COP Special event on Mercury Science

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UN environment programme

MINAMATA CONVENTION ON MERCURY

COP-3 | 2019

BRIDGING KNOWLEDGE ON GLOBAL MERCURY WITH ENVIRONMENTAL RESPONSIBILITY, HUMAN WELFARE AND POLICY RESPONSE

Jozef M. Pacyna
AGH University of Science and Technology, Krakow, Poland

Major research questions to be addressed

1. How is mercury cycling changing on the global, regional and local scales in response to perturbations caused by major anthropogenic drivers of the change, such as climate change, emissions control, remediation?

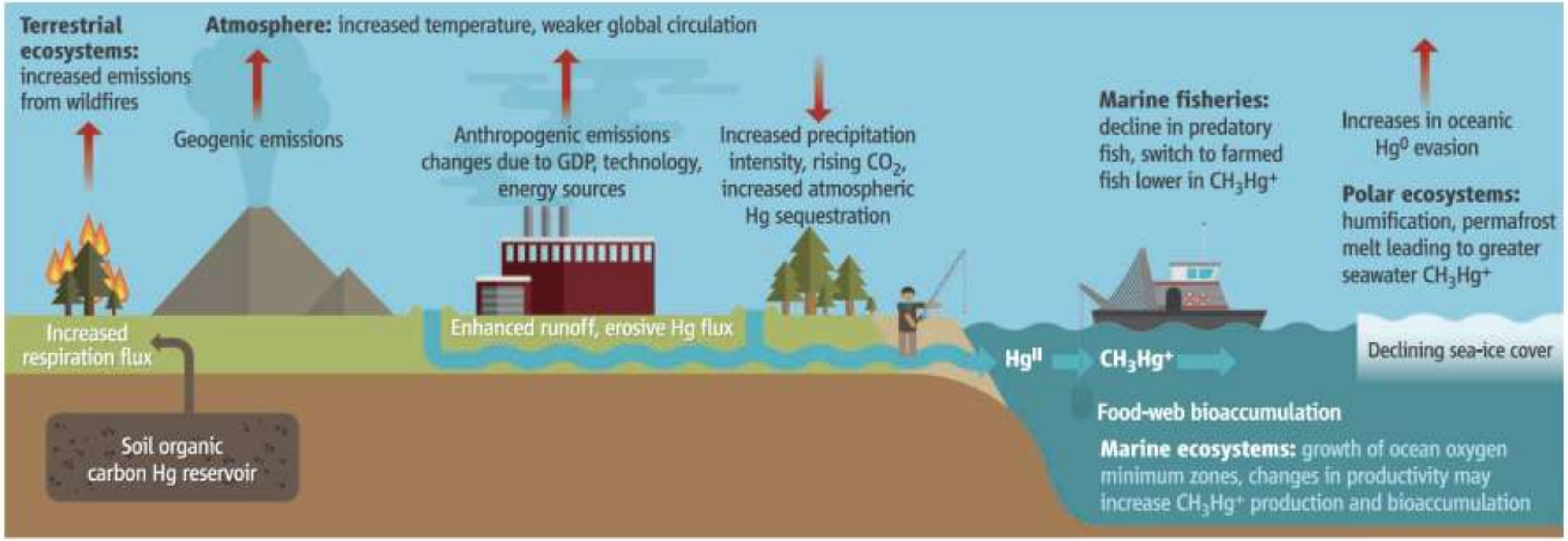
2. What is the relative risk of mercury exposure to human health and wildlife?

3. How can technological development contribute to the reduction of mercury exposure and improvement of environmental responsibility. How will industry achieve more control of Hg emissions, handle waste products, and clean up contaminated site ?

ENVIRONMENTAL SCIENCE

Global Change and Mercury

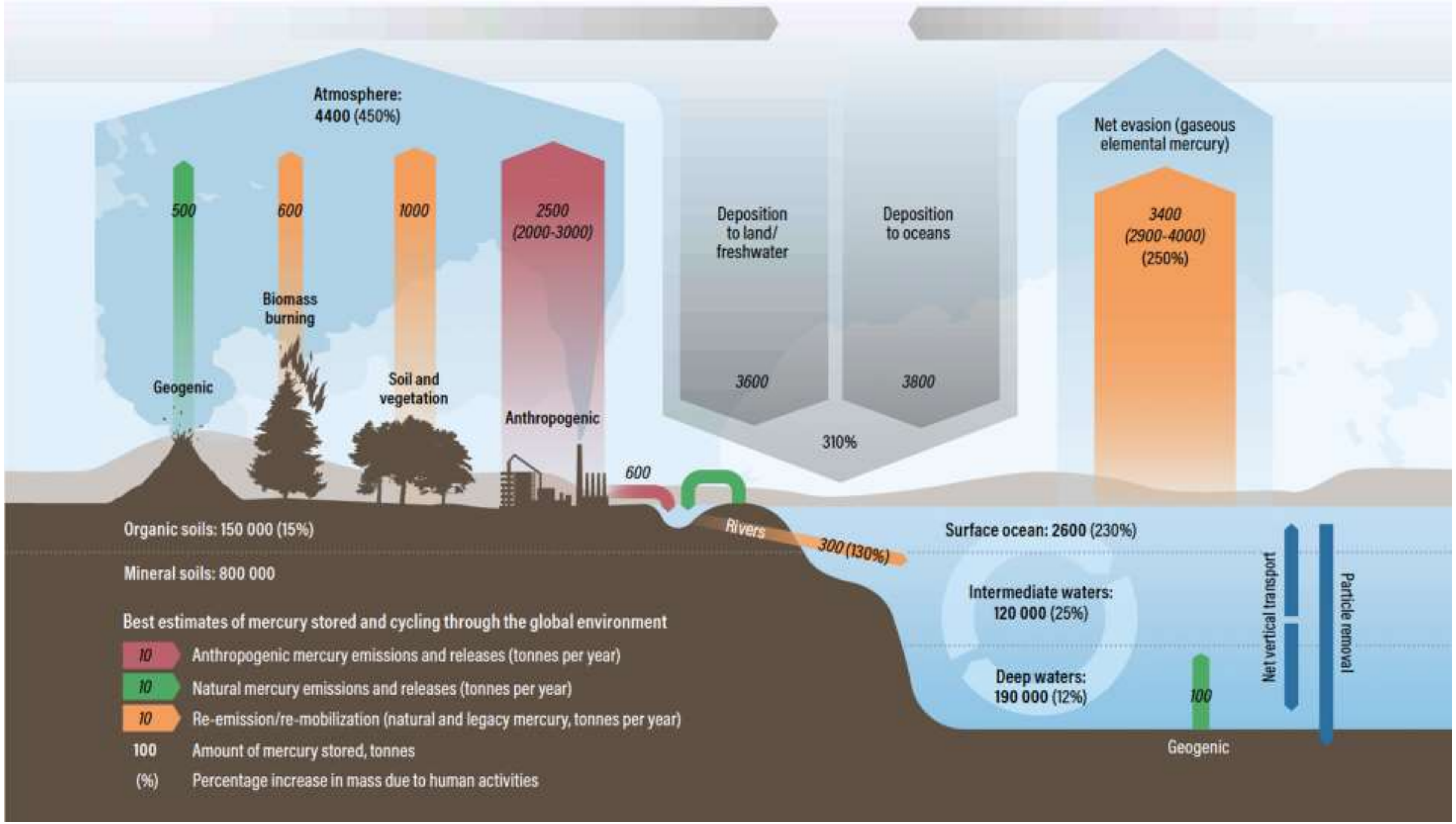
David P. Krabbenhoft[1] and Elsie M. Sunderland[2]



Krabbenhoft & Sunderland 2013 Science

How is mercury cycling changing on the global, regional and local scales in response to perturbations caused by major anthropogenic drivers of the environmental change.

How much Hg is in the ocean?



Ocean

2013: 0.36 ng L^{-1} = 1,8 pM => 358,000 t

2018: 0.31 ng L^{-1} = 1.6 pM => 313,000 t

UNEP Global Mercury Assessment 2018

Mercury emission reduction:
a challenge to industry

- Is the industry prepared to address this challenge?
- What emission controls are already in place in various sectors of industry? What are some of the key variables in process conditions which guide mercury abatement decisions? What more needs to be done?
- How will industry achieve changes in trade and supply, control emissions, handle waste products, and clean up contaminated sites?
- How can we use other environmental policies and strategies to maximize mercury control - can we coordinate action with other initiatives such as greenhouse gas reduction and the move towards greener and more renewable energy?

Discussed at the ICMGP 2019 by Prof. Jozef Pacyna

What to expect in the future?

1. **Decrease of Hg emissions from electric power plants, due to implementation of emission control equipment (FGD, CCS), clean combustion technologies (combustion efficiency up to 40%), different energy mix**
2. **Decrease of Hg emissions from industrial sources through the application of BATs and BEPs (example in non-ferrous metal industry in China)**
3. **Status quo in Hg emissions from small residential units and waste incineration**
4. **Decrease of Hg emissions from various users of mercury due to implementation of various bans on Hg use**
5. **Possible increase of re-emission of Hg from aquatic and terrestrial surfaces due to climate change impacts**

<u>In summary:</u>

Lowering of anthropogenic emissions, constant emissions from natural sources, and potential increase of re-emission

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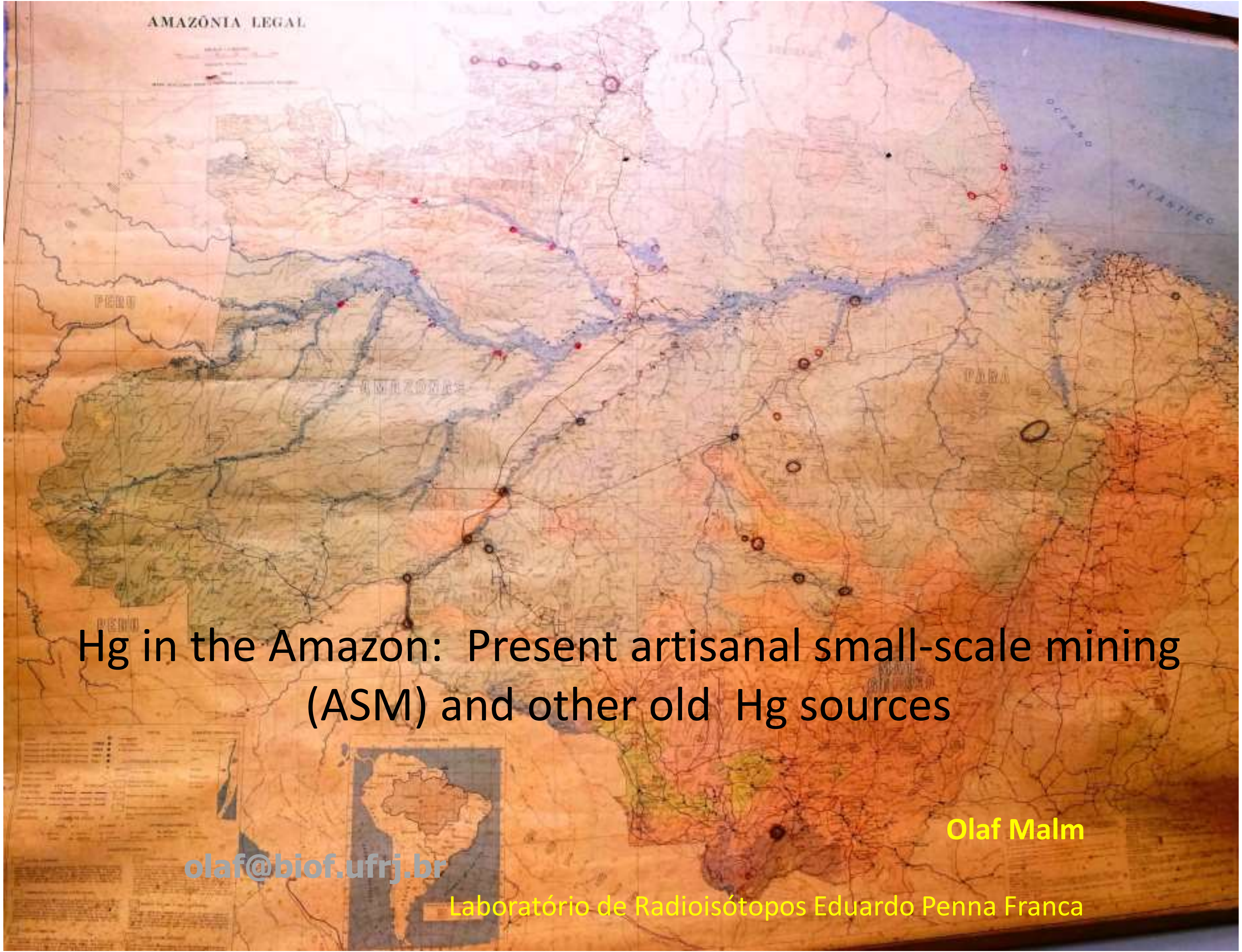
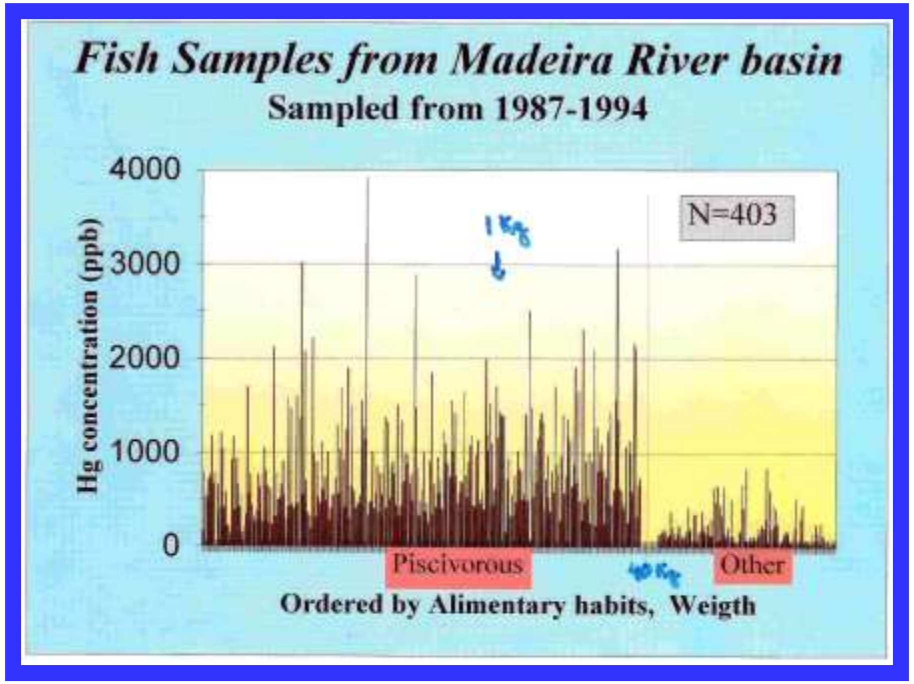


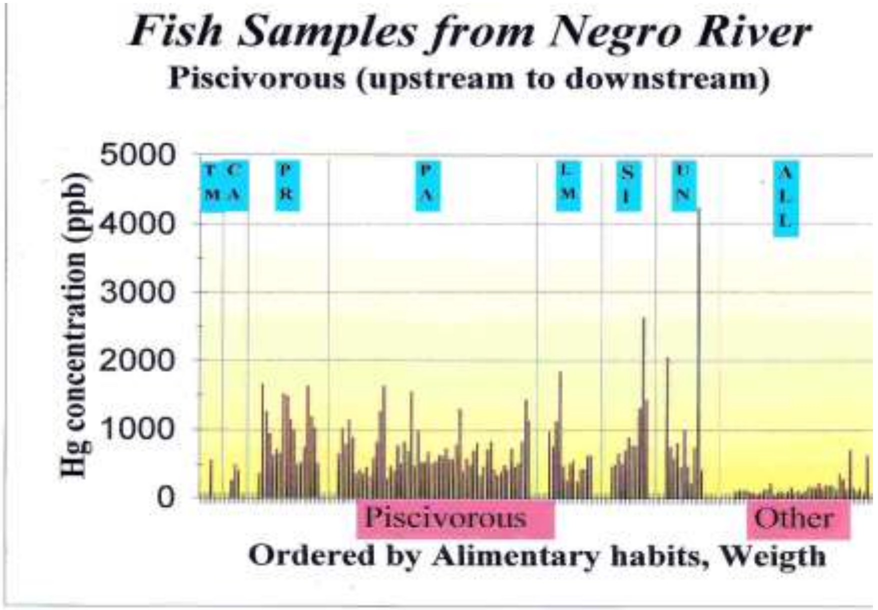
Hg in the Amazon: Present artisanal small-scale mining (ASM) and other old Hg sources

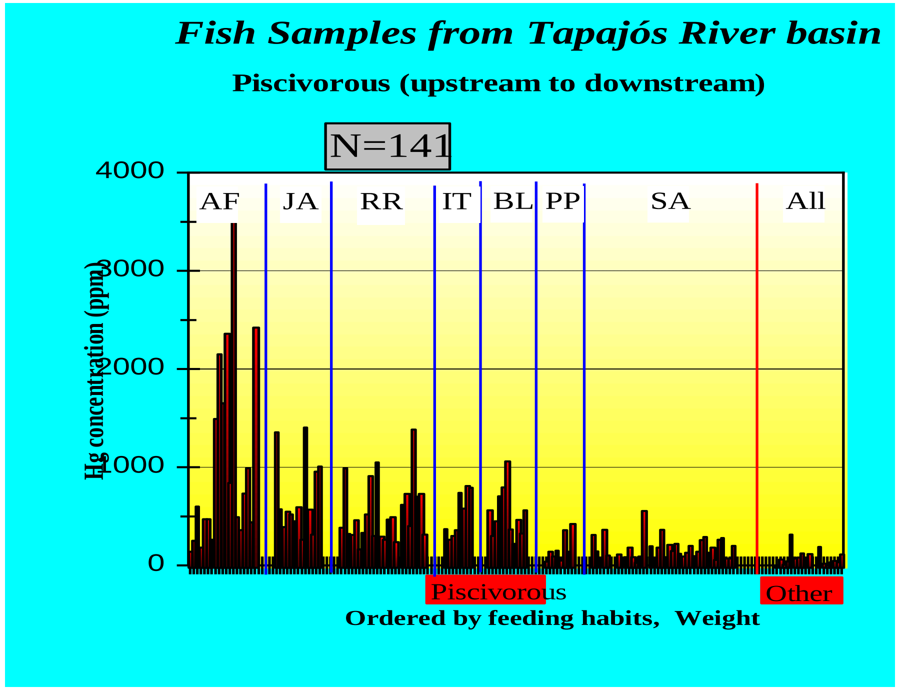
Olaf Malm

olaf@biof.ufrj.br

Laboratório de Radioisótopos Eduardo Penna Franca







MERCURY CONCENTRATIONS IN CARNIVOROUS OR PISCIVOROUS FISH FROM DIFFERENT AMAZON AREAS

Origin	Number of species	Number of samples	Average (ng.g-1).	Range (ng.g-1).	Reference
• Madeira River	50	370	850	165 - 3920	Malm et al, 1997
• Madeira River	22	154	665	60 - 3960	Silveira et al, 1997
• Madeira River	-	251	638	- 11500	Barbosa et al, 1995
• Tapajós River	23	118	498	25 - 5960	Malm et al, 1997
• Tapajós River	12	212	499	46 - 2200	Uryu, 1996
• Tapajós River	19	73	511	132 - 1354	Lebel et al, 1995
• Tapajós River	09	85	723	120 - 3580	Hacon, 1996
• Negro river	18	113	780	226 - 4231	Malm et al, 1994
• Tucuruí Reservoir	8	121	1300	200 - 5900	Porvari et al, 1995
• Balbina Reservoir	6	27	371	49 - 1103	Malm et al 1996,
	N total =	1524			

Environmental conditions can be more important for Hg accumulation by biota than the human releases.

Environmental agencies should indicate sensible/susceptible/fragile areas for Hg contamination and potentially other pollutants that deserve special attention/protection regarding disturbances (mining, industries, dams…).

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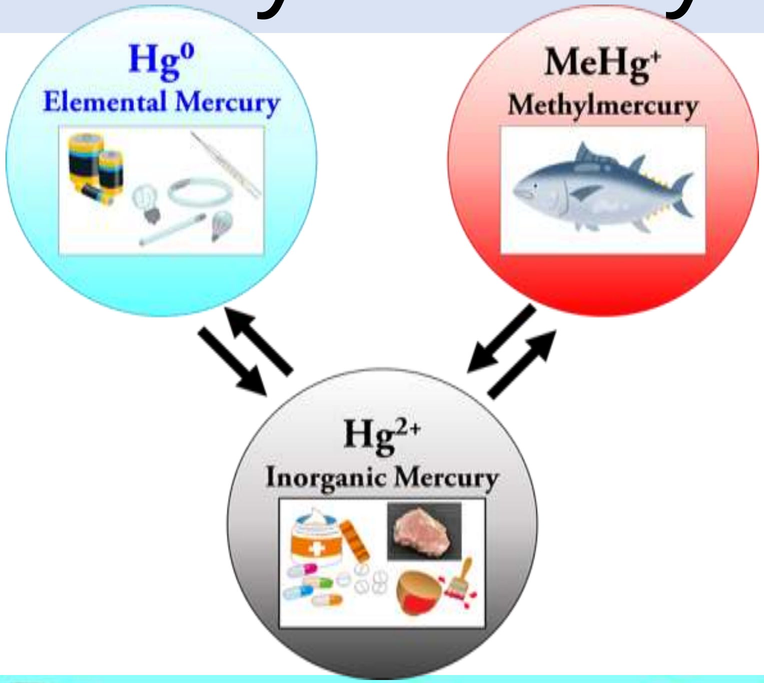
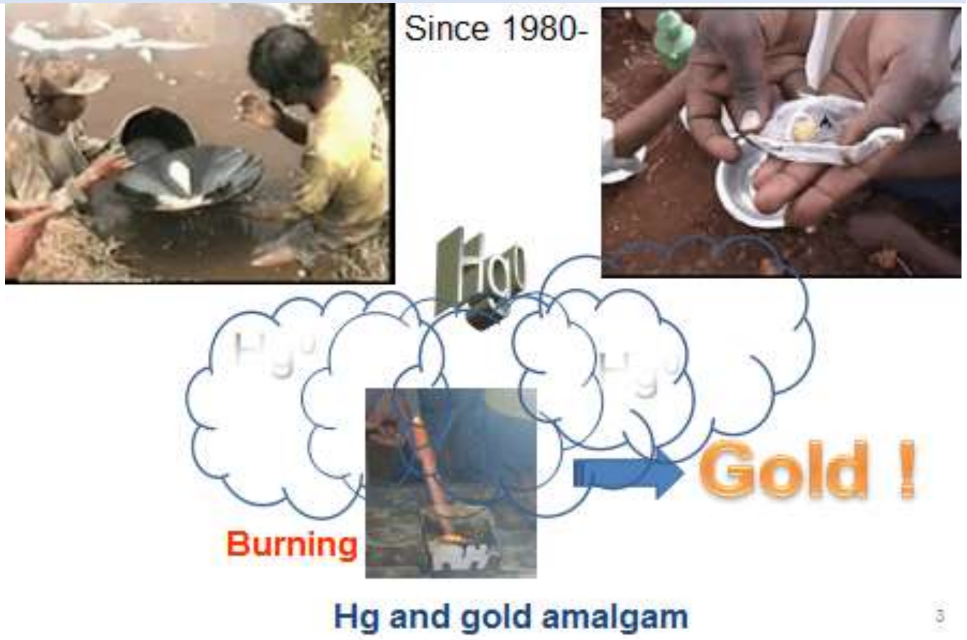
Health risks of different chemical forms of mercury

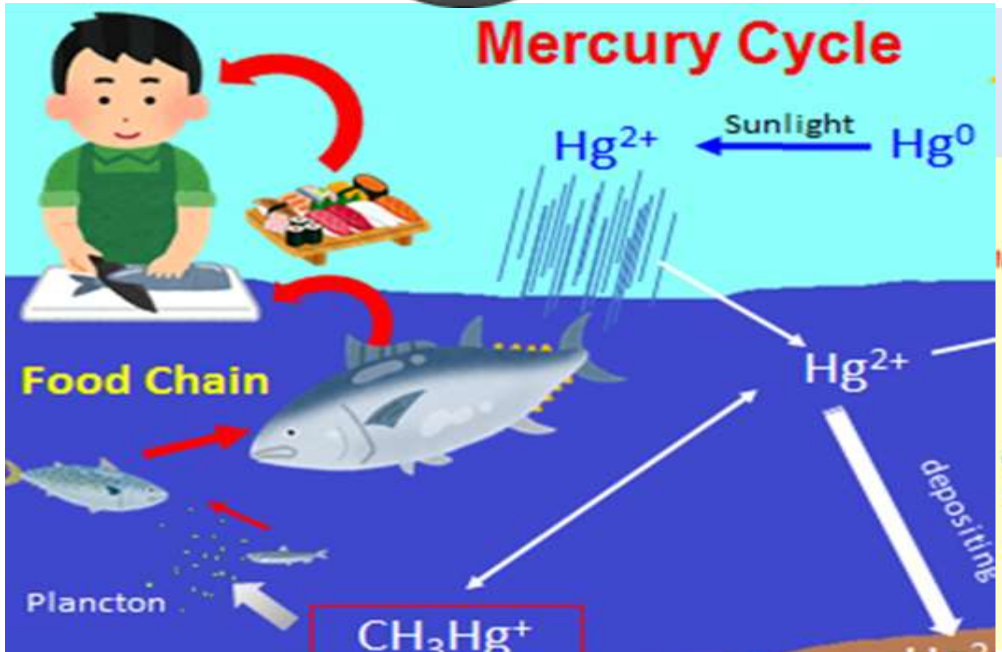
Mineshi　Sakamoto

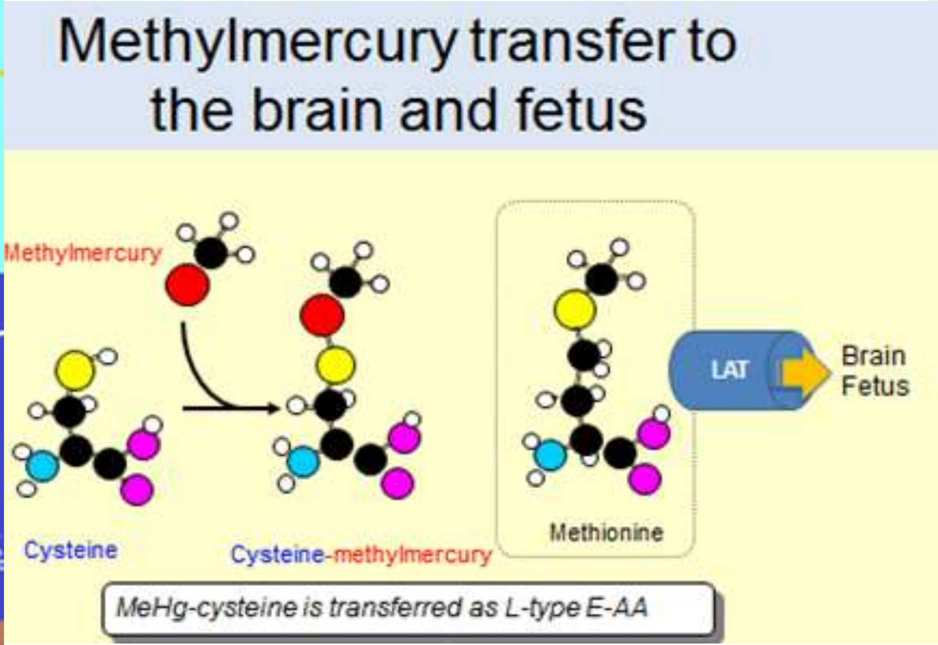
National Institute for Minamata Disease, Ministry of the Environment

Methylmercury & Hg vapor exposure









		MeHg	Hg^0
Exposure Source		Fish & shellfish, rice (polluted area)	ASGM, mercury mine
Pathway		GI tract →blood →(BBB & BPB) →brain, fetus	Lung→blood →brain (oxidation)→kidney
Target organs		Brain, fetus brain	Brain, Kidney
HBM	Adult, infant	Blood, Hair	Urine , Serum
	Fetus	M-Blood, hair Cord blood	Breast milk, Cord blood

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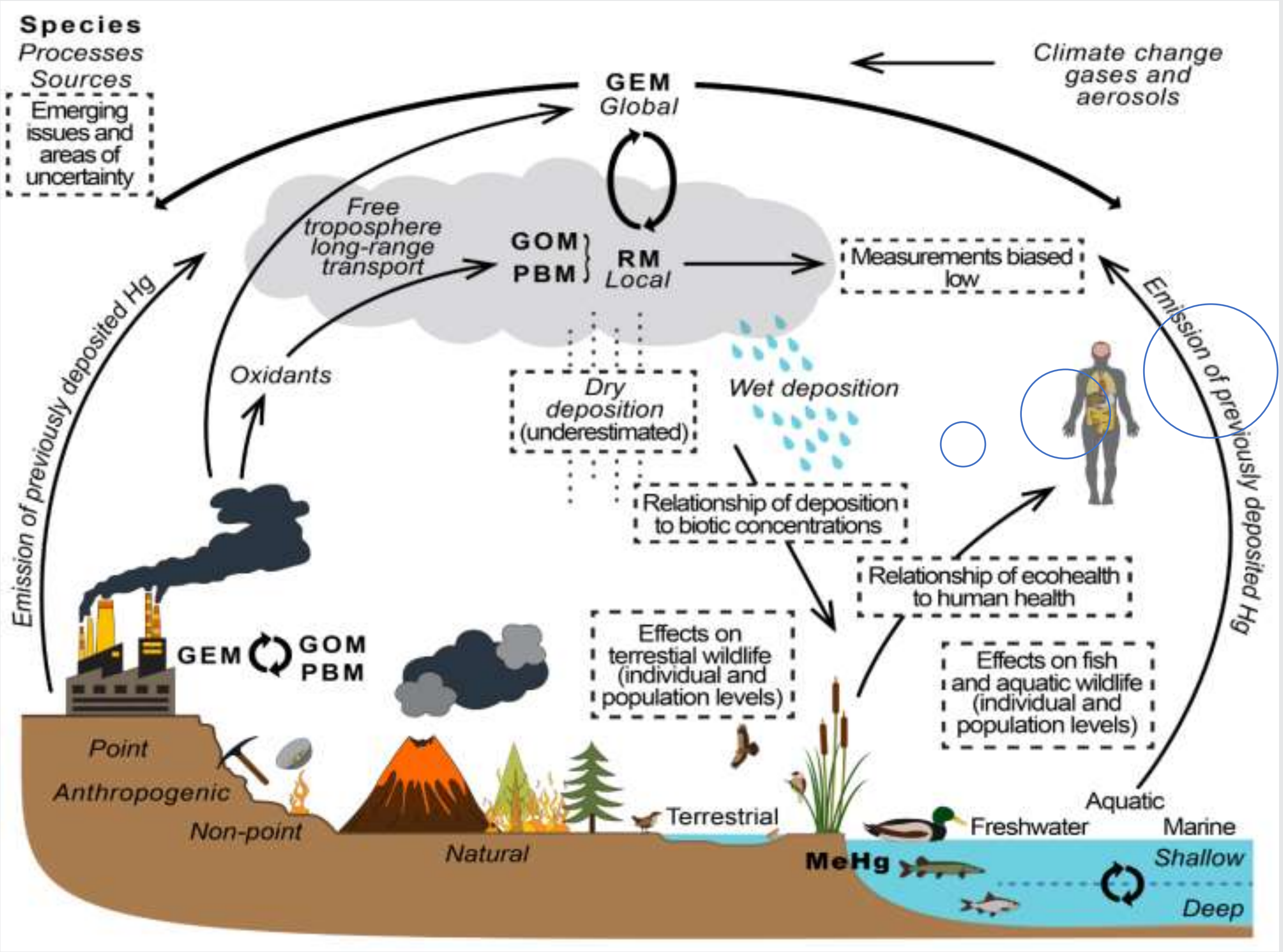
GMOS: Emerging Issues and Areas of Uncertainty

Prof. dr. Milena Horvat, Jožef Stefan Institute, Slovenia

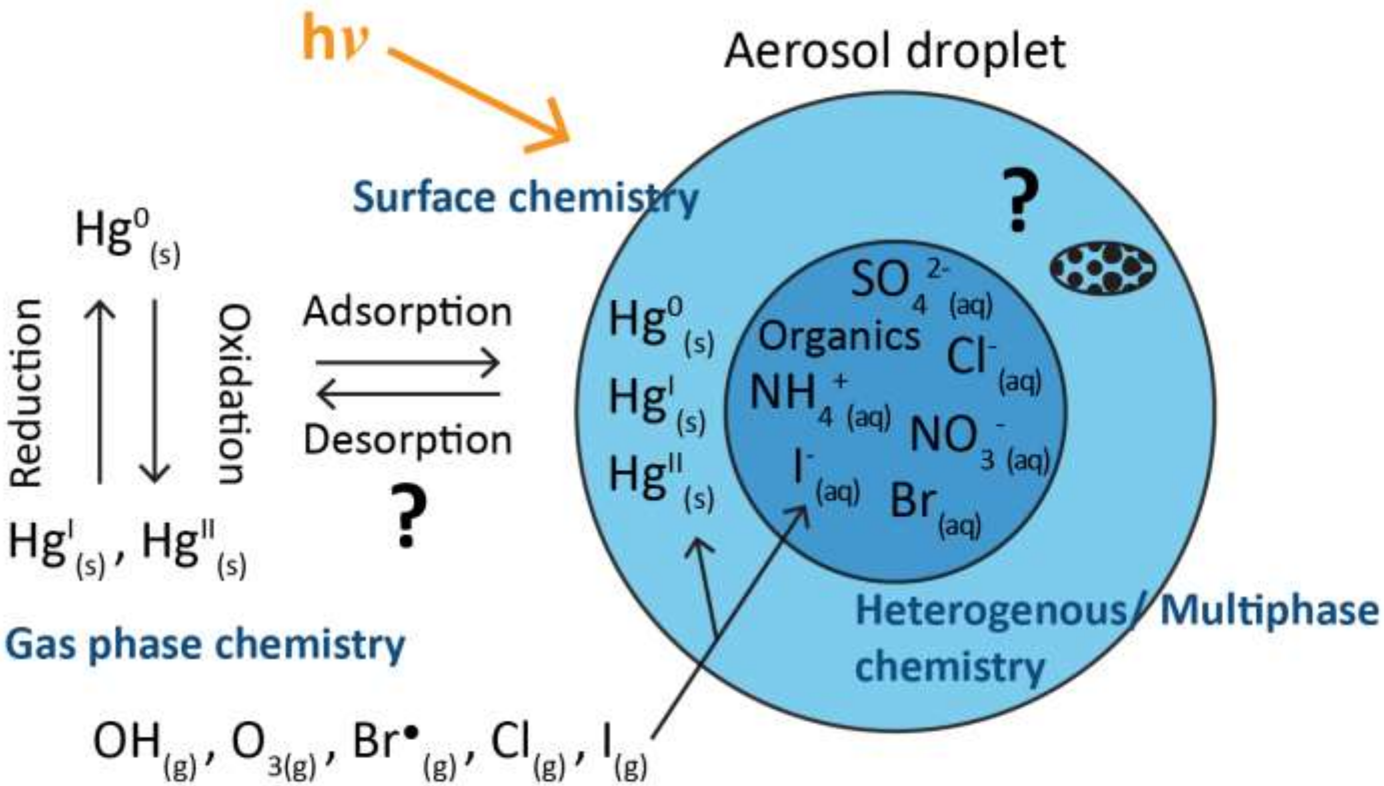


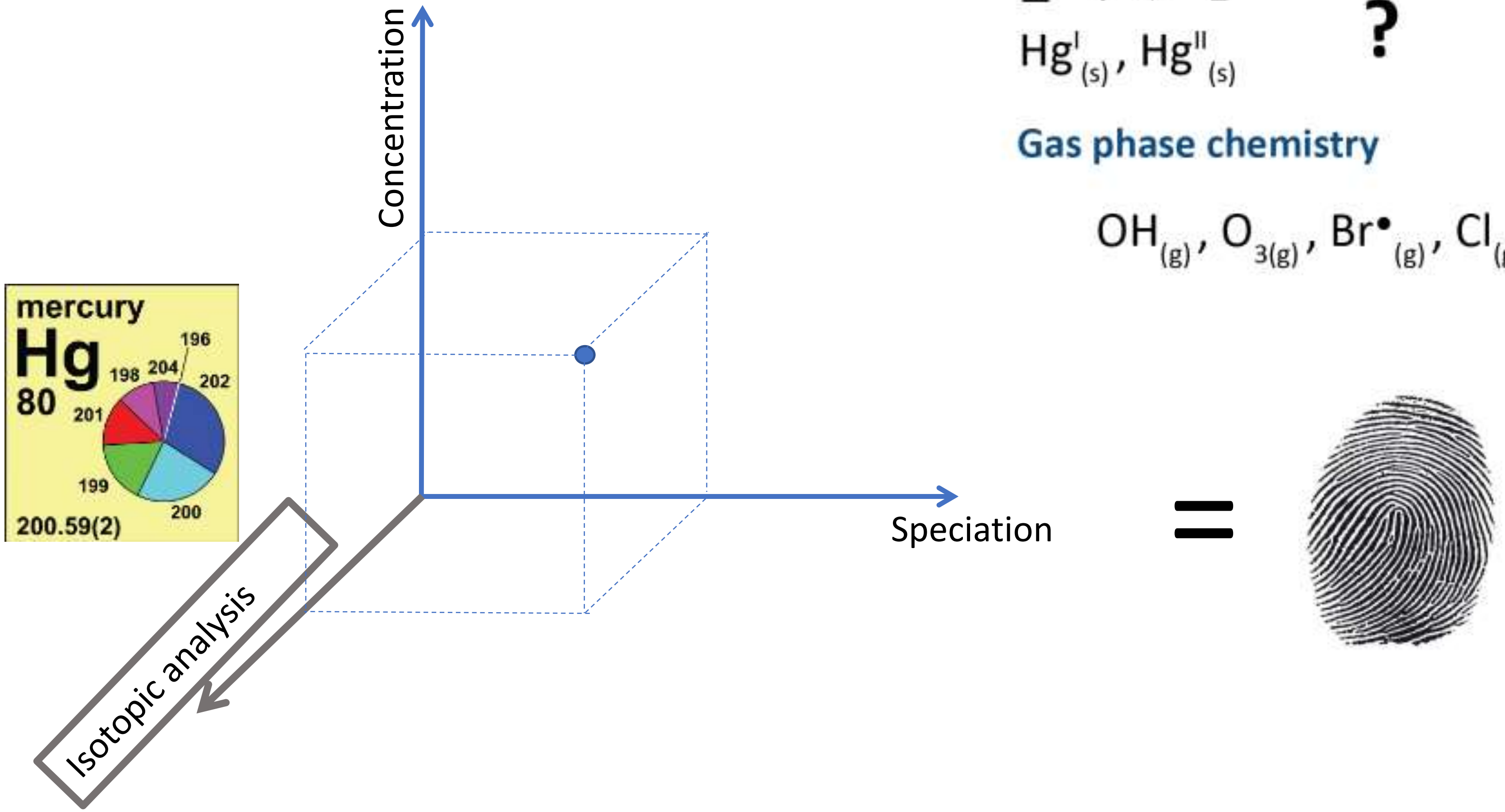
Currently no metrological infrastructure for traceable, validated and accurate measurements of oxidised mercury species in the atmosphere and emission sources exists.

Adopted from Gustin et al. 2016. EST

GMOS TRAIN

Atmospheric Hg: Analytical challenges



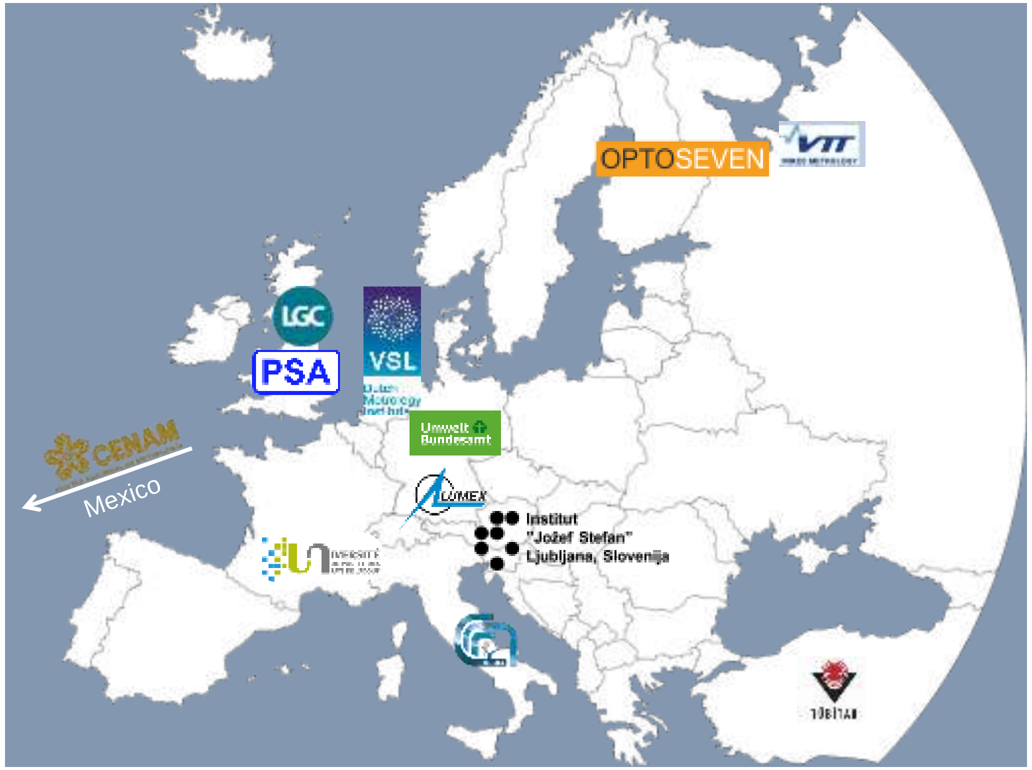


Air concentrations:

- **Hg^0** (GEM): <ng/m^3 *(ambient air)* to µg/m^3 *(emission sources)*
- **Hg^{2+}** (GOM) and **Hg_p** (PBM): pg/m^3 *(ambient air)* to ng/m^3 *(emission sources)*

Traceability of oxidised mercury - MercOx project
(2017-2020)

Total costs: 1,96 Mio EUR



- *to **validate and develop traceable oxidised Hg standards** and methods for **sampling and analysing oxidised Hg species** in **flue gas** emissions and in **the atmosphere**.*
- *to improve **comparability** of measurement results.*

Coordinator:
Milena Horvat
Jožef Stefan Institute,
Ljubljana, Slovenia

and the MercOx consortium:
Ina Fettig, Timo Rajamäki, Panayot Petrov, Iris Krom, David Amouraux, Maria del Rocio Arvizu, Jarkko Makkonen, Warren Corns, Ian Hangecock, Reinhold Moeseler, Can Suleyman

GMOS TRAIN

MSCA ITN
Global Mercury Observation Training Network

- (2020-2024, 3.9 Mio EUR)

- in Support to the Minamata Convention

This project will receive funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie grant agreement no. 860497

Jožef Stefan Institute, Ljubljana, Slovenia

The overall objectives of the ITN GMOS-Train network are

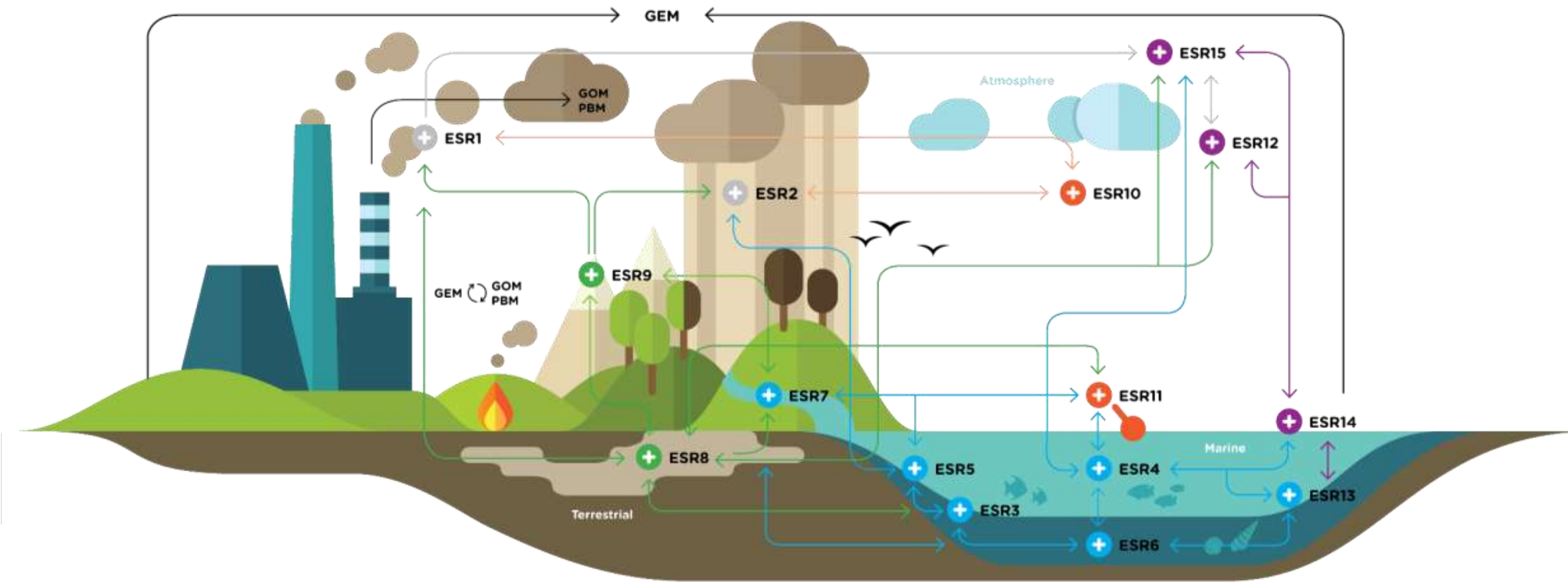
- to provide urgently needed training in Hg science within the context of the UNEP Minamata Convention

01

- to fill key knowledge gaps in biogeochemical Hg cycling linking anthropogenic emissions and Hg in marine food webs.

02

Training for 15 PhDs (ESRs) in Hg science within the context of the UNEP Minamata Convention



Legend 1

- WP1 (ESRs 1-2) Atmospheric processes
- WP2 (ESRs 3-7) Marine processes
- WP3 (ESRs 8-9)Terrestrial-land-water systems
- WP4 (ESRs 10-11) Traceability & sensors
- WP5 (ESRs 12-13) & WP6 (ESRs 14-15) Modeling

Legend 2

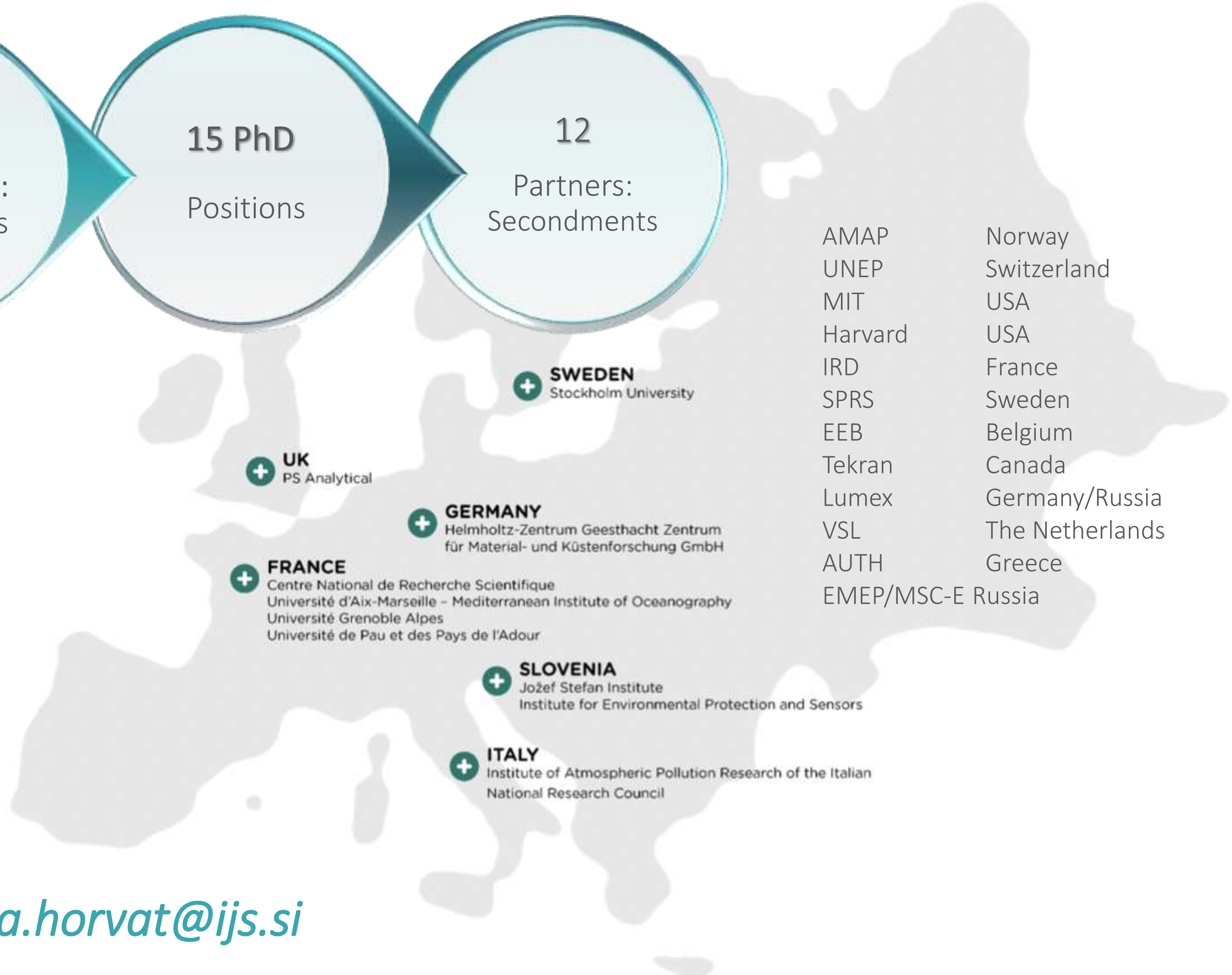
ESR1	Oxidants and RM
ESR2	Kinetics/deposition/re-emission
ESR3	C/H/Hg compound specific analyses
ESR4	Ocean speciation/cruises
ESR5	Coastal dynamics Methylation/demethylation
ESR6	Lower food web
ESR7	Land water interactions
ESR8	Permafrost
ESR9	Terrestial/canopy
ESR10	Traceability/comparability
ESR11	Sensors
ESR12	Regional models
ESR13	Ecosystem model
ESR14	Ocean/atmosphere exchanges
ESR15	Global models

15 PhD positions: www.gmos-train.eu

11
Beneficiaries:
Recruitments

15 PhD
Positions

12
Partners:
Secondments



AMAP	Norway
UNEP	Switzerland
MIT	USA
Harvard	USA
IRD	France
SPRS	Sweden
EEB	Belgium
Tekran	Canada
Lumex	Germany/Russia
VSL	The Netherlands
AUTH	Greece
EMEP/MSC-E	Russia

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MINAMATA CONVENTION COP-3
GENEVA - NOV 27, 2019

CONVERTING SPOKES INTO HUBS: REFLECTIONS ON BUILDING CAPACITY IN LMICS

Niladri (Nil) Basu

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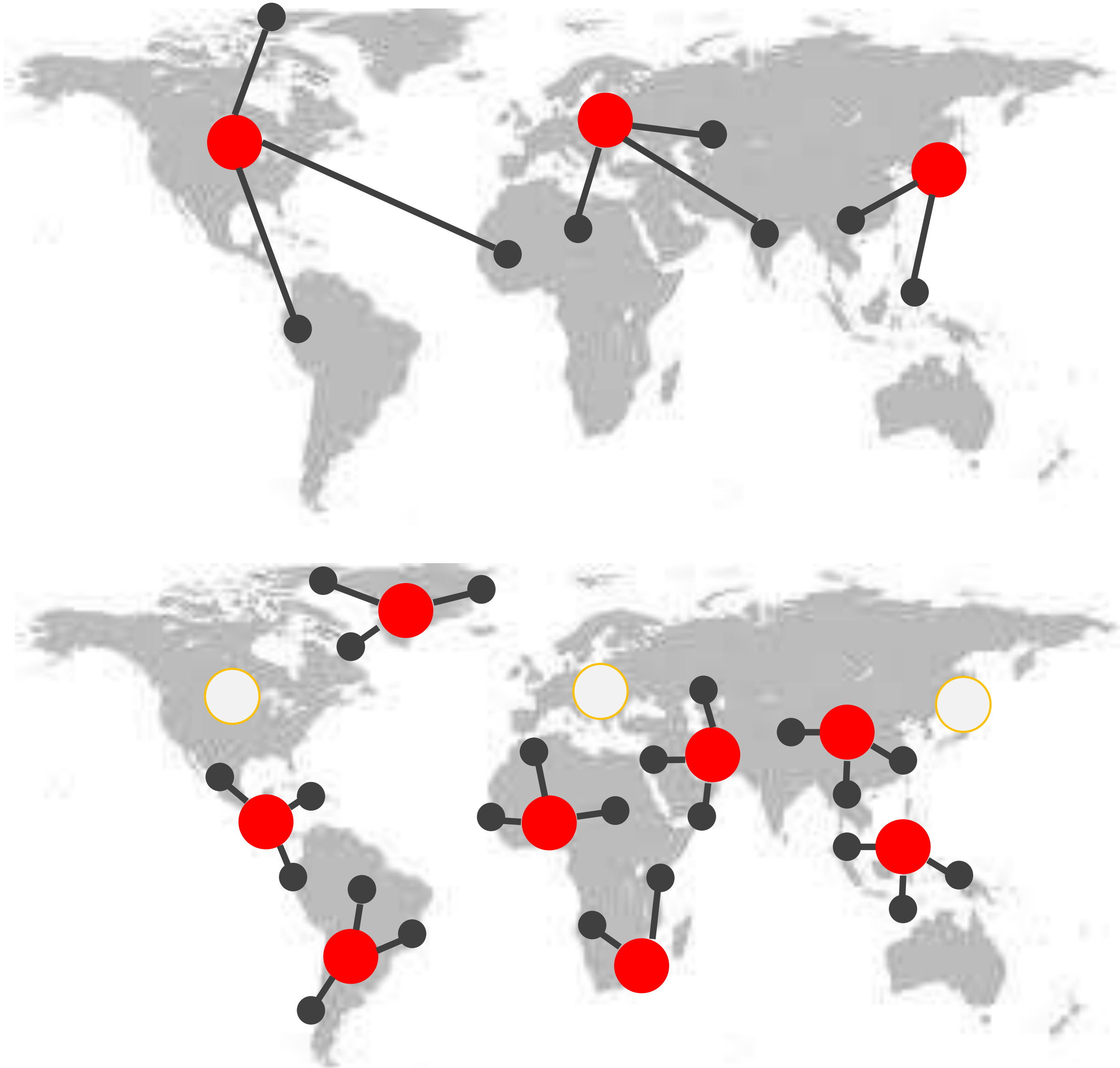
McGill

My Hg global capacity building efforts



- Most “science” done by HICs yet most challenges exist in LMICs
- Hg is a global pollutant yet it disproportionately impacts vulnerable groups largely in LMICs
- How build research capacity in the places where it matters most? **How make the spokes into the hubs?**

spokes → hubs? Hg science ready!

- Science underpins key indicators: biota (fish), foods, and human biomarkers (blood, hair, urine)
- Measurement is easy (science, methods, cost): available, affordable, accessible, utilizable, scalable
- Encompass entire research lifecycle

- Equipment + Materials: <$50K USD one time
- Annual maintenance: <$5K USD
- Per sample cost: <$20/sample
- Staff & Training: <$2K + refreshers + Technician salary


MANAGE
BUILD
TRAIN
SHARE

NIL BASU, PhD

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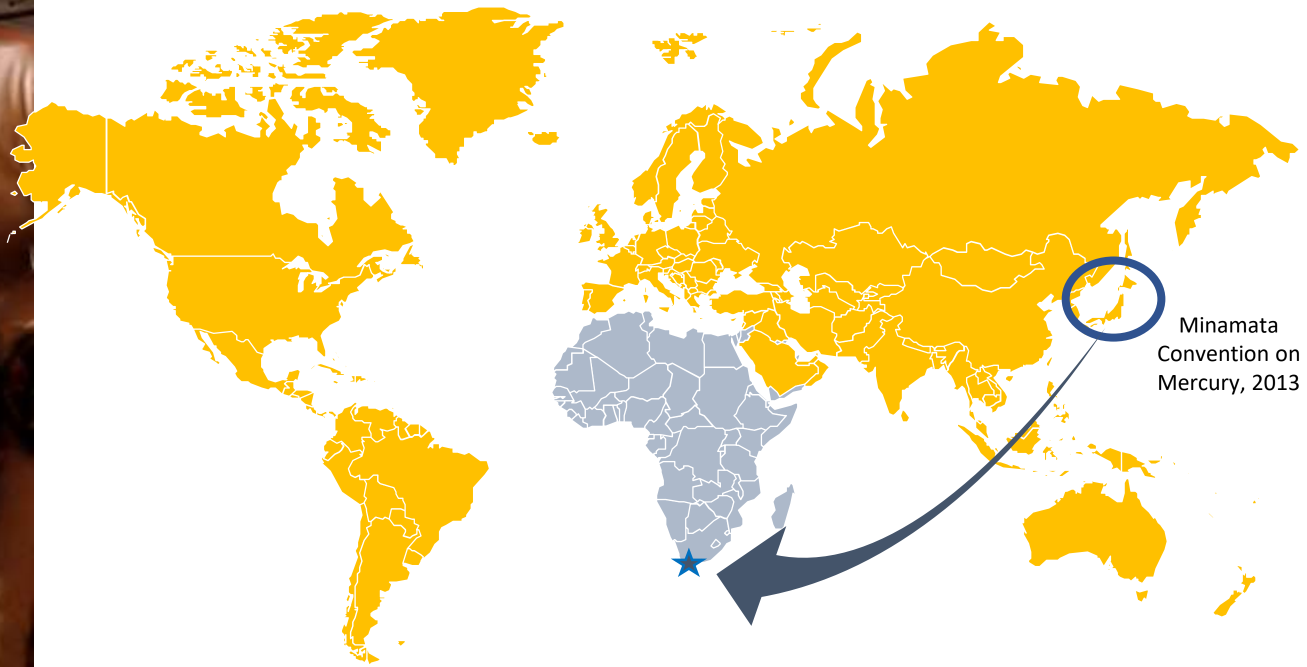
ICMGP Cape Town 2021

Hg

15th INTERNATIONAL CONFERENCE ON MERCURY AS A GLOBAL POLLUTANT

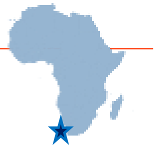
CAPE TOWN | SOUTH AFRICA | 11-16 JULY 2021

ICMGP 2021 | CONFERENCE THEME



"From Minamata to Africa and Beyond: Addressing Mercury Challenges in Global Environmental Change"

LEGACY | 8-POINT PLAN



1 Reconnect Africa to Mercury Science

- international scientists, students and policy makers will be reconnected with Africa.
- include a "how to" session on ratifying the Minamata Convention on Mercury.
- North –South research agenda

2 Target Global Info Platforms

- to host special sessions on Hg matters on the African continent e.g. SETAC Africa & the mercury community will be targeted as platforms to host special sessions on sensitive Hg matters on the African continent (e.g. ASGM).

3 Build Mercury Partnerships

- easy access allows for building conduits between scientists and policy makers from across Africa, for mercury research to inform policy development (south-south research agenda)

4 Raise Awareness on Mercury

- develop educational and awareness strategies to inform the public on the risks associated with mercury pollution, particularly the ASGM sector

LEGACY | 8-POINT PLAN

5 Initiate African Mercury Network

- long-lasting and new partnerships in Hg research and policy development across the world
- using a platform to the likes of a South African Mercury Association

6 Advance Mercury Policy

- establish collaborations for the advancement of Hg policy at national, regional, and international scales, focussing on the Minamata Convention

7 Establish Networks & Hg Laboratories

- develop Hg monitoring programmes / networks and establish laboratories that foster international and regional student-scientist exchange visits across Africa.

8 Initiate focused Training Programs

- inclusive of training modules for use on the African continent, which will lead to quality peer-reviewed journal publications.

Regional Level: Western Cape Mercury Risk Management Strategy

- **Establish a Western Cape Mercury Management Programme, inclusive of a Mercury Deposition Network:**
  - Establish partnerships with relevant stakeholders in the Province (viz. Local and National government, Academia, Industries etc.)
  - Investigate means for monitoring mercury in the Western Cape (air-land-sea) (e.g. Western Cape Mercury Reference Laboratory)

- Key Challenges
  - Funding to implement the Western Cape Mercury Risk Management Strategy
  - Obtain accurate and reliable data from sources – an update is required

Contact Us

Western Cape Government
Environmental Affairs and Development Planning
BETTER TOGETHER.

- Dr Joy Leaner
- Director: Air Quality Management

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