critical for driving mercury volatilization, molecular interaction studies among MerA, NADPH, FAD, and Hg²⁺ were carried out to evaluate the efficiency of Hg²⁺-to-Hg⁰ transformation in mercury-resistant bacteria. In this study, a mercury-resistant bacterial strain, MR1_IITISM, was isolated from a mercury-contaminated site and characterized through phylogenetic analysis, merA gene identification, and evaluation of its mercury bioremediation and volatilization potential. SEM and FTIR analyses further revealed cellular and functional-group changes associated with mercury exposure, while in silico structural analysis of the MerA homodimer elucidated its molecular interactions with NADPH, FAD, and Hg²⁺. Molecular docking showed genus-specific interaction patterns for MerA-mediated Hg²⁺ transformation in MR1_IITISM, with binding energies of −7.15 kcal/mol for NADPH, −9.63 kcal/mol for FAD, and a binding score of 3.29 for Hg²⁺. These interactions correlated strongly with merA expression and Hg²⁺ volatilization, and two-way ANOVA confirmed significant differences among interaction energies ($P < 0.05$), indicating that MerA–cofactor and MerA–Hg²⁺ interactions underlie strain-specific mercury transformation efficiency. Together, these experimental and computational findings provide a mechanistic understanding of microbial mercury transformation and establish MR1_IITISM as a strong candidate for biological mercury detoxification, illustrating how integrating microbial characterization with structural analysis advances insight into mercury bioremediation.

ABSTRACT ID: PP 1521

Title	Human Health Risk Assessment of Mercury Exposure via Consumable Fish From East Kolkata Wetlands: Evidence from Kolkata Markets
Lead Author	Manish Kumar Sharma
Co-Authors	Indrani Das, Vipin Kumar

ABSTRACT

Kolkata sustains one of India's highest per-capita fish consumption rates, with a substantial share of its supply drawn from the Ramsar-designated East Kolkata Wetlands (EKW), a sewage-fed aquaculture system historically exposed to mercury-bearing effluent from mercury-cell chlor-alkali plants, coal-fired power stations, and urban/industrial runoff. This continuous effluent loading has created a persistent methylmercury exposure pathway through the aquatic food chain, raising concern for consumers reliant on EKW-derived fish. This study assesses mercury and methylmercury concentrations in consumable fish collected from Kolkata markets sourced from EKW bheris, evaluating human health risk through Estimated Daily Intake (EDI), Provisional Tolerable Weekly Intake (PTWI), Target Hazard Quotient (THQ), Hazard Index (HI), and cancer risk (CR). Approximately 200 fish samples were collected from markets near the EKW, including vendors close to Kalikapur, Chowbhaga, Bantala, and Gariahat. Reported carcinogenic risk associated with mercury in EKW fish ranges from 5.6×10^{-5} in an earlier wetland study to 1.4×10^{-4} in farmed rohu in a more recent EKW-specific study, both meeting and exceeding USEPA's upper acceptable cancer-risk threshold of 1×10^{-4} . Separately, a case-control study has linked elevated dietary mercury intake to increased colorectal cancer risk, though its effect estimate is not directly transferable to local exposure conditions. Applying USEPA exposure-duration scaling to parameters from the most recent EKW study, illustrative modelling indicates mercury-driven lifetime cancer risk exceeds acceptable limits once fish intake reaches approximately 100 g/day, or once 30 g/day intake is sustained for nearly 29 years. These findings underscore that mercury-related risk in EKW fish is species- and site-specific, highlighting a critical need for a dedicated, EKW-focused mercury carcinogenic risk assessment.

ABSTRACT ID: PP 1522

Title	Maternal Hair Mercury Levels and Associations with Neonatal Outcomes in the Brazilian Amazon
Lead Author	Marta Turull
Co-Authors	Mônica Cunha, Montse Marquès, Jean R. D. Guimarães, Rejane C. Marques, Sergi Díez

ABSTRACT

Early-life exposure to environmental contaminants represents a critical public health concern, particularly in highly vulnerable regions such as the Brazilian Amazon. Mercury (Hg), a potent neurotoxicant, is of special relevance due to its persistence, bioaccumulation, and widespread occurrence in Amazonian ecosystems. However, evidence on maternal Hg exposure and its potential implications for perinatal health in this region remains limited.

This study aimed to quantify total Hg concentrations in maternal hair from women living in urban and agricultural areas of the Brazilian Amazon and to evaluate associated health risks and perinatal outcomes. A cross-sectional study was conducted including 163 mothers residing in the state of Rondônia, Brazil. Total Hg levels were determined in maternal hair samples as a biomarker of chronic exposure during pregnancy. Exposure levels were assessed against international health-based guidance values for hair Hg. Associations between Hg concentrations, sociodemographic characteristics, residential setting (urban vs. agricultural), diet, and perinatal outcomes were examined using multivariable regression models.

Mothers residing in urban settings exhibited significantly higher hair Hg concentrations (0.59 µg/g, n=130) compared to those living in agricultural areas (0.37 µg/g, n=163). In addition, significant differences were observed according to fish consumption frequency, with median concentrations of 0.16 µg/g among women who never consumed fish (n=27), 0.48 µg/g among those consuming fish 1-3 times per week (n=105), and 0.65 µg/g among those consuming fish 4-7 times per week (n=31). The influence of fish trophic level on Hg exposure was also evaluated.

Furthermore, this presentation will explore potential associations between elevated maternal Hg levels and adverse perinatal outcomes, including prematurity and low birth weight. The results will identify the main predictors of mercury exposure among women in the Brazilian Amazon, providing evidence to strengthen environmental monitoring and support targeted public health strategies aimed at mitigating mercury exposure among women of reproductive age in vulnerable populations.

ABSTRACT ID: PP 1523

Title	Mercury in the Indian Coastal and Open-Ocean Water Column: Challenges and Future Directions
Lead Author	Sneha Hanchinamani
Co-Authors	Manisha UK, , Krushna vudamala

ABSTRACT

Mercury (Hg) studies in the Indian coastal and open-ocean water column are particularly important because the northern Indian Ocean contains one of the world's most intense oxygen minimum zones (OMZs), representing a major global continental-margin area affected by natural oxygen deficiency ($O_2 < 0.2 \text{ mL L}^{-1}$) (Naqvi et al., 2006). These suboxic thermocline waters provide favourable conditions for anaerobic microorganisms to convert inorganic mercury (Hg^{2+}) into the toxic and bioavailable methylmercury (MeHg), which biomagnifies through marine food webs and can poses risks to marine ecosystems and human health(Bowman et al., 2020).

Although India has made significant progress in mercury research, most studies have focused on sediments, biota, estuaries, and coastal pollution. In contrast, systematic investigations of total mercury (THg), methylmercury (MeHg), and mercury speciation in the Indian coastal and open-ocean water column remain scarce. This limits our understanding of mercury sources, vertical transport, microbial methylation, air-sea exchange, and the influence of expanding OMZs on mercury cycling in the northern Indian Ocean.

Addressing these knowledge gaps requires comprehensive investigations across the Indian coastal and Open Ocean, encompassing surface, thermocline, and deep waters. Future studies should integrate mercury speciation, methylmercury production, microbial processes, and oceanographic parameters to better understand mercury transformation, transport, and bioavailability under changing environmental conditions. Such efforts will improve regional and global mercury assessments, support the implementation of the Minamata Convention on Mercury, and provide a scientific basis for evaluating the impacts of climate-driven ocean deoxygenation on mercury cycling in the Indian Ocean. The 17th International Conference on Mercury as a Global Pollutant (ICMGP 2026) provides a timely platform to discuss these scientific challenges, identify key research priorities, and define the way forward for advancing mercury research in the Indian coastal and open-ocean water column.

ABSTRACT ID: PP 1524

Title	Mercury Pollution in River Ecosystems: Implications for Biodiversity Conservation
Lead Author	Mohd Kamaluddin Sheikh
Co-Authors	Wazir Alam

ABSTRACT

Mercury (Hg) is a globally recognized toxic pollutant that poses a persistent threat to aquatic ecosystems and biodiversity because of its toxicity, environmental persistence, long-range transport, and ability to bioaccumulate and biomagnify through food webs. River ecosystems are particularly vulnerable to mercury contamination because they receive mercury from atmospheric deposition, geological weathering, agricultural runoff, mining, industrial activities, and urban waste. Once introduced into aquatic systems, inorganic mercury can be transformed by microorganisms into methylmercury, a highly toxic and bioavailable form that readily accumulates in aquatic organisms and biomagnifies from plankton and invertebrates to fish, birds, mammals, and ultimately humans.

Mercury pollution can alter species abundance, community structure, reproductive success, growth, behaviour, and physiological functions, thereby reducing ecosystem resilience and biodiversity. Fish and other aquatic organisms are especially important indicators because their position within food webs makes them susceptible to elevated mercury concentrations. Changes in sediment characteristics, organic matter, pH, redox conditions, and microbial activity further influence mercury mobility, methylation, and bioavailability. Consequently, mercury contamination can extend beyond individual organisms to affect trophic interactions, ecological connectivity, and overall ecosystem functioning.

This poster highlights the major sources, pathways, environmental fate, and ecological consequences of mercury contamination in river ecosystems, with particular emphasis on bioaccumulation, biomagnification, and biodiversity loss. It also discusses the importance of monitoring mercury concentrations in water, sediments, and aquatic biota to identify ecological risks and vulnerable habitats. Effective biodiversity conservation requires an integrated approach combining pollution-source control, regular environmental monitoring, protection and restoration of riparian habitats, sustainable watershed management, and risk-based conservation strategies. Strengthening mercury management and ecosystem-based conservation can help safeguard aquatic biodiversity, maintain ecological integrity, and reduce long-term environmental and human health risks associated with mercury pollution.

ABSTRACT ID: PP 1525

Title	Methyl Mercury Toxicity and Nanomaterial-Based Remediation
Lead Author	G. Satheesh
Co-Authors	

ABSTRACT

To understand the molecular mechanisms of MeHg toxicity, we investigated how MeHg interacts with important molecular targets. One important human protein target identified in the literature is thioredoxin reductase (TrxR), a selenium-containing enzyme that plays an important role in maintaining cellular redox balance. It is highly sensitive to mercury because mercury strongly binds to selenium at its active site. MeHg can also bind to cysteine and form a methylmercury-cysteine complex, which can mimic methionine and use amino-acid transport pathways such as L-type amino acid transporter 1 (LAT1) to cross the blood-brain barrier. Using density functional theory (DFT) and molecular dynamics (MD) simulations, we studied how MeHg interacts with the human TrxR enzyme. Our MD simulations reveal that MeHg binding induces structural changes, affects the catalytic environment, and may interfere with electron-transfer processes at the catalytic site of TrxR. Loss of enzymatic function can contribute to the accumulation of reactive oxygen species (ROS), leading to severe oxidative stress and cellular damage and, under severe exposure conditions, potentially cell death. After investigating the molecular mechanisms underlying MeHg toxicity, we propose sustainable remediation strategies, including the use of functionalized carbon nanotubes (CNTs).

ABSTRACT ID: PP 1526

Title	Multivariate Analysis of Mercury : Geochemical Associations and Hydrothermal Signatures
Lead Author	G. Satheesh
Co-Authors	Asif Qureshi

ABSTRACT

Here, we present a dataset of mercury and other trace-element measurements from the provinces of Andhra Pradesh and Karnataka, India, collected over a period of 23 years under the National Geochemical Programme (NGCM) and provided by the Geological Survey of India (GSI). The dataset contains 65 elements including major and minor oxides, rare earth elements (REEs), and trace elements such as Hg, Au, Ag, As, Sb, Se, Te, and Tl. Mercury concentrations range from 0 to 570 ppb. Mercury was analysed using DMA, while the other geochemical elements were determined using multiple analytical techniques, including XRF, GF-AAS, AAS with FIAS, ISE, ICP-MS, and fire-assay based methods. Data preprocessing and statistical analyses, including log transformation, histogram analysis, correlation analysis, principal component analysis (PCA), and K-means clustering, were performed to investigate the relationships between mercury and its associated elements. Preliminary multivariate analysis indicates strong associations of Hg with Au, Ag, As, Sb, Se, Bi, Mo, and W, with Hg, Au, Ag, As, and Sb forming a prominent geochemical association in PCA. The observed multielement associations and spatial patterns will be further evaluated in a geological context by integrating GIS-based spatial mapping with lithology, structural features, known mineral occurrences, and hydrothermal processes to better understand the origin of Hg anomalies and their possible relationship with different hydrothermal mineral systems.

ABSTRACT ID: PP 1527

Title	Quantifying Carbonate Turnover and Mercury Source Variations Along the Walvis Ridge Hotspot Trail, South Atlantic Ocean
Lead Author	Siddhant
Co-Authors	Huu-Viet Nguyen, Seunghee Han

ABSTRACT

The pore-water Ca primarily records the net balance between carbonate dissolution and precipitation and may therefore underestimate substantial dissolution–reprecipitation turnover. Here, we performed Ca–Sr reactive-transport modeling of pore-water profiles from IODP Expedition 391 (U1575–U1578) along the Walvis Ridge hotspot trail to separate net carbonate reaction from gross dissolution and secondary calcite precipitation. Near-surface gross-dissolution rates span more than three orders of magnitude, from 2.61×10^{-4} to $6.51 \times 10^{-1} \text{ Myr}^{-1}$. U1575 represents the strongest and most localized turnover endmember, whereas U1577 shows extremely weak exchange and no resolved finite gross-dissolution attenuation scale. At U1575, U1576, and U1578, gross dissolution exceeds the near-surface net reaction by factors of 24–2000, demonstrating substantial carbonate turnover despite limited net carbonate loss. Residence-time projection shows that reaction persistence depends strongly on accumulation and decompaction history as well as sediment age. We address additional biogeochemical and sedimentological drivers, showing that local microbial sulfate reduction modifies pore-water alkalinity profiles at U1576, but does not govern the broader,

cross-site Ca–Sr reaction structure. Overall, this study demonstrates that Ca–Sr inversion provides a powerful framework for identifying active carbonate exchange that remains hidden when diagenesis is evaluated solely based on net dissolution signals. Currently, the mercury stable isotope analysis is going on with U1575 and U1576 cores to understand how Hg sources have been changed to respond to the carbonate exchange rate and geological events between Paleocene to Pleistocene.

ABSTRACT ID: PP 1528

Title	Scope of utilizing lichens as biomonitors of atmospheric mercury pollution in India
Lead Author	Farishta Yasmin
Co-Authors	Sanjeeva Nayaka, Debajyoti Paul

ABSTRACT

Mercury (Hg) is a globally important pollutant because of its persistence, long-range atmospheric transport, bioaccumulation and high toxicity to humans and ecosystems. In India, Hg pollution is of particular concern owing to the country's extensive dependence on coal dependent thermal power generation, together with emissions associated with non-ferrous metal production,

industrial activities, waste combustion and other anthropogenic sources. However, systematic monitoring of atmospheric Hg remains scarce, and Hg is presently not included among the pollutants

regulated under India's National Ambient Air Quality Standards. Hence, there is a need for cost- effective approaches capable of providing spatially extensive information on Hg deposition and

identifying potential pollution hotspots. Lichens are symbiotic organism and are popular as bioindicators of air pollution. The absence of true roots and cuticle, high surface area to volume ratio, slow growth and dependence on atmospheric inputs enable them to intercept and accumulate airborne elements and particulate-bound contaminants over time. Lichens accumulate pollutants and the elemental composition in their thalli can provide an integrated indication of atmospheric contamination over a period of exposure, complementing conventional instrumental monitoring. Therefore, lichens can be an ideal organism for biomonitoring Hg pollution and such studies are already being carried out internationally to identify Hg emission hotspots and spatial patterns of atmospheric deposition. In the Indian context,

however, research specifically addressing Hg through lichen biomonitoring is limited. In an earlier study at Kodaikanal demonstrated the utility of *Parmelia sulcata* and mosses for assessing Hg contamination associated with a thermometer-manufacturing facility. Otherwise, Indian lichen biomonitoring research has largely focused on other potentially toxic elements such as Pb, Cd, Cr, Ni, Zn, Cu, As, and Fe.

Pyxine cocoas (Sw.) Nyl. is particularly suitable as a model species for biomonitoring of Hg pollution. It is widespread, foliose, epiphytic lichen that can be readily located and sampled from tree

bark across urban, industrial, rural and relatively pristine environments. Its suitability for biomonitoring of atmospheric contaminants has already been demonstrated in different cities of India, where it accumulated multiple potentially toxic elements and responded physiologically to air pollution. A systematic review has further identified *P. cocoas* as a potential biomonitor, bioindicator and bioaccumulator, documenting its ability to accumulate a broad spectrum of elements, including Hg. Its relatively robust and pollution-tolerant nature, abundance, ease of transplantation, established biomonitoring protocols and demonstrated capacity to accumulate atmospheric metals make it an especially appropriate candidate for Hg focused studies. A systematic programme employing *P. cocoas* could therefore establish baseline Hg concentrations across Indian landscapes, compare urban, industrial, mining, thermal-power and background environments, identify Hg hotspots and investigate relationships between Hg accumulation and potential emission sources. Combining in situ sampling with standardized transplantation experiments, total Hg quantification and physiological indicators could further distinguish atmospheric exposure from site-specific background variation. Such an approach could provide a low-cost, scalable and spatially integrative biomonitoring tool to complement conventional atmospheric Hg measurements. Development of a *P. cocoas* based Hg biomonitoring protocol would consequently fill an important gap in Indian environmental monitoring and could contribute to improved assessment of Hg deposition, source identification and long-term environmental management.

ABSTRACT ID: PP 1529

Title	Temporal and Spatial Comparison of Sedimentary Mercury in Vembanad Lake System, Kerala, India
Lead Author	Arun Ramachandran
Co-Authors	Megha Rajan, Mahesh Mohan

ABSTRACT

Mercury is a persistent environmental toxicant of global concern, capable of accumulating in aquatic sediments and undergoing transformation to methylmercury, with implications for ecosystem health and human exposure. Vembanad Lake, a Ramsar site on the southwest coast of India, has previously been reported to exhibit elevated mercury levels in its northern, industrially influenced sector. The present study compares historical sediment data collected in February 2002 with recent surface-sediment samples obtained in 2023, in order to explore temporal patterns and spatial variability of sedimentary mercury within the lake system. The historical dataset comprised a sediment core from the Cochin estuary and associated surface sediments analysed for total mercury (THg) using a direct mercury analyser. THg concentrations in the core ranged from 0.23 to 113.96 ppb, with a maximum at 15–20 cm depth and consistently elevated values in the upper 0–75 cm, reflecting a legacy of sustained mercury inputs. Historical surface sediments from other parts of the lake showed very low THg, between 0.06 and 0.18 ppb. In contrast, twelve surface-sediment samples collected in 2023 exhibited markedly higher THg, ranging from 26.58 to 1009.04 ppb, with several sites (6–9) exceeding 500 ppb and a clear hotspot in the northern sector. Although differences in sampling locations, sediment characteristics and analytical details between the two periods warrant cautious temporal interpretation, the orders-of-magnitude increase in surface-sediment mercury at multiple sites indicates substantial enrichment and persistence of contamination in parts of Vembanad Lake. These findings highlight the need for systematic basin-wide mercury monitoring, source identification and comprehensive ecological and human-health risk assessment for this ecologically and socio-economically important backwater ecosystem.