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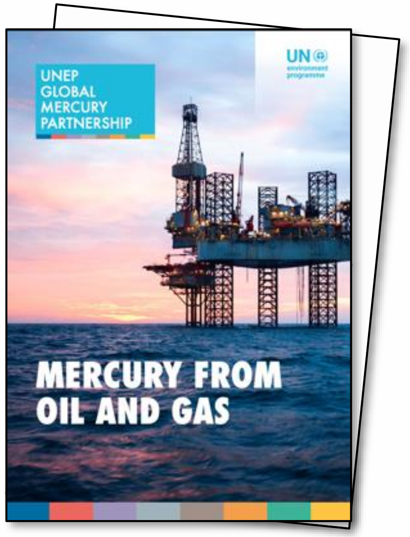
Minamata Convention Pre-COP6 side Event

Managing Mercury in Offshore Oil and Gas: Risks, Challenges, and opportunities.



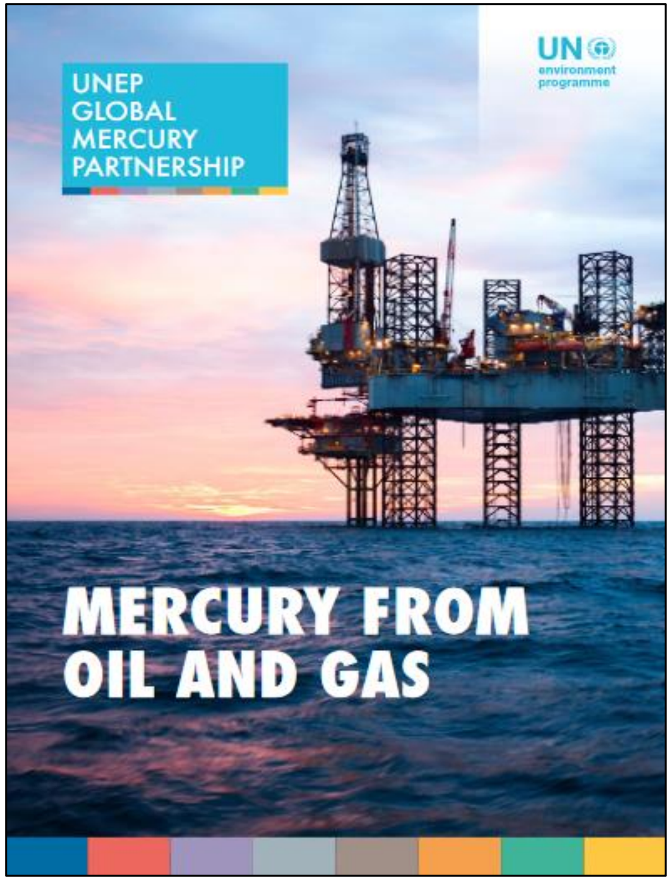
INTRODUCTION:
Managing Mercury in Offshore Oil and Gas: Risks, Challenges, and opportunities.

- Judith Torres (GMP Supply and Storage Partnership Area): Introduction
- Lilian Corra (GMP Supply and Storage Partnership Area): Presentation of GMP oil and gas report findings
- Dr Tarren Reitsema (NOPSEMA): Mercury releases during offshore oil and gas exploration and production
- Dr Tom Cresswell (ANSTO): Mercury associated with offshore infrastructure decommissioning; the importance of speciation and future research needs
- Dr Darren Koppel (AIMS): A risk assessment framework for mercury in offshore oil and gas infrastructure
- Gaspar Corra (Instituto Tecnológico de Buenos Aires (Buenos Aires Institute of Technology, ITBA): in oil and gas regional approach: the experience in South America
- Ludovic Bernaudat – UNEP Head of Knowledge and Risk Unit – Closing Remarks

Q and A is in the chat

Study report on “Mercury from oil and gas”

UNEP Global Mercury Partnership



Lilian Corra
International Society of Doctors for the Environment
ISDE
Supply and Storage Partnership Area

1. Objective of the report

The objective of the report is to analyze the life cycle of mercury in the oil and natural gas value chains and understand how this heavy metal, naturally present in oil and natural gas, may be released to the environment at different stages of the process, including the decommissioning of oil and gas infrastructure.

It further aims to identify how mercury waste from the sector is treated and whether it may be entering the market for other uses.

2. Current knowledge

The presence of mercury in oil and gas is well known, varies depending on the origin, operation conditions and represents a problem for the equipment of the processing systems.

Mercury containing waste like toxic sludge, waste water and sorbent materials are difficult to treat, process and store.

The good understanding of the problem may be impeded by the limited available information from the different processes and uses:

- emissions and releases (extraction/processing/decommissioning)
- mercury or mercury containing waste from extraction or processing
- occupational exposure
- human exposure (low chronic exposure, early human development)

3. Occupational exposure

Mercury presence in vapor suffers considerable variation in working areas, highlighting the importance of continuous monitoring to evaluate possible inhalation.

Mercury accumulates in equipment at different stages of the processes and may lead to occupational exposure, especially during maintenance, inspection and decommissioning in the petroleum industry.

4. Mercury content in oil and gas deposits
Geographical distribution of the presence of mercury in crude oil and natural gas

It is important to know the *geographical distribution* of the presence of mercury in crude oil and natural gas to understand the nature of the problem.

A mercury mass balance in oil and gas processes is difficult to obtain due to the nature of mercury and the **significant variation in the concentration in the deposits.**

The implementation of a better global multicentric harmonized studies using comparable analytical techniques and data analysis is needed.

4. Mercury content in oil and gas deposits
Regional content of mercury as an indicator

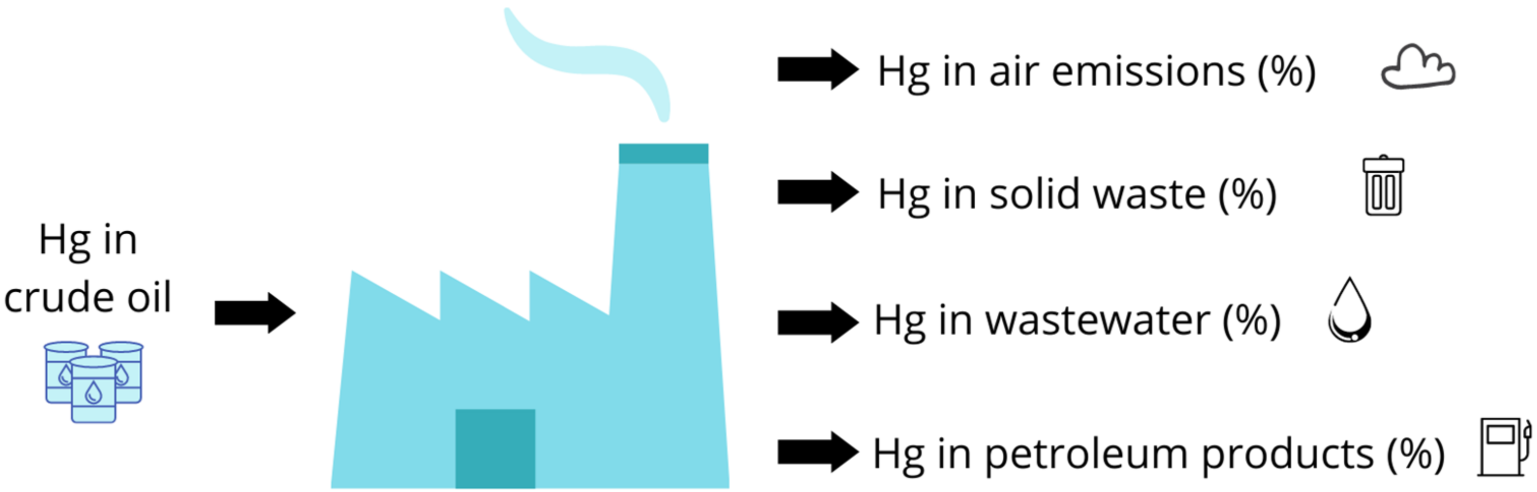
Regional averages concentrations are used as indicators to estimate the amounts of mercury present in oil and gas.

Even there is a tendency by region, the *average concentrations varies significantly* depending on the sources of the information.

But, regional average concentrations cannot be used as indicators to understand *local problems*, given the different concentration of mercury in the deposits.

5 & 6. Mass of mercury potentially released from crude oil and natural gas.

Mercury may be found and released at different stages of the oil and gas value chain:
extraction, transport, processing and from products.



7. Techniques used to remove mercury from crude oil and natural gas

Removal of mercury from crude oil is not simple and is not carried out by many companies.

In gas, mercury may cause catastrophic failures in the processing facilities, it is essential that a mercury removal process is deployed upstream of the cryogenic distillation.

The disposal of the collected mercury by the removal systems varies depending on the type of system used, but in every case should be considered *hazardous waste*.

8. Fate or possible fate in the environment of mercury generated from oil and gas activities

Based on a review of the literature, the following key points can be highlighted:

- There is little information about the fate of the sludge produced during the processing of oil and gas.

- There is very little information available about the fate of the solid waste with a high mercury content (which comprises saturated “wastewater filters” and “saturated adsorbent” from the mercury removal systems).

- The replacement and decommissioning of facilities and tankers generates mercury-containing waste.

- The mercury present in the different fuels will be released to the atmosphere as elemental mercury after its combustion in power generation plants, vehicles and heaters.

9. Initial ideas for further research and cooperation

The following points would ***contribute to better understanding and assessing mercury emissions and releases*** from crude oil and natural gas:

● Monitor in a systematic, standardized, comparable and multi-centric way the whole process.

● Complete mass balances in the most accurate way.

● Promote information exchange on mercury determination and sampling methods.

● Facilitate the access to information on the production and fate of mercury waste and mercury containing waste flow, especially in oil and gas deposits and/or regions where mercury concentrations are known to be higher.

9. Initial ideas for further research and cooperation

The following points would ***support the implementation of measures to reduce or eliminate mercury emissions and releases*** from the sector:

●Identify, monitor and assess mercury waste and mercury containing waste volumes generated by the sector.

● Understand and track the fate of such waste.

●Spread information on BAT/BET.

●Improve the capacities of the concerned facilities to process mercury and mercury containing waste and safely dispose it off.

●Strengthen human and technical capacities, and collaboration to facilitate identification and evaluation of mercury emissions and releases from oil and gas all along its value chain.

9. Initial ideas for further research and cooperation

It is important to highlight that there is also a ***need for guidelines dissemination to support the implementation of best available technologies and best environmental practices*** for the removal of mercury from oil and gas at the different stages of the process.

In relation to ***worker's protection***, while several guidelines aim to prevent chemical toxic exposure and codes of practice for the control of occupational exposure to mercury, ***none appear to focus specifically on workers exposure to mercury in the petrochemical industry.***

Acknowledgements

The UNEP Global Mercury Partnership thanks individuals and organizations that contributed their expertise to this work.

Special thanks to Ana Garcia (Ministry for the Ecological Transition and the Demographic Challenge. MITECO. Spain) and Judith Torres (Ministry of Environment. Uruguay Uruguay), Supply and Storage Area co-leaders

ISDE was commissioned to draft the report, under the overall coordination of Lilian Corra (ISDE), with the support of Carlos M. López Alled (Tragsatec - Ministry for the Ecological Transition and the Demographic Challenge of Spain) and Gaspar Corra (Department of Exact and Natural Sciences, Instituto Tecnológico de Buenos Aires (ITBA).

1. Acknowledgements

Special thanks to Ana Garcia (Ministry for the Ecological Transition and the Demographic Challenge. MITECO. Spain) and Judith Torres (Ministry of Environment. Uruguay Uruguay), Supply and Storage Area co-leaders, for taking into consideration the concerns generated by the issue of "mercury in the oil and gas sector" and highlighting to the Partnership Advisory Group the need to fully understand the reality and consequences of the mercury mobilized and released from this sector.

Internal review at UNEP: Jacqueline Alvarez (UNEP), Sandra Averous (UNEP), Kenneth Davis (UNEP), Imelda Dossou Etui (UNEP), Stéphanie Laruelle (UNEP), Monika G. MacDevette (UNEP), Daniel Chovil (UNEP).

1. Acknowledgements

The Partnership also wishes to thank the co-chairs of the Partnership Advisory Group, Rodges Ankrah (Environmental Protection Agency of the United States) and Teeraporn Wiriwutikorn (Ministry of Natural Resources and Environment of Thailand) as well as the co-leads of the Partnership Areas on Mercury Air Transport and Fate Research, Celia Chen (Toxic Metals Superfund Research Program, Dartmouth College), Nicola Pirrone (Institute of atmospheric pollution research, National Research Council of Italy), David Evers (Biodiversity Research Institute), on Mercury Supply and Storage, Ana García (Ministry for the Ecological Transition of Spain) and Judith Torres (Ministry of Housing, Territorial Planning and Environment of Uruguay) and on Mercury Waste Management, The Ministry of the Environment of Japan and Misuzu Asari (Graduate School of Global Environmental Studies, Kyoto University) for their guidance and support.

1. Acknowledgements

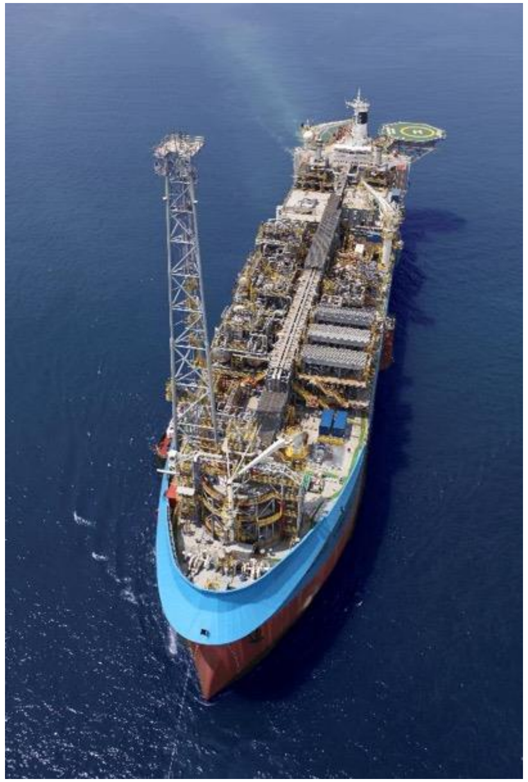
The Partnership thanks to whom provided their inputs: Mark Andrew (Qa3 Limited), Stuart Baker (Qa3 Ltd), Matt Bower (Qa3 Ltd), Warren Corns (PS Analytical), Rob Cox (IPIECA), Evan Granite (US Department of Energy), Marcela Gregori (Environmental Pathology, La Plata National University, Argentina), Sebastien Grizard (William Blythe Ltd), Lee Hunter Jr (Total Hazardous and Integrated Solutions), Yuyun Ismawati (Nexus3, IPEN), Clotilde Jubin (Axens), Matthew Kirby (Qa3 Ltd), Gilbert Kuepouo (Centre de Recherche et d'Education pour le Développement), David Lennett (Natural Resources Defense Council), Fabio S. Luna (National Institute of Industrial Technology, Argentina), Peter Maxson (Concorde East/West Sprl), Guia Morelli (Institute of Geosciences and Earth Resources, National Research Council, Italy), Peter Nelson (Macquarie University), Stephan Plisson-Saune (IPIECA-TOTAL), Tristan Robert (BATREC Industry AG), Reinhard Schmidt (Econ Industries), Mitsugu Saito (UNEP), Eisaku Toda (Secretariat Minamata Convention on Mercury), Bo Simon Walch (Sea2Cradle B.V.) and experts who contributed through consultative meetings to the present report.

NOPSEMA | Australia's offshore energy regulator

Mercury releases during offshore oil and gas exploration and production

Tarren Reitsema

Offshore Oil & Gas



Drilling

Operations/ Production

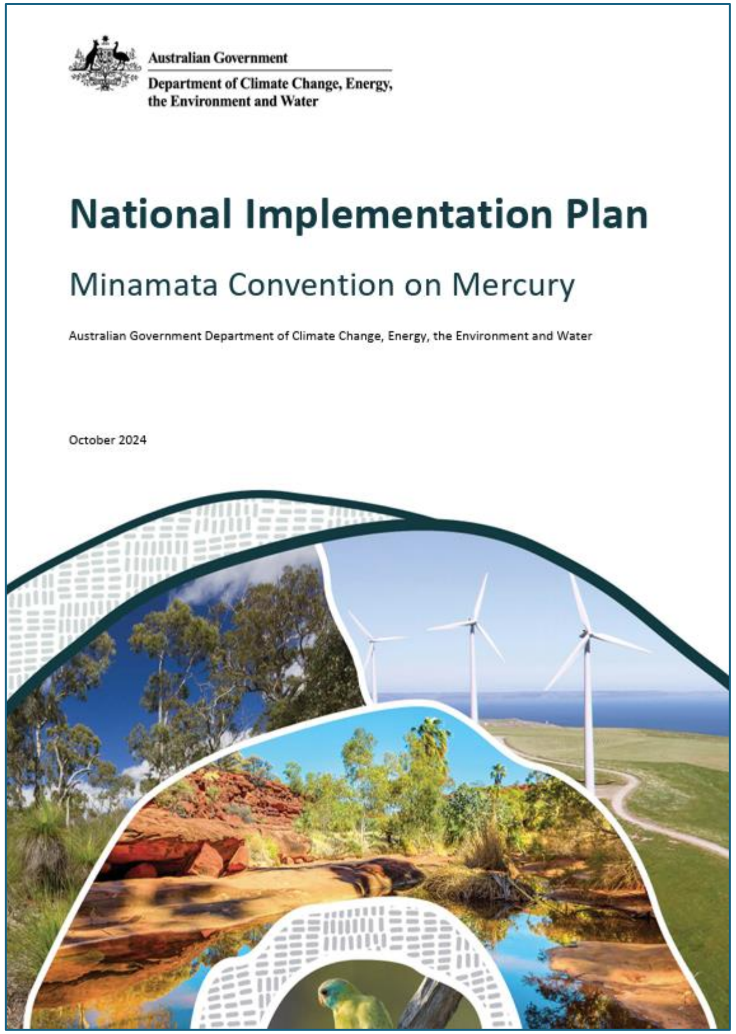
Decommissioning

Drilling

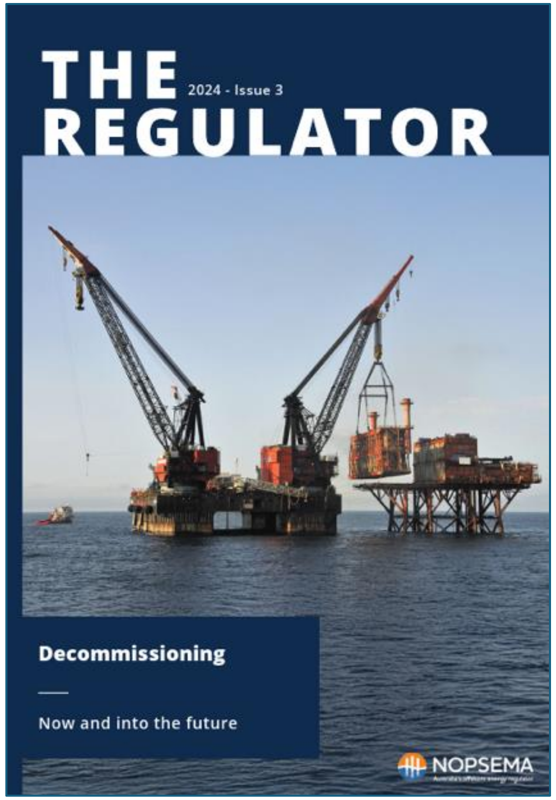
- Cuttings, barite, bentonite, cement → bulk discharges
- Dust from bulk powders - human health considerations
- Mercury also introduced via drilling mud chemicals, cuttings
- Cuttings piles can become anoxic → methylmercury
- Management:
    - ✓ Limit < 1 mg Hg kg^{-1} barite
    - ✓ no bulk disposal

Production

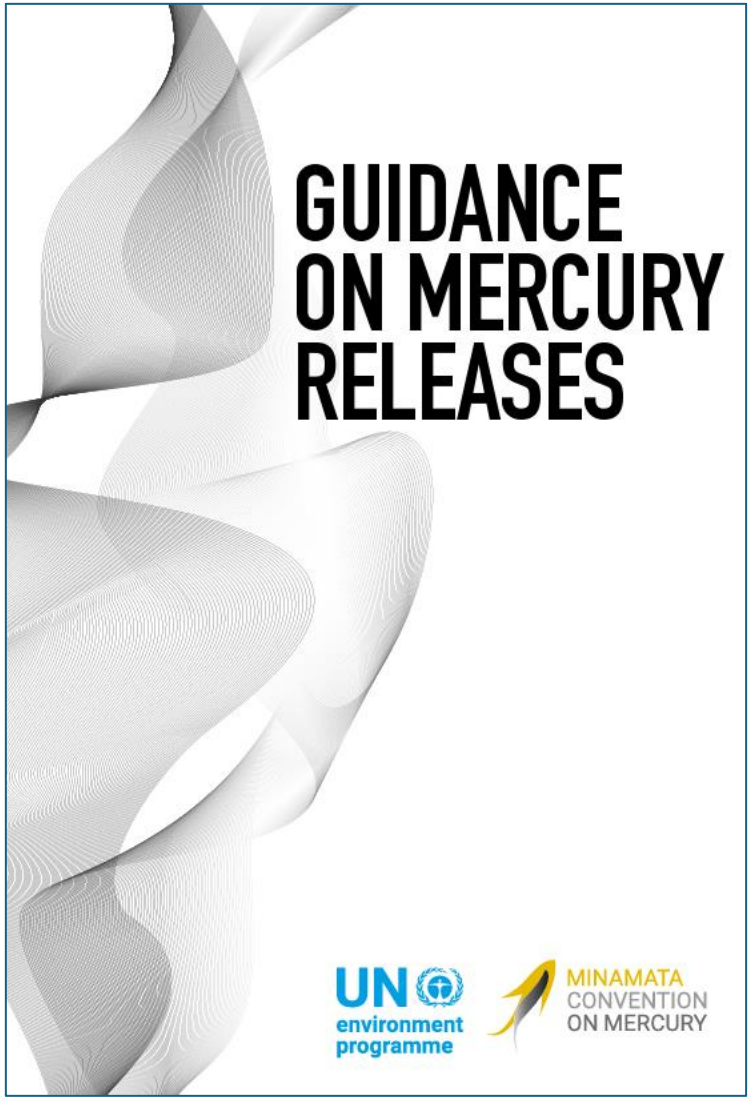
- Produced water discharges
- Process equipment: sludges / scales / filters accumulate Hg
- Atmospheric emissions: fuel gas & flaring emissions
- Treatment: focus upon often for corrosion of equipment or gas export specifications, not environmental considerations
- Ongoing education re Minamata emphasis on best environmental practice required

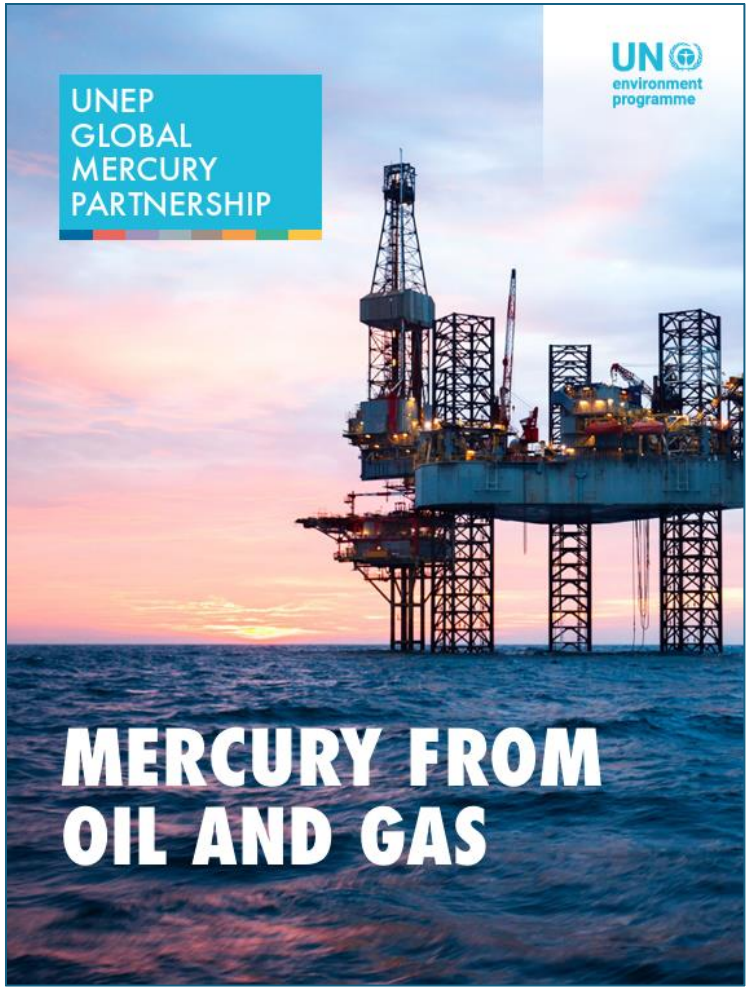


"NOPSEMA requires offshore oil and gas projects to be compliant with the Minamata Convention and to apply best available techniques and best environmental practices to control mercury releases and manage mercury waste in an environmentally sound manner"



"It's NOPSEMA's expectation that bulk powders are not dumped into the marine environment at the end of an offshore activity"





- Examples of existing sources of information
- We would like to continue building on that good work through collaboration with the UNEP GMP
- Seeking your support and engagement!

NOPSEMA | Australia's offshore energy regulator

Tarren Reitsema

(contact via *Linkedin*)

nopsema.gov.au

Australian Government | ANSTO

Mercury associated with offshore infrastructure decommissioning

The importance of speciation and future research needs

Dr Tom Cresswell

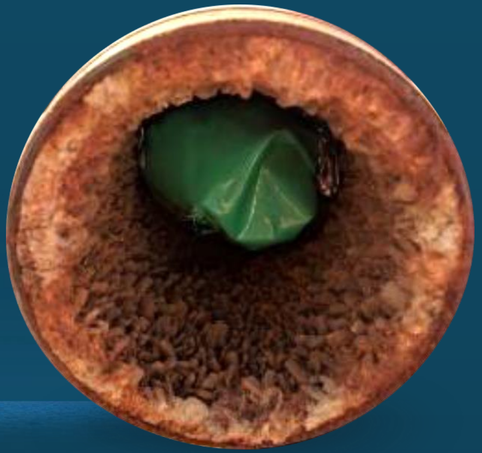
Principal Research Scientist
Radioecology & Ecotoxicology

Minamata Pre-COP 6 Webinar, 17 Oct 2025

Science. Ingenuity. Sustainability.

Subsea pipelines

Full removal or leave in place?



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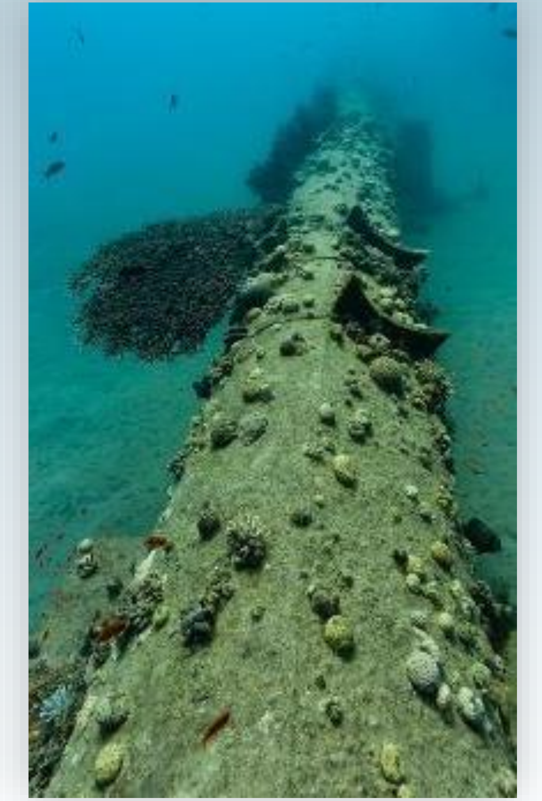

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Contaminants identified as No. 1 research priority for offshore decommissioning

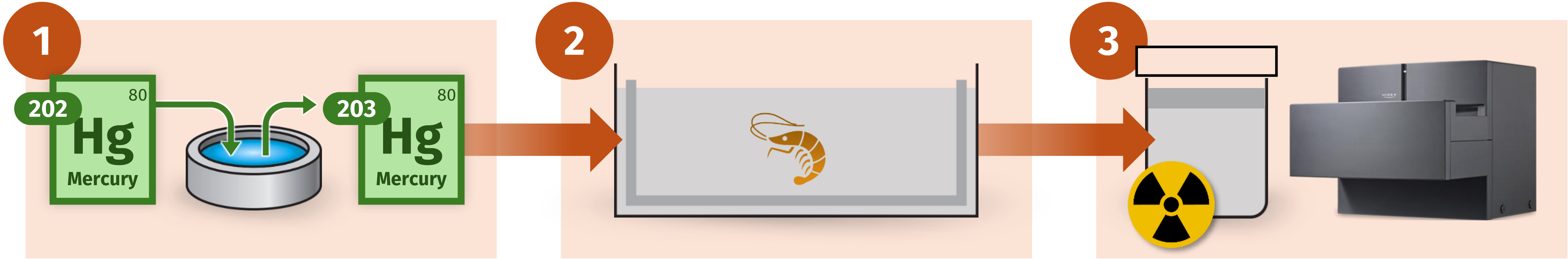
NORM

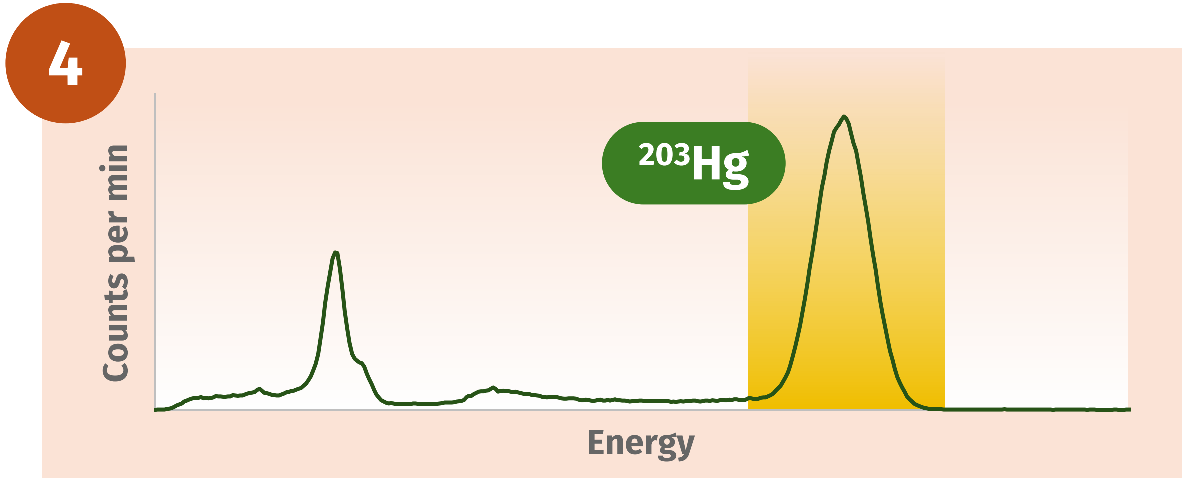
Mercury

ANSTO

Mercury ecological risk assessment

^{203}Hg radiotracing





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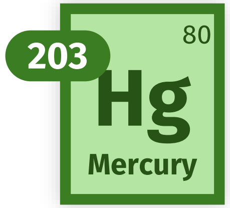
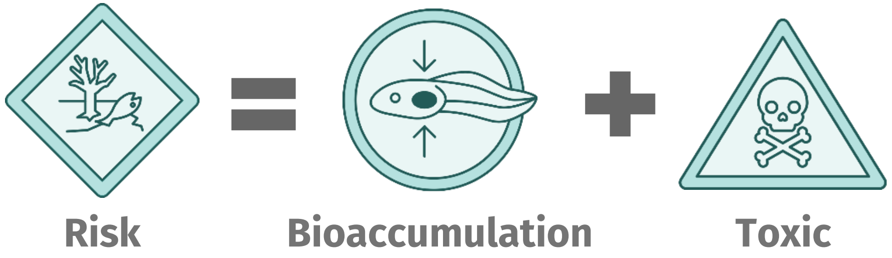
Radiolabel different contaminant sources:

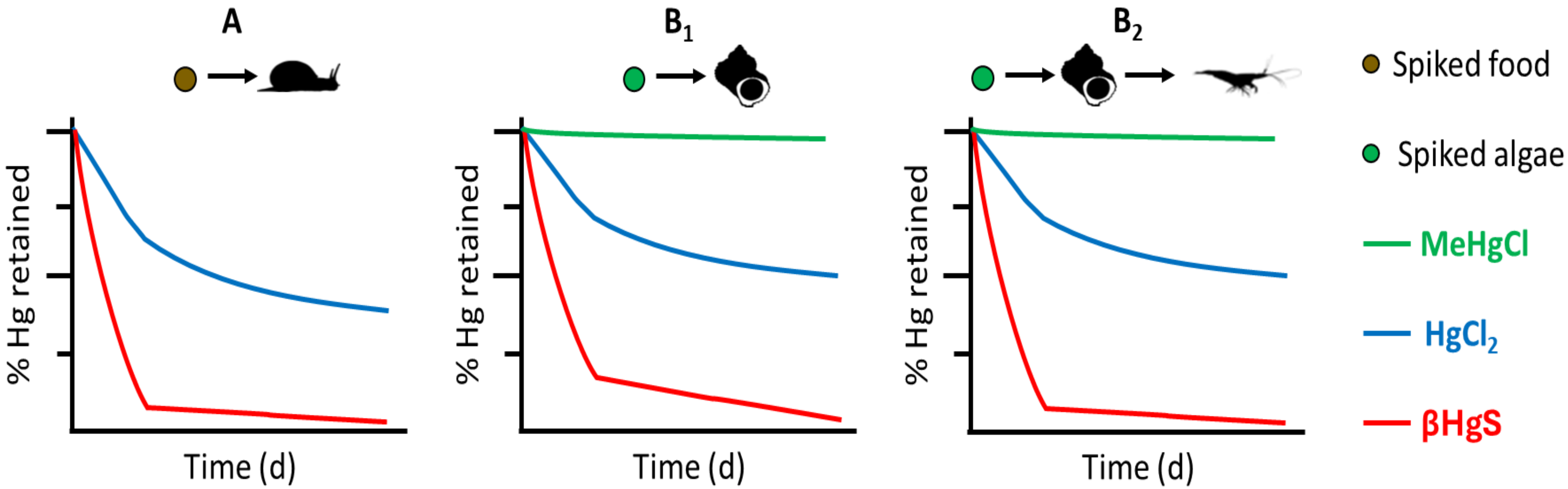
ANSTO

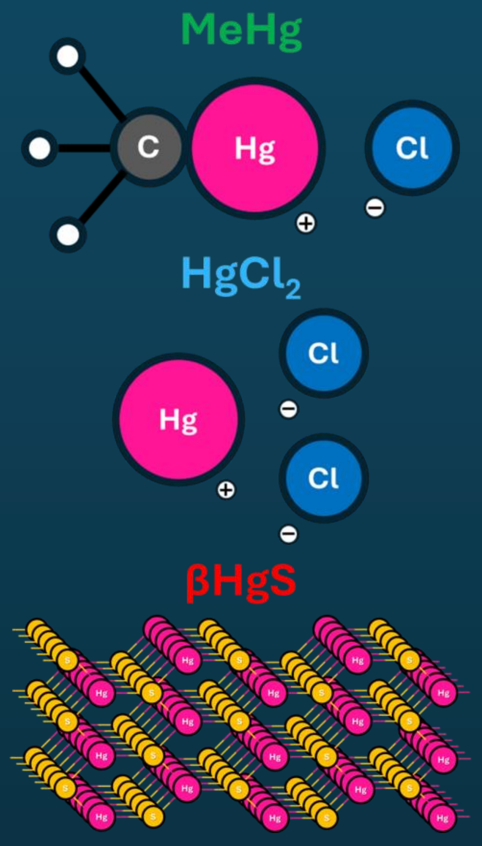
Mercury risk

Bioaccumulation using radiotracers





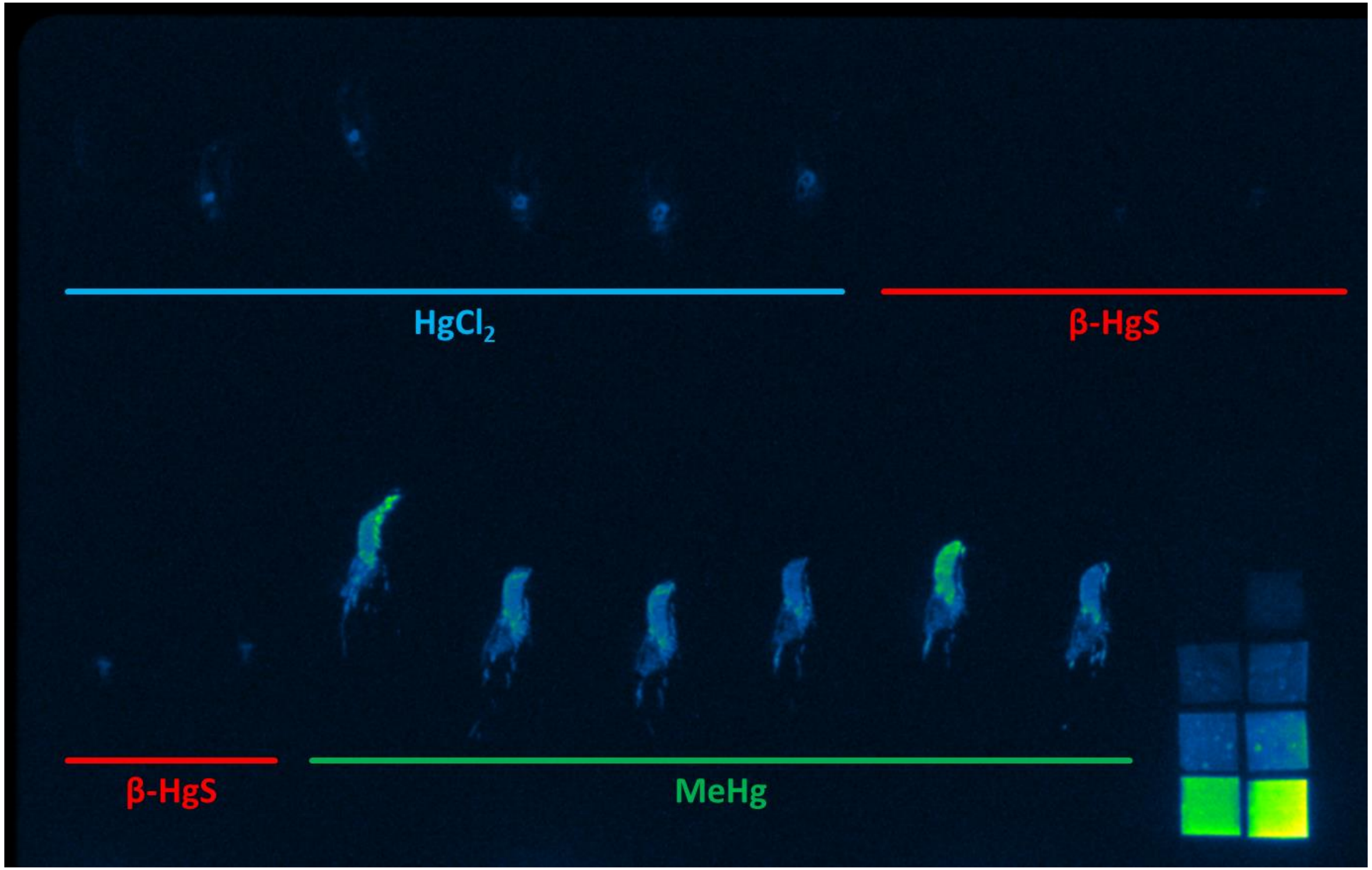


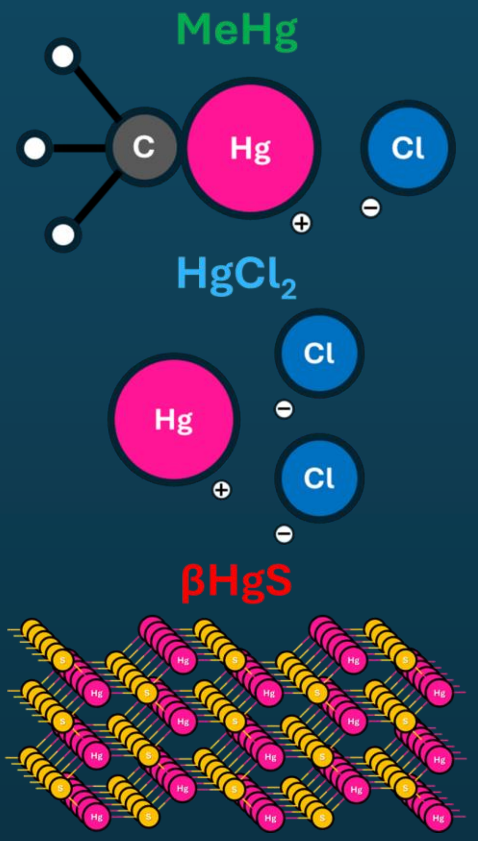


ANSTO

Mercury risk

Bioaccumulation using radiotracers





ANSTO

Future research

1. Understanding the solubility of metacinnabar (β-HgS) in seawater under different conditions.
2. Understanding the potential for methylation of β-HgS in marine sediments.
3. Improve understanding of Hg biomagnification in marine food webs from subsea infrastructure as a source.
4. Determine speciation-based marine water quality guidelines for mercury.

ANSTO

Connect with me
Dr Tom Cresswell

Australian Government

ANSTO

An environmental risk assessment framework for NORM and mercury

Dr Darren Koppel
Dr Tom Cresswell

Australian Government | Australian Institute of Marine Science

National Decommissioning Research Initiative

Environmental risk assessment framework for the offshore decommissioning of NORM and mercury contaminated oil and gas infrastructure

Dr Darren Koppel and Dr Tom Cresswell

2025

CODA Centre of Decommissioning Australia

Australian Government

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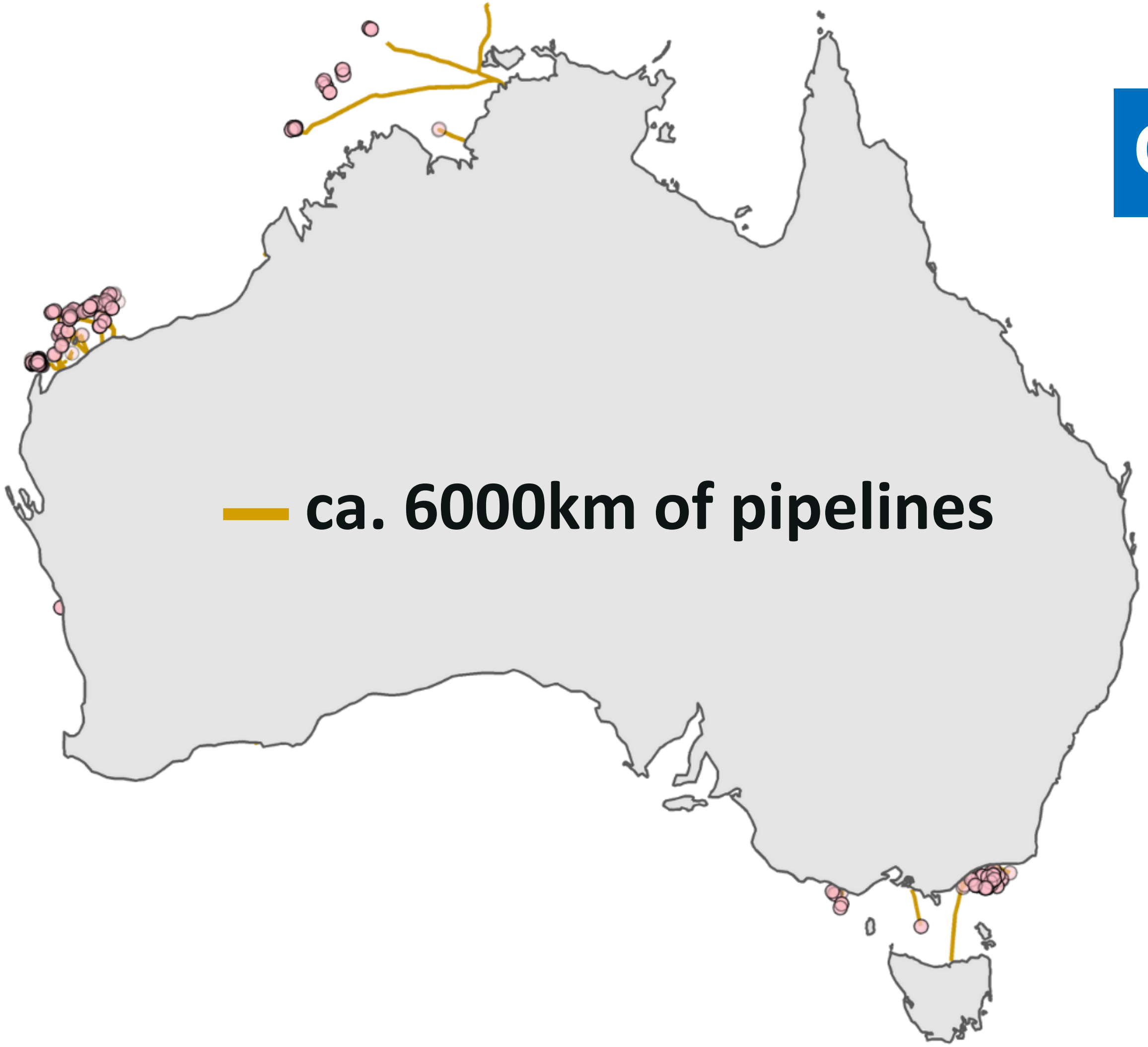


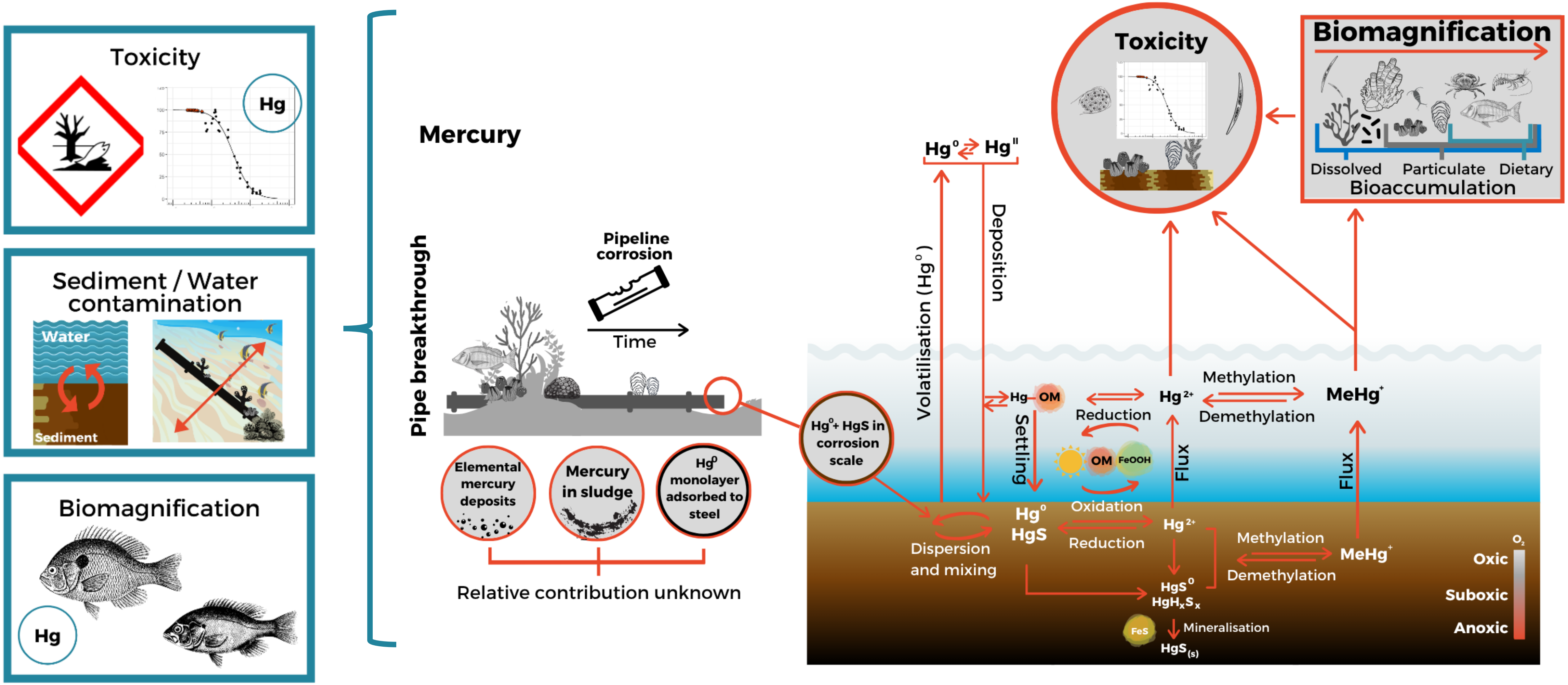
Contaminant inventory estimates

223–1674 t NORM [1]

16-91 t Mercury [2]

[1] Marsden Jacob Associates (2024) *Management of mercury when decommissioning offshore oil and gas infrastructure,* Marsden Jacob Associates Pty Ltd., Perth, Australia, https://www.industry.gov.au/sites/default/files/2025-02/managing-mercury-when-decommissioning-offshore-oil-and-gas-infrastructure.pdf, accessed 4 March 2025.
[2] McKay S, Higgins SA and Baker P (2020) 'NORM inventory forecast for Australian offshore oil and gas decommissioned assets and radioactive waste disposal pathways', *The APPEA Journal*, 60(1):19–33, doi:https://doi.org/10.1071/AJ19159.

Mercury impacts



Kho F, Koppel DJ, von Hellfeld R, Hastings A, Gissi F, Cresswell T and Higgins S (2022) 'Current understanding of the ecological risk of mercury from subsea oil and gas infrastructure to marine ecosystems', Journal of Hazardous Materials, 438:129348, doi:10.1016/j.jhazmat.2022.129348.

Australia - complete removal by default

Leaving infrastructure in situ may be permissible in limited circumstances where:

1. Activity is consistent with the principles of ecologically sustainable development
2. Environmental impacts and risks are acceptable
3. Environmental impacts and risks are ALARP
4. Meets our international convention obligations

Need for an environmental risk assessment framework

Clarify data needs for risk assessments

Align regulatory requirements to good science

Ensure assessments are contaminant-appropriate

Ensure assessments reflect a decommissioning-specific exposure scenario

Is not regulatory guidance or advice


NDRI National Decommissioning Research Initiative

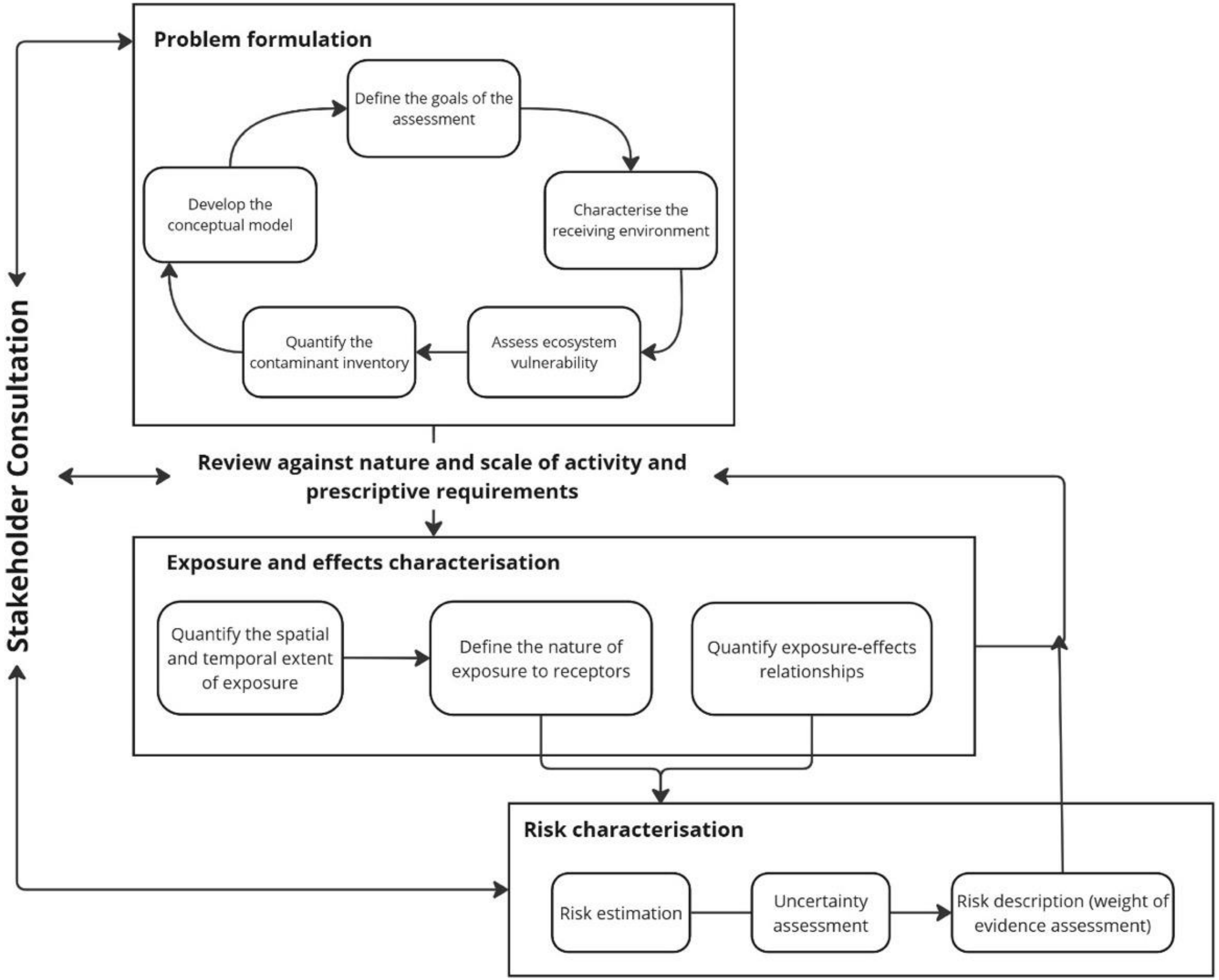
Environmental risk assessment framework for the offshore decommissioning of NORM and mercury contaminated oil and gas infrastructure

Dr Darren Koppel and Dr Tom Cresswell

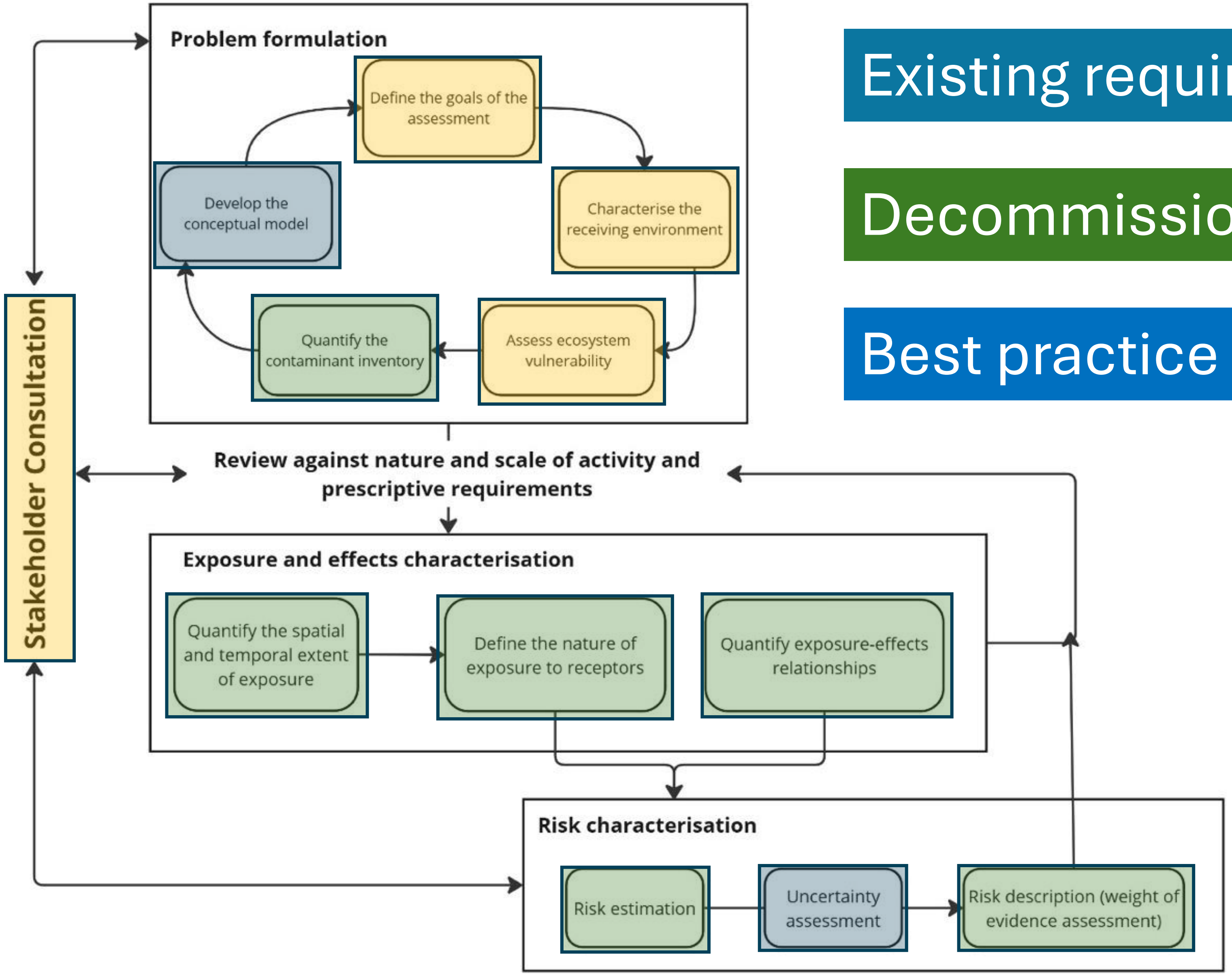
2025

CODA Centre of Decommissioning Australia

The assessment framework



The assessment framework

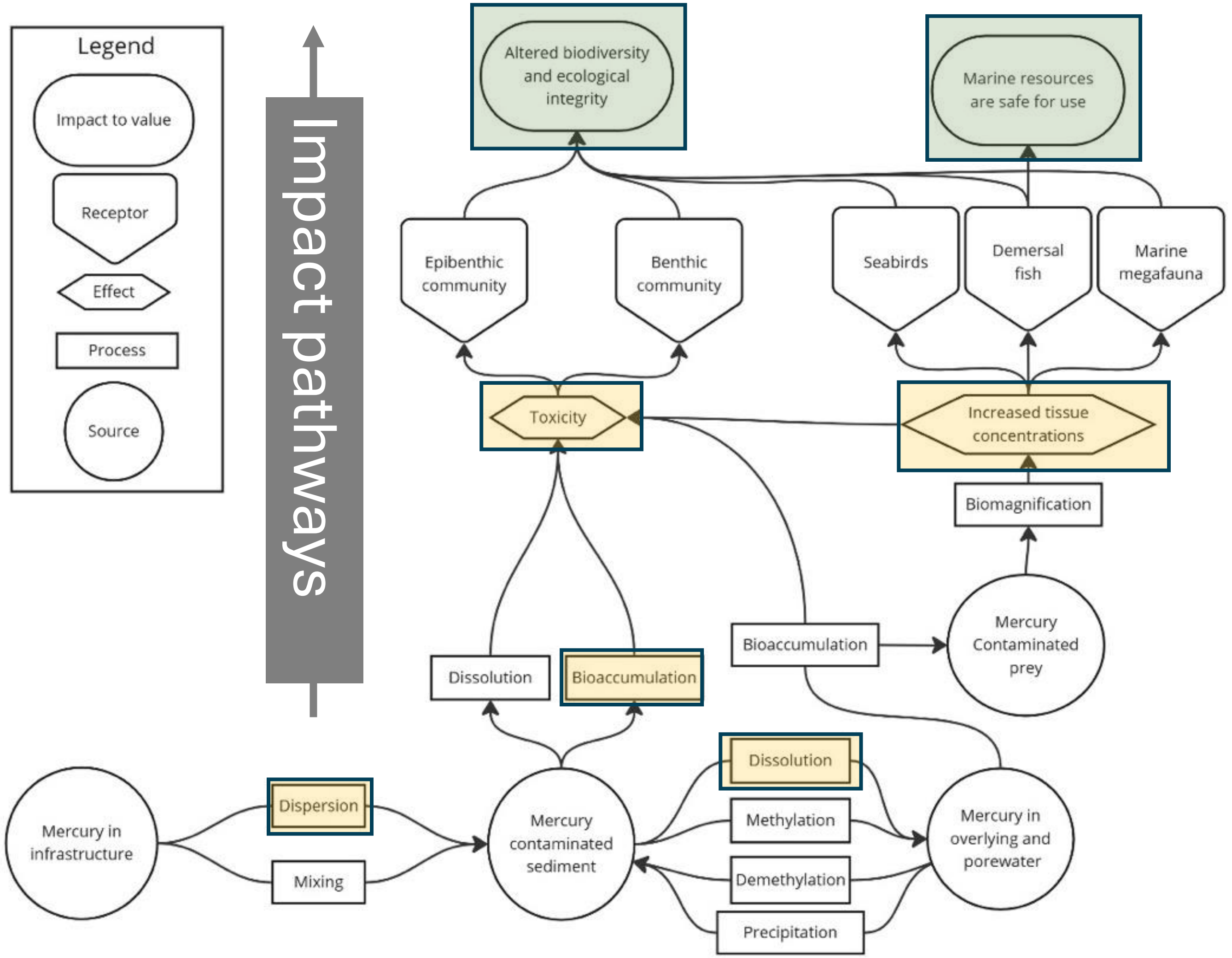


Existing requirements (all activities)

Decommissioning requirements

Best practice

Applying the framework



Cause effect pathways

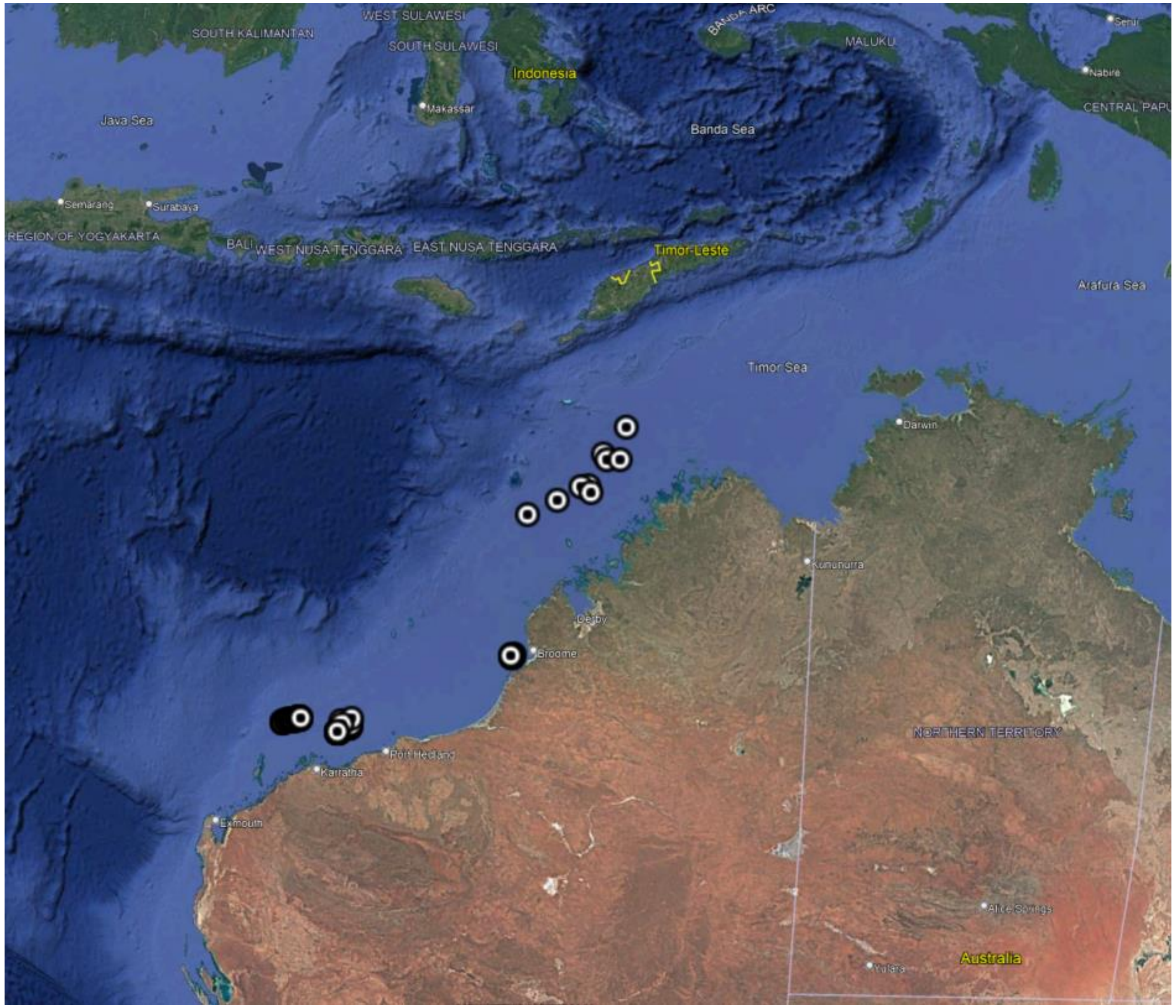
Potential impacts

Multiple lines of evidence

Weight of evidence

Uncertainty assessment

Mercury research at AIMS



Baseline environmental mercury concentrations

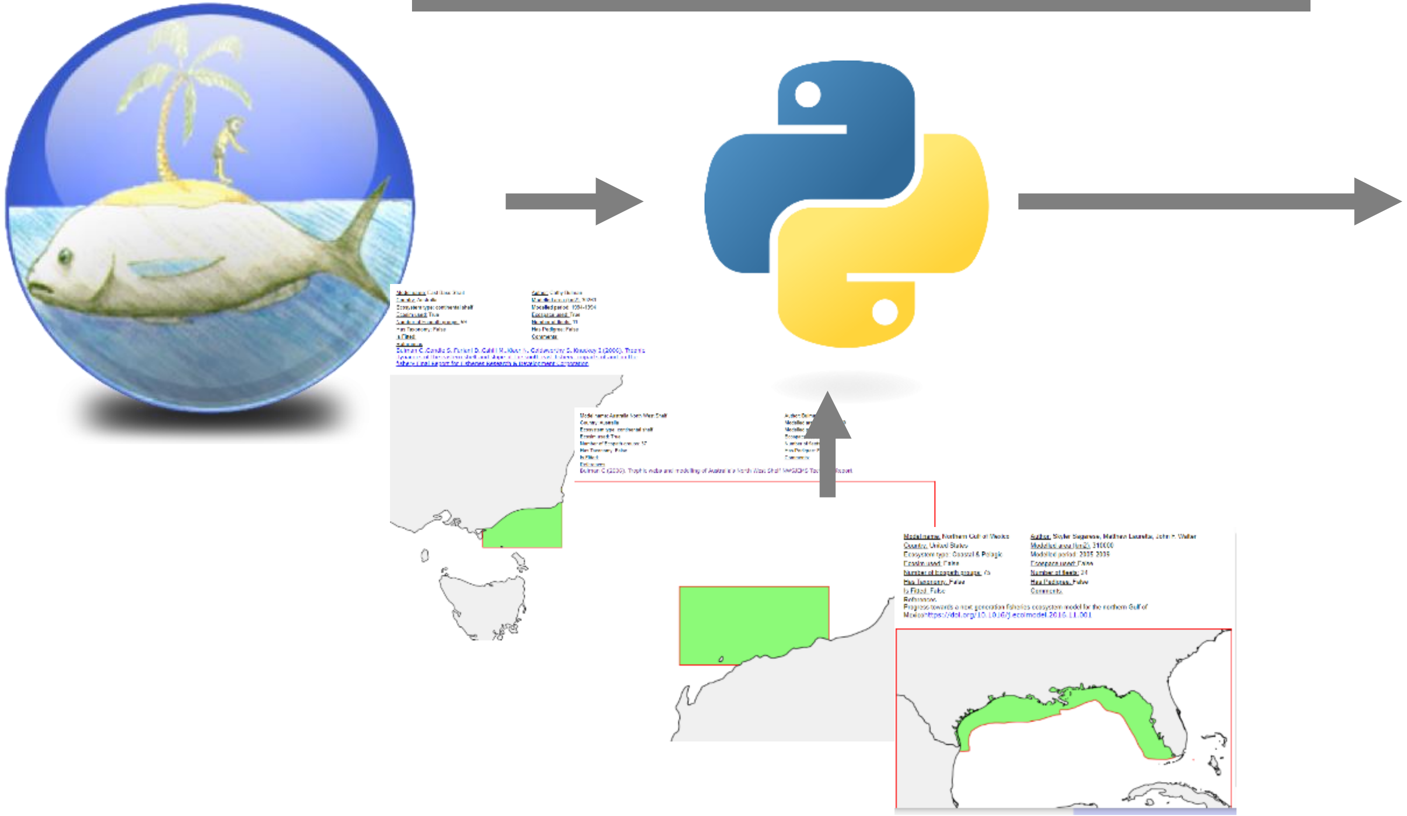
- Commercially important fish
- Marine megafauna
- Marine sediments

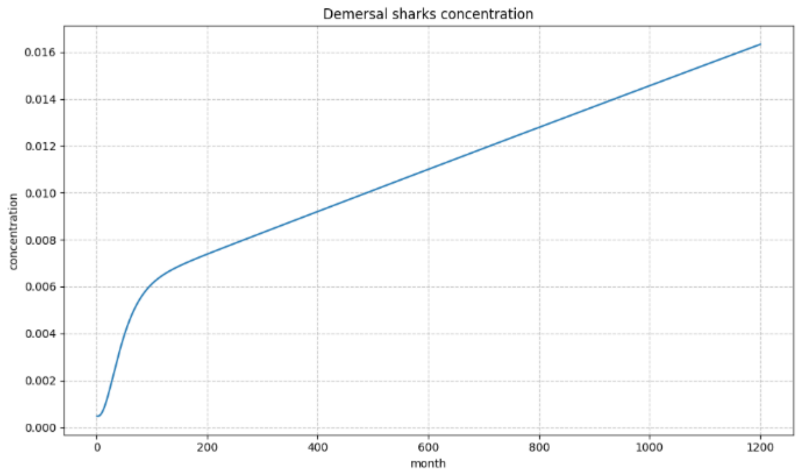
Mercury mobility in sediment

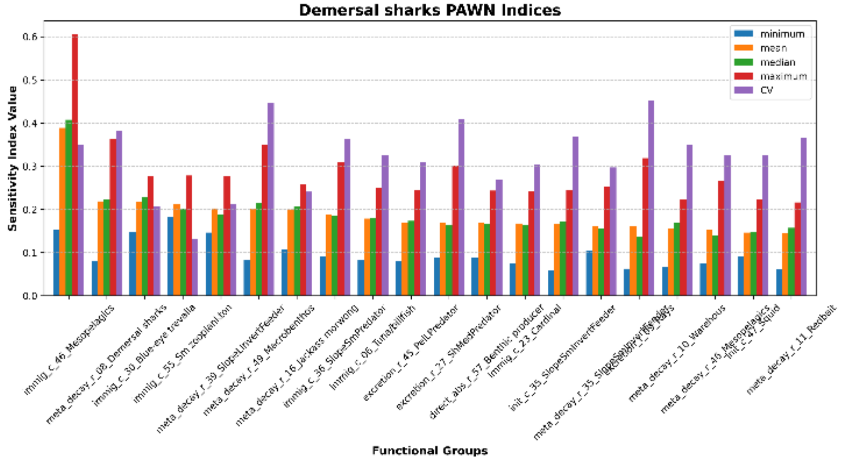
Mercury biomagnification

Marine food-web sensitivity to mercury inputs

AIMS Decision Support Team







Thank you

Dr Darren Koppel

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Australian Government | Australian Institute of Marine Science

NDRI National Decommissioning Research Initiative | CODA Centre of Decommissioning Australia

“Mercury in Oil and Gas: A Regional Approach – The Experience in South America”

Gaspar Corra
Department of Exact and Natural Sciences – Buenos Aires Institute of Technology.
Instituto Tecnologico de Buenos Aires (ITBA)

Regional Overview: South America

- South America has the **second-highest mercury concentrations in crude oil** globally (after Asia), with **about 11% of crudes exceeding 15 ppb Hg**.
- The information is fragmented given by different private and official sources.
- **Weak data exchange between countries limits regional cooperation and policy development.**
- Strengthening **regional cooperation** is essential to close data and technology gaps.

Case study: Austral basin

- The Austral Basin, located in southern Argentina and Chile, includes **both onshore and offshore** oil and gas production areas.
- Field data indicate some of the **highest measured mercury levels** in hydrocarbons in the region.
- There are basin's operations in Tierra del Fuego, an Argentine island-province with limited transport connections to the mainland.

Operational Impacts, Mercury Waste and Health

•Operational impacts include **catalyst deactivation, corrosion, and amalgamation** in metallic equipment.

•Generation of **mercury-containing hazardous waste**, such as contaminated filters, pipes, and processing units.

•**Oily sludges**, consisting of solids, water, and heavy cuts, present **high mercury concentrations — up to ~35,000 ppb** in some open air waste pits.

•These sludges qualify as **mercury waste** under the *Minamata Convention* (Article 11).

•**Occupational incidents** related to mercury exposure have occurred, **compromising workers health and safety** during maintenance of affected units.

Environmentally Sound Management Barriers

- **Technologies for hazardous waste treatment and final disposal on the island are limited** and **may not represent the best available technologies (BAT)**.
- Argentina's **federal system** gives provinces authority over hazardous-waste transport.
- Off-island transfers of hazardous waste are **highly restricted**, and the nearest authorized treatment facility may be **over 1,000 km away by land, through Chile**.
- The **Basel Convention** restricts cross-border movement of hazardous waste, while the **Minamata Convention** calls for environmentally sound management.
- Together, these conditions create **logistical, technical, and regulatory barriers** for proper management.

Path Forward / Regional Cooperation

- **Promote regional technology transfer and cooperation** for capacity building and training.

- **Establish a shared regional platform** for mercury data, monitoring, and best-practice exchange.

- **Enhance coordination** among the Basel and Minamata Conventions and occupational health frameworks.

- **Foster dialogue between governments, industry, and academia** to accelerate practical solutions.

Gaspar Corra
Department of Exact and Natural Sciences – Buenos Aires Institute of Technology.
Instituto Tecnologico de Buenos Aires (ITBA)

Questions and discussion

Closing Remarks: Ludovic Bernaudat
Head of Knowledge and Risk Unit UNEP