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end of life management

UNEP
GLOBAL
MERCURY
PARTNERSHIP

Mercury waste
management Area*



UN
environment
programme



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Yellowfin Tuna, Courtesy NOAA Fisheries, © Photo by Jeff Muir

“Treating Mercury Wastes: Tools and Technologies”

Online webinar, 15 February 2022

Views expressed are those of speakers and do not reflect those of UNEP or the Global Mercury Partnership Secretariat

Smooth running of the meeting - Few tips

- All participants are now muted
- Participants can also use the “Chat” to ask technical questions or share views with panelists and participants (select the option to “everyone” if you wish to send a chat to all attendees, including panelists)
- The meeting will be recorded, presentation slides and recorded video will be available after the event on the UNEP Global Mercury Partnership website

UNEP GLOBAL MERCURY PARTNERSHIP

Mercury waste management Area*



Provisional Agenda

Opening remarks

Teeraporn Wiriwutikorn, Ministry of Natural Resources and Environment, Thailand, Co-chair of the Global Mercury Partnership Advisory Group

Session 1: Resources available for the sound management of mercury wastes, introduced by Misuzu Asari, Kyoto University, Lead of the Global Mercury Partnership Area on Waste Management

- ❖ *Overview of tools and guidance: “Catalogue of Technologies and Services on Mercury Waste Management” and “Technical guidelines on the ESM of mercury wastes” under the Basel Convention by Junko Nishikawa, Ministry of the Environment, Japan, lead of the Global Mercury Partnership Area on Waste Management*
- ❖ *Development of Factsheets on the Environmentally Sound Management of certain mercury waste streams by Nicolas Humez, International Solid Waste Association*
- ❖ *Question and Answer Session*

Session 2: Technologies for solution, introduced by Immaculate Javia, Sustainable Alluvial Mining Services

- ❖ *Mercury waste technologies and case studies for the oil & gas and chlor-alkali sectors by Reinhard Schmidt, econ industries services GmbH*
- ❖ *Example of technologies and international cooperation with stakeholders for ensuring the ESM of mercury-containing lamps by Hiroki Iwase, Nomura Kosan Ltd*
- ❖ *Mercury Stabilization – Security and Traceability of Treatment and Practical Applications by Nick Morgan, BATREC*
- ❖ *Question and Answer Session*

Closure

Rodges Ankrah, United States Environmental Protection Agency, Co-chair of the Global Mercury Partnership Advisory Group



Session 2: Technologies for Solution

Introduced by Immaculate Javia, Sustainable Alluvial Mining Services

Treating Mercury Wastes: Knowledge and Technology

Mercury waste technologies and case studies
for the oil & gas and chlor-alkali sector



econ 
INDUSTRIES

Zero industrial waste ...!

Local treatment of mercury wastes

Why?

Basel Convention:

Controlling transboundary movements of hazardous waste and their disposal

econ's Convention – we call it 'Basel 2.0':

Avoidance of transboundary movements of hazardous waste and their disposal

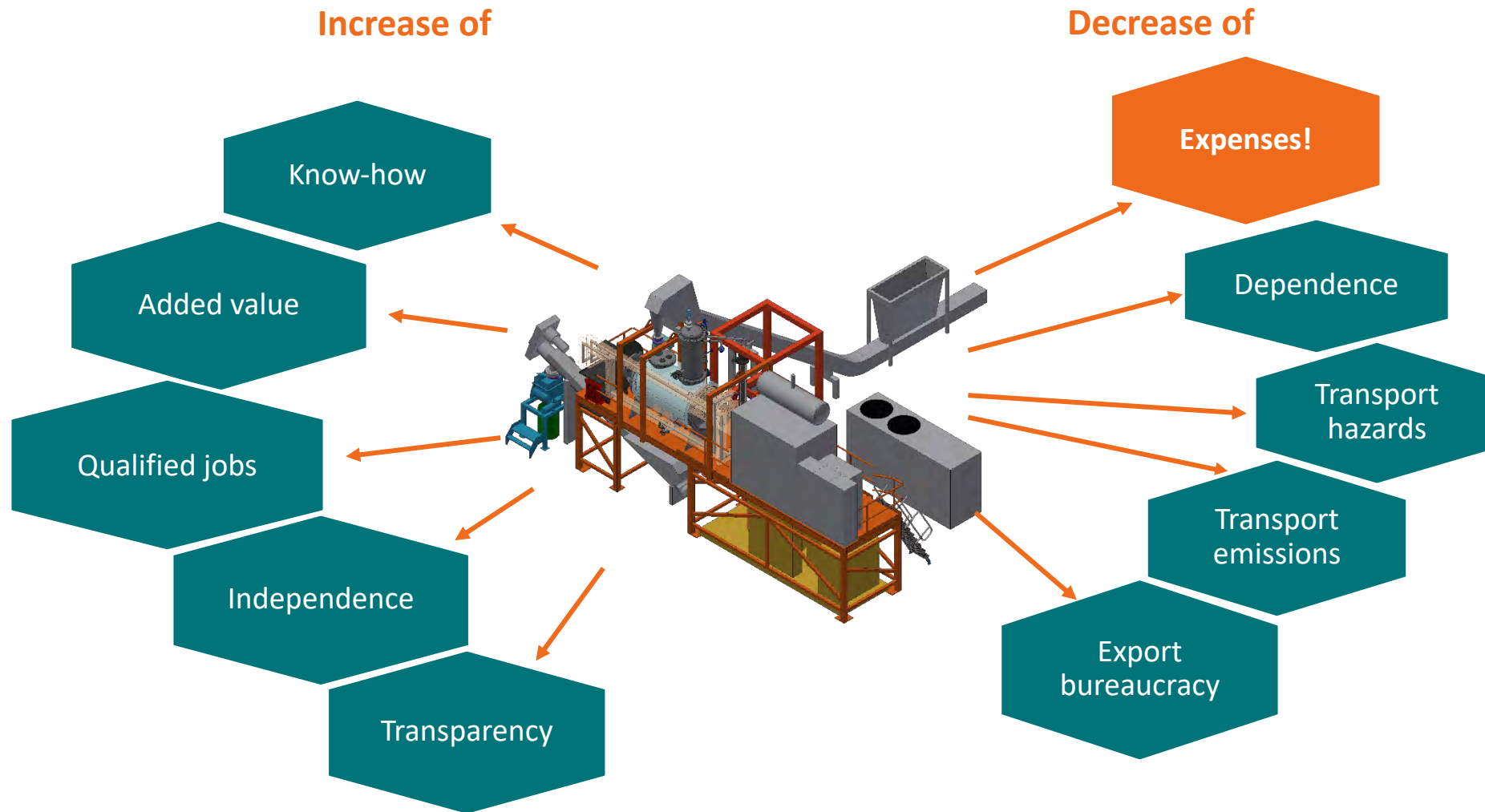
It's all about

taking over responsibility

and **saving money!**

Local treatment of mercury wastes

The benefits



Soils & sludge contaminated with elemental mercury

- Vacuum distillation - VacuDry®
eventually after soil washing → only the fine fraction goes into thermal treatment
- max. 400 °C; low vacuum < 50 mbar abs

Spent activated carbon & catalysts contaminated with mercury compounds

- High temperature treatment - HTTU
- max. 1,000 °C; atmospheric pressure

Pure elemental mercury

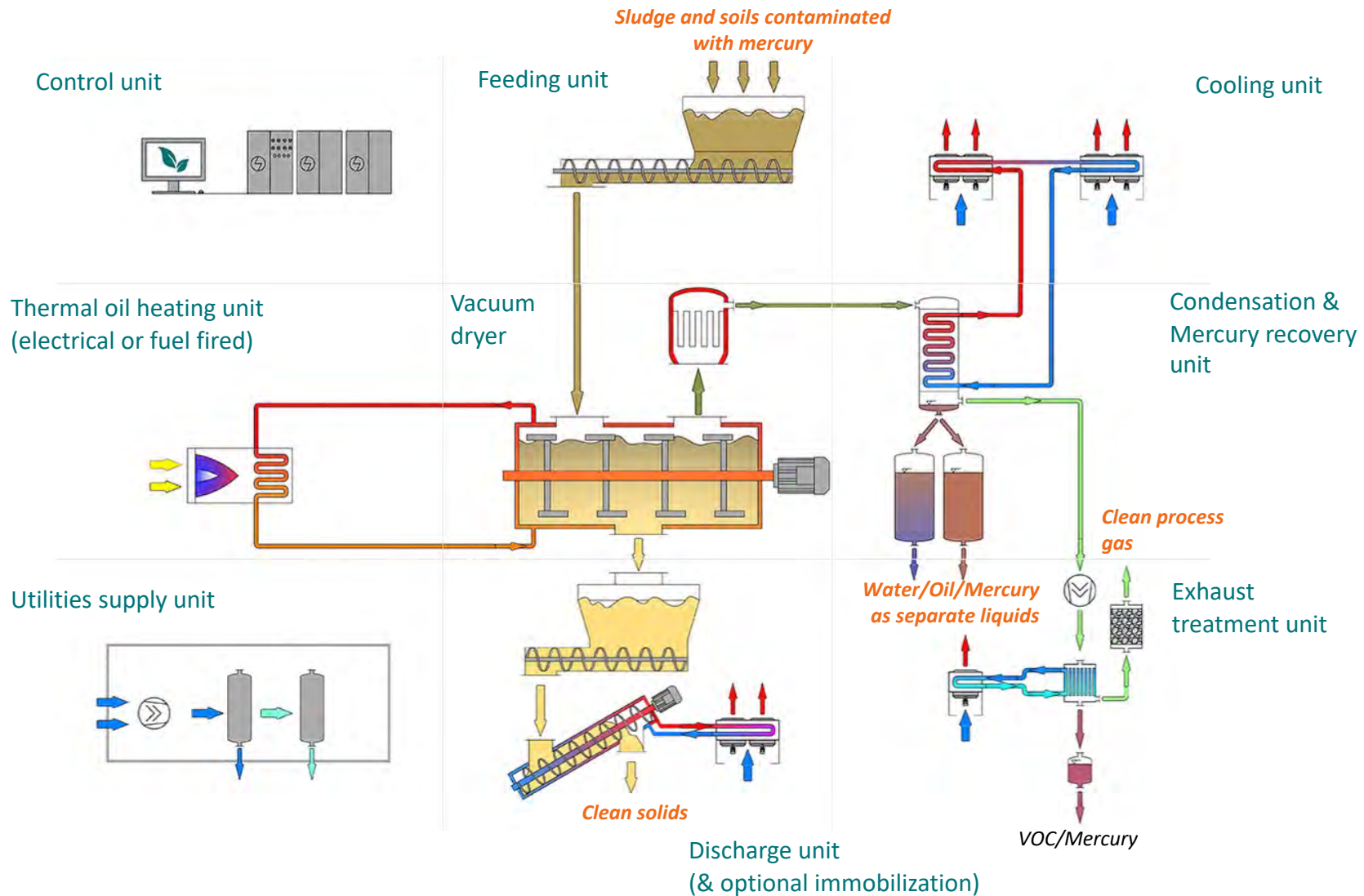
- Conversion to HgS
- max. 200 °C; atmospheric pressure

Market position

- econ's proprietary VacuDry[®] technology is a vacuum distillation process; it uses low heat and vacuum for **safe and efficient separation of materials** like **mercury** and **hydrocarbons** as well as other evaporable contaminants from solids
 - econ's technology is **flexible** to deal with all typical industrial waste consistencies such as **soils, crushed building rubble, landfilled residues, lagoon sediments, sludge, filter & centrifuge cake, spent catalysts, spent active carbon, powder, etc.**
 - econ's scope of supply and services includes equipment manufacturing, commissioning and operator training
- **leading solutions to recover valuable resources from hazardous wastes and contaminated soils**

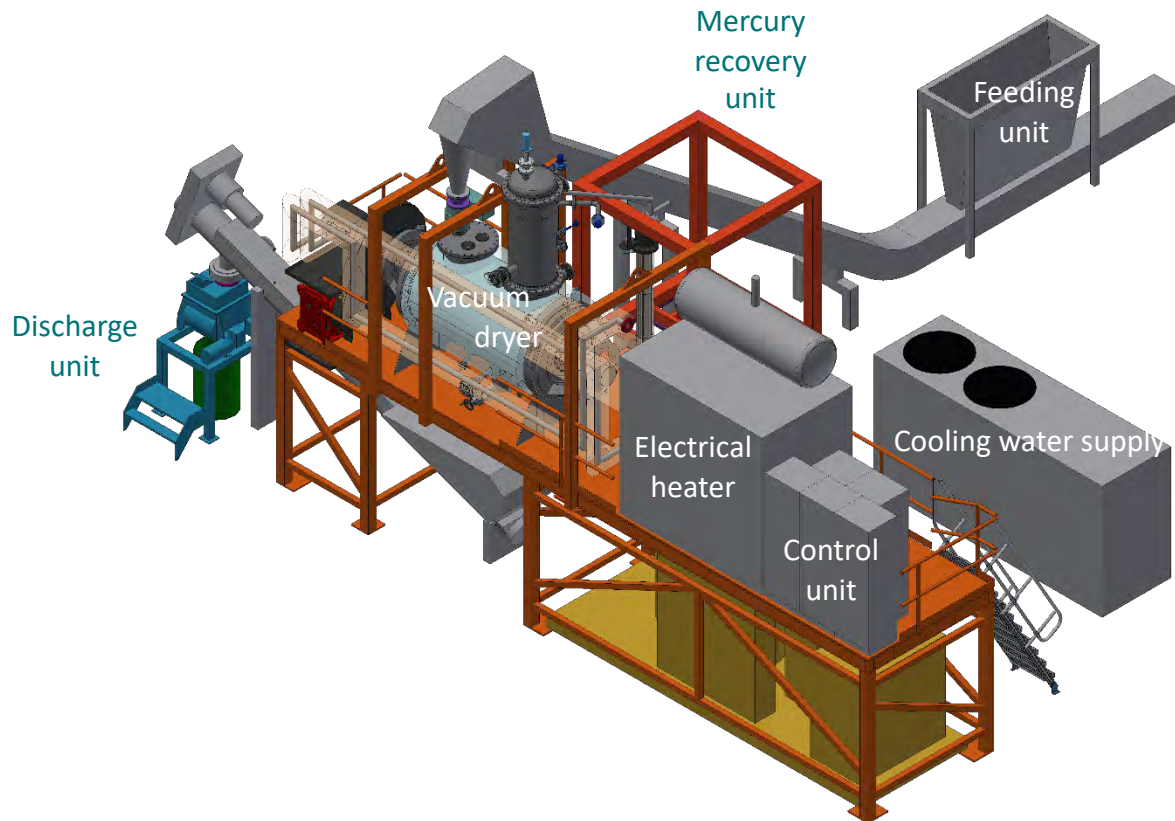
Soils & sludge contaminated with elemental mercury

Vacuum distillation - VacuDry®



Soils & sludge contaminated with elemental mercury

Vacuum distillation - VacuDry®



CAPEX:
30 to 150 €/ton
usage time 10+ years
250 to 600 m² workspace

OPEX:
< 35 €/ton for energy
1 – 2 operators
< 20 €/ton other costs
Disposal separated fractions

Mobile & fixed, skid-mounted units with throughput from 5 to 500 tons per day

Soils & sludge contaminated with elemental mercury

VacuDry[®] Vacuum distillation – 10 tons / day

Location: Western Australia



Soils & sludge contaminated with elemental mercury

VacuDry® Vacuum distillation – 10 tons / day

Location: India



Soils & sludge contaminated with elemental mercury

Vacuum distillation - VacuDry®

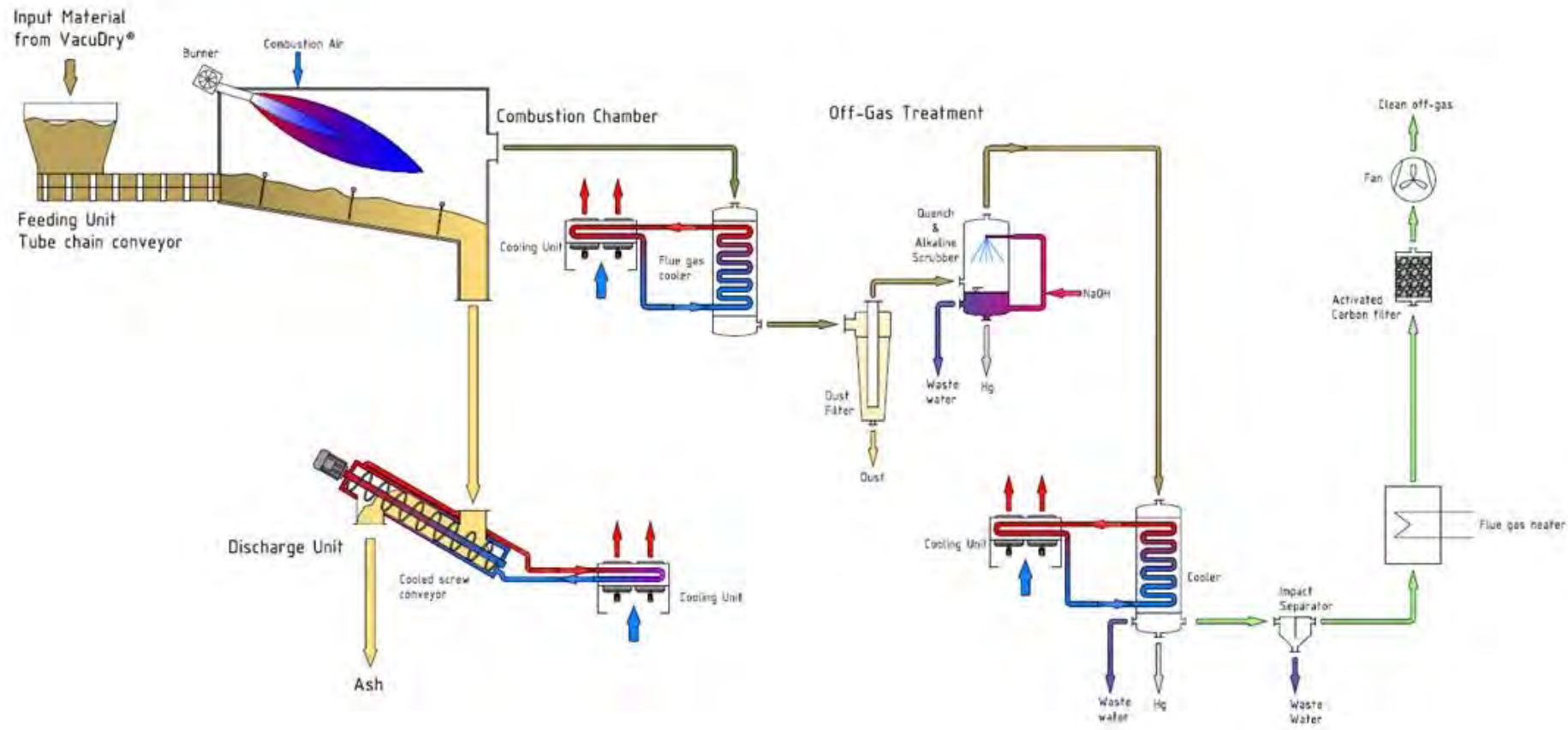
Units available with throughput ranging from 5 to 500 tons per day

Exemplary projects:

- **Germany** (in operation since 1998!) – hydrocarbon and mercury containing wastes from LNG production (with and without NORM)
- **Australia; Brunei** – LNG wastes and tank cleaning sludges containing oil and mercury
- **France** – contaminated soils from former chemical plant
- **India** – contaminated soils from former thermometer factory (combined with soil washing)

Soils & sludge contaminated with elemental mercury

HTTU - high temperature treatment unit



Wastes contaminated with mercury compounds

HTTU - high temperature treatment unit



Wastes contaminated with mercury compounds

HTTU - High Temperature Treatment Unit

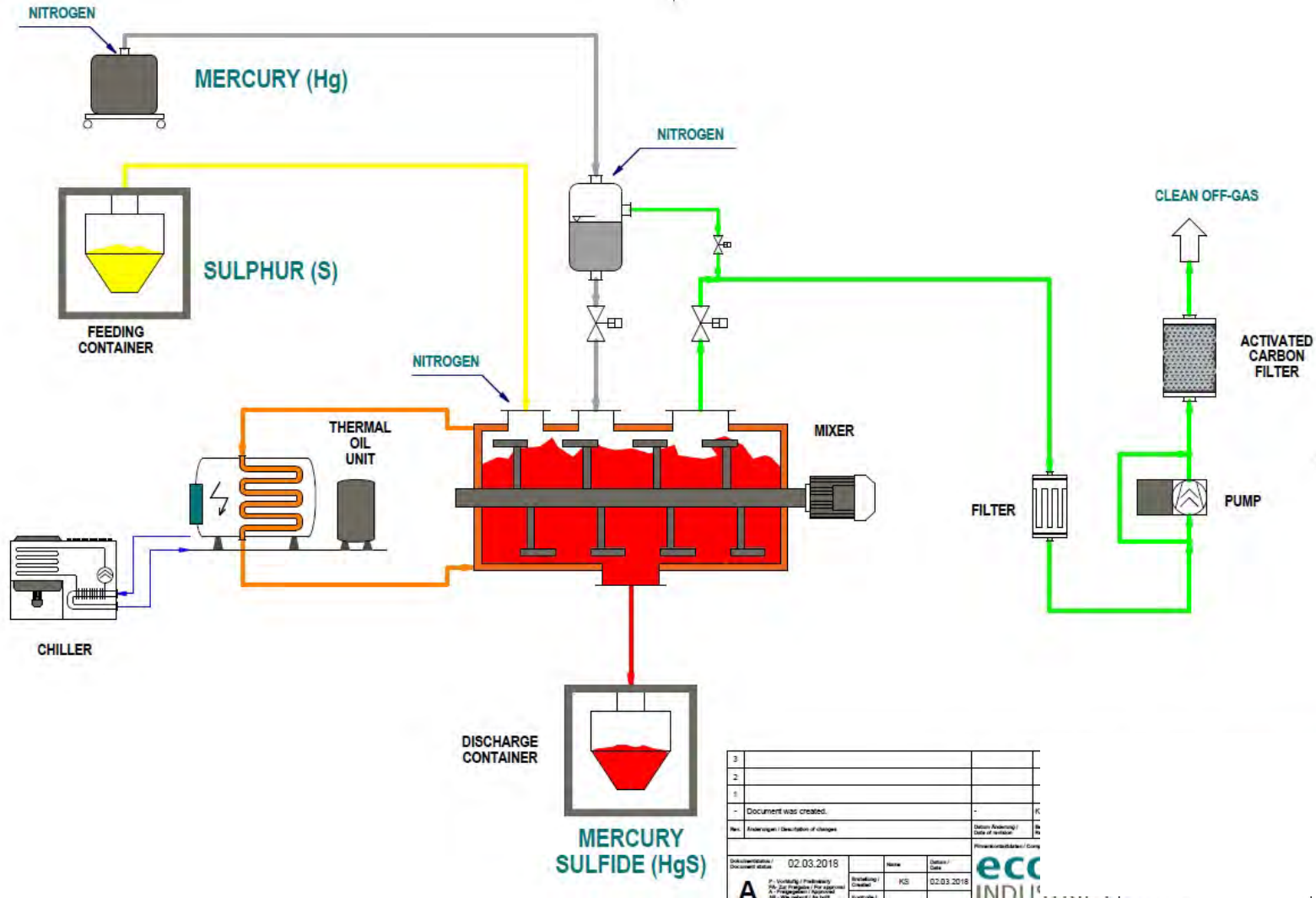
Modular equipment available starting from 100 kg throughput per day

Exemplary projects

- **Australia** – spent catalyst from LNG facilities containing hydrocarbons and mercury
- **Europe** – spent catalyst from LNG facilities containing hydrocarbons and mercury

Pure elemental mercury conversion to HgS

MMCU - Mobile Mercury Conversion Unit



Pure elemental mercury conversion to HgS

MMCU - Mobile Mercury Conversion Unit – 200 kg/day

Elemental
Mercury



Elemental
Sulphur



Mercury
sulphide
(HgS)



Pure elemental mercury conversion to HgS

MMCU - Mobile Mercury Conversion Unit – 5,000 kg/day

Elemental
Mercury



Elemental
Sulphur



Mercury
sulphide
(HgS)



Pure elemental mercury conversion to HgS

MMCU - Mobile Mercury Conversion Unit

Units available starting from 100 kg
up to 5 tons per day throughput

- Transparency - Conversion of mercury directly at client facility
- High throughput - short project duration
- Lowest price- due to reduced requirements for mercury storage transport and short disposal path
- Technical reliability - robust and easy to operate semi-automatic system

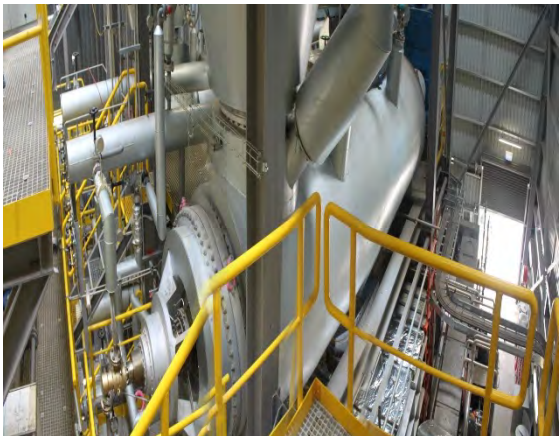
CAPEX:

200 to 1,000 €/ton
usage time 10+ years
50 to 250 m² workspace

OPEX:

< 20 €/ton for energy
1 – 2 operators
< 100 €/ton other costs
Final disposal locally

Larger References > 50 tons/day



Do you want to treat mercury wastes?

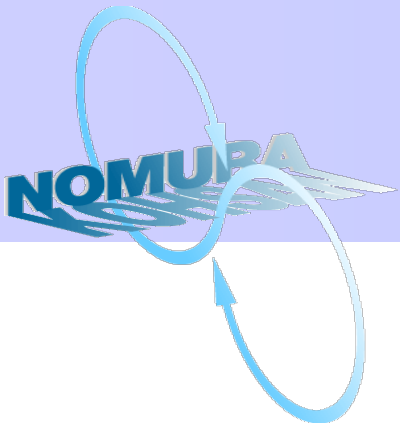
Ask our team: We are all enthusiastic about what we do, but **it's not rocket science!**



Zero industrial waste ...!



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Example of technologies and international cooperation with stakeholders for ensuring the environmentally sound management of mercury-containing lamps

Nomura Kohsan Co., Ltd.
Hiroki Iwase

15 February 2021

1. Overview of Nomura Kohsan
2. Treatment Process
3. Examples of International cooperation
the Philippines
Malaysia



1. Overview of Nomura Kohsan



Overview of Nomura Kohsan

Company Name : Nomura Kohsan Co., Ltd.

Established : December 10th , 1973

Capital: 182,095,000Yen

Employees: 263 (As of July 1, 2021)

Head Office : Tokyo

Treatment facility

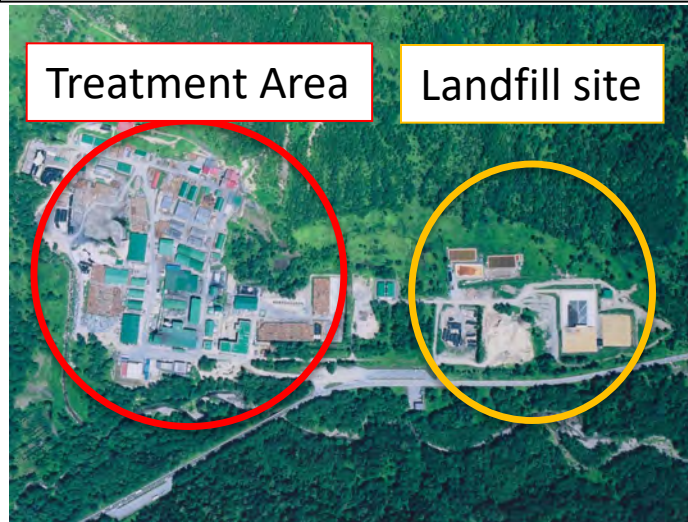
Itomuka Plant (Hokkaido)

Kansai Factory (Osaka)

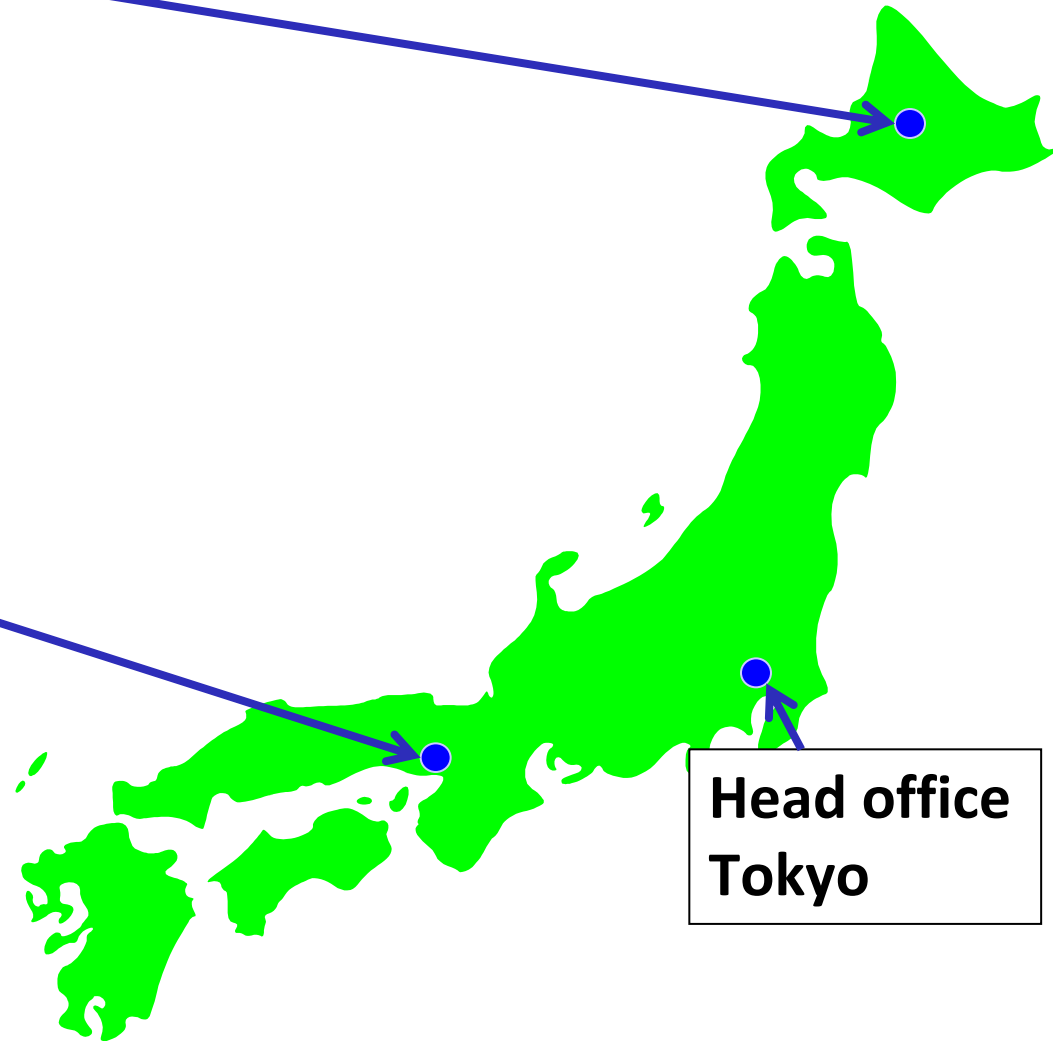


Overview of Nomura Kohsan

Itomuka Plant, Hokkaido



Kansai Factory, Osaka



Overview of Nomura Kohsan

We treat a total of **33,400** tons
of mercury waste in 2020

-**16,700** tons of dry-cell batteries

-**9,000** tons of fluorescent lamps

-**7,700** tons of other types of waste



2. Treatment process



Roasting process

- Waste is heated at a temperature between 600°C to 800°C
- The mercury evaporates, which is then collected through a cooling process.



Used Fluorescent Lamp Recycling System

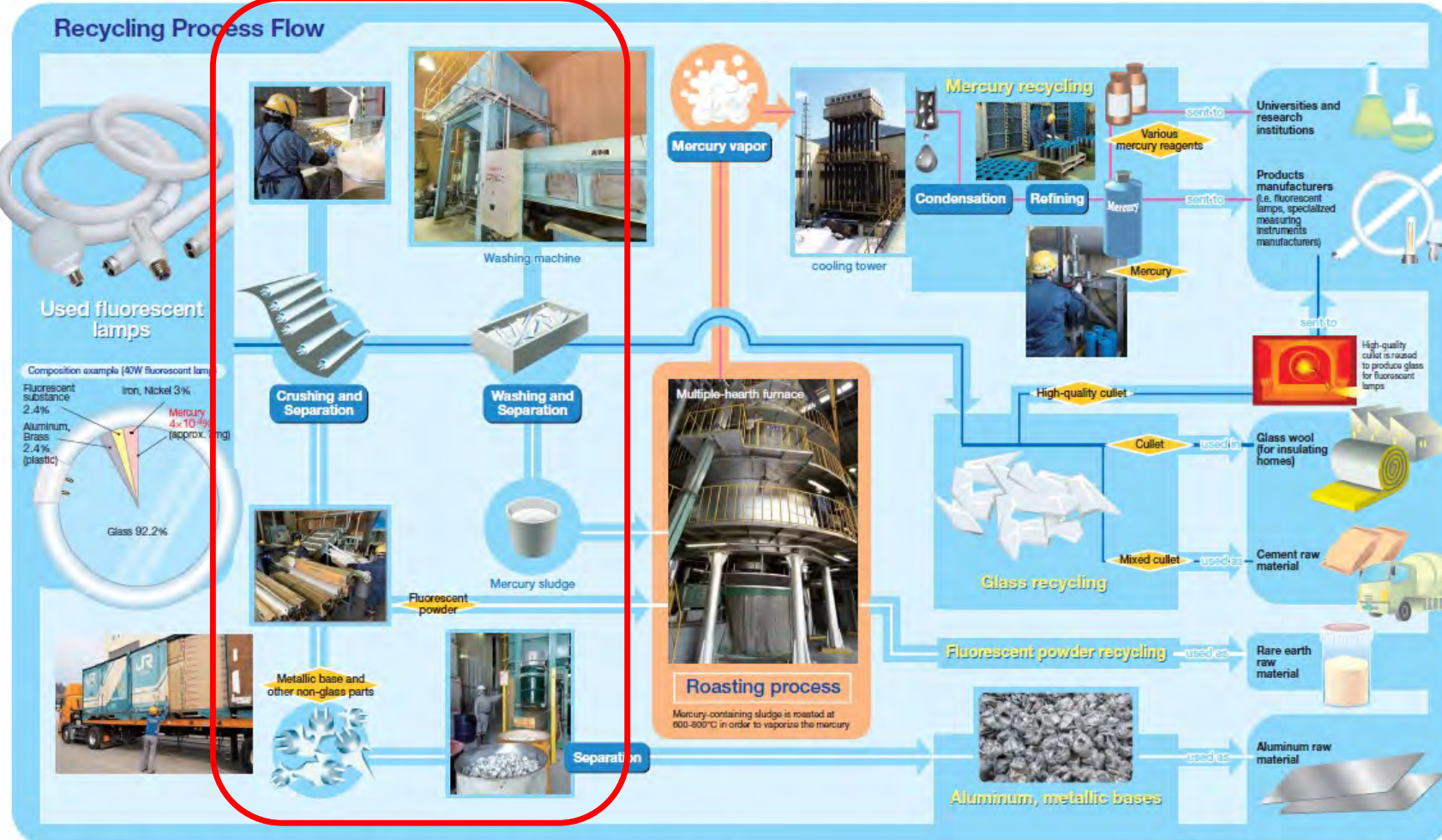


Used Fluorescent Lamp Recycling System



At Nomura Kohsan, used fluorescent lamps are collected and made ready for distribution. Recycled glass can be transformed into glass wool insulation for homes and raw glass converted into aluminum raw material. Mercury is recovered from wastewater and can be reused in new fluorescent lamps.

Kansai Factory



*For more information regarding plant visitations and where we deliver our recycled products, please contact our sales representative at info@nkl.jp

Nomura Kohsan Co., Ltd.



3.Examples of International cooperation

the Philippines case
Malaysia case



The Philippines

Conducted activities for the Philippines From 2014 to 2016

- 1) **Field surveys** (Manila, Cebu)
- 2) In-country **workshops** (Manila, Cebu)
- 3) **Training** in Japan
- 4) **Installation** of a **lamp crusher** for two local companies.



Imported crushed lamps to Itomuka plant

2017 30t

2019 13t

The Philippines

1) Field surveys

- Meeting with Government office
Department of Environment and Natural Resources(DENR)
Cebu city
- Field visits to Private sector
Waste management company
Final landfill site
Waste Generator



The Philippines

2) In-country workshops held in Manila and Cebu

- Contents

Awareness raising of mercury waste management

Announcement of start of fluorescent lamp processing business in the Philippines

- Speakers

Department of Environment and Natural Resources

Cebu city

Waste management company which has a lamp crusher in Cebu City (CCTFI)

NGO (Ban Toxics)



The Philippines

3) Training in Hokkaido, Japan

- Site visit:

Asahikawa city

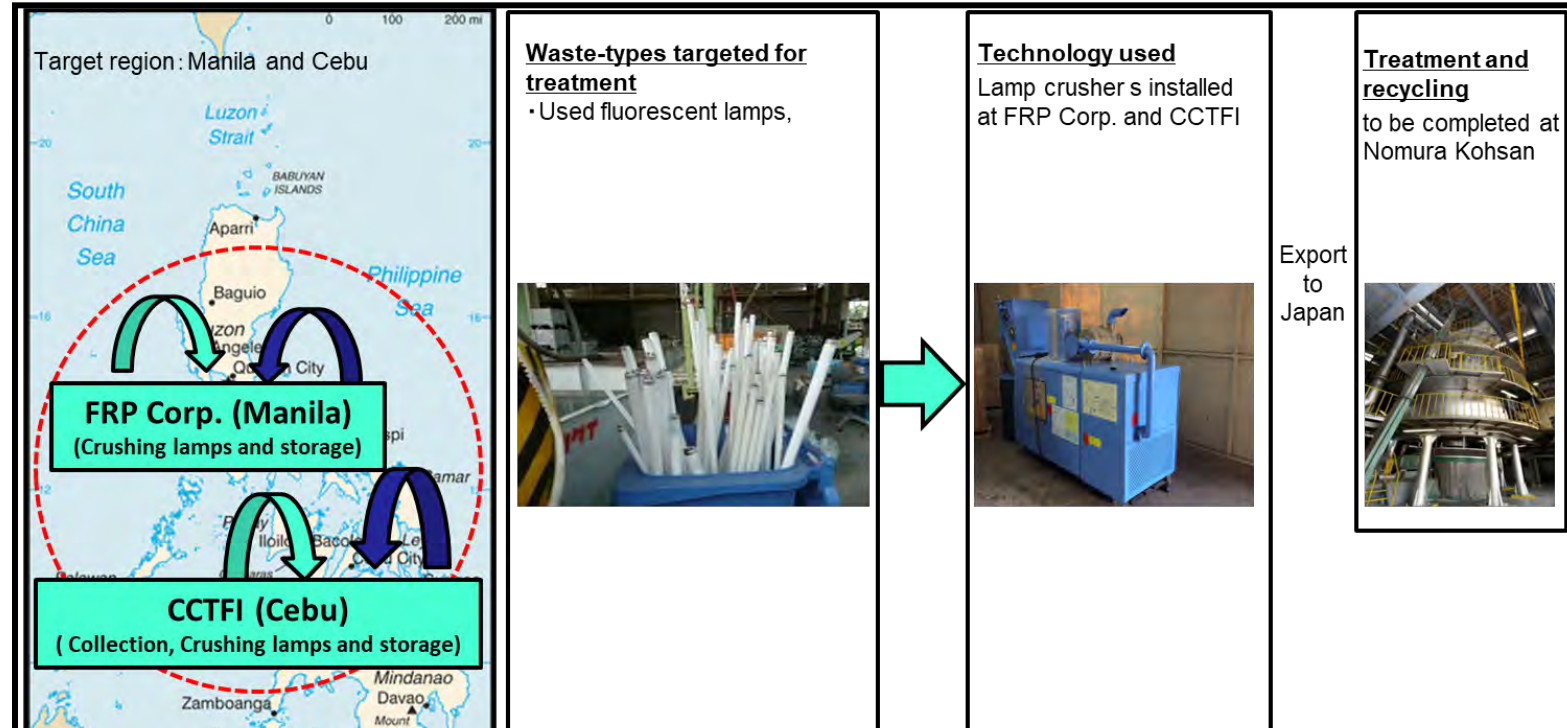
Itomuka Plant of Nomura Kohsan



The Philippines

4) Conclusion

Nomura Kohsan developed sound management of fluorescent lamps as below.



Nomura Kohsan imported the crushed lamps and treats in Itomuka Plant in accordance with the Basel Convention.

The import record is 30t in 2017 and 13t in 2019.



Malaysia

Conducted activities From 2015 to 2016 funded by JICA

1) Field surveys

- Meeting with Government office
Department of environment Malaysia
State of Penang government
- Field visits to Private sector
Waste management company
Final landfill site
Waste Generator



Malaysia

2) Training in Osaka, Japan

- Lecture:

Osaka city and Kyoto City

How to collect fluorescent lamps from household

UNEP IETC

Minamata Convention and Mercury waste management

- Site visit:

Kansai Factory of Nomura Kohsan



3) Conclusion

- Further discussion was continued on collaboration with a local waste treatment company.
- A glass cullet recycler was not found.

Nomura Kohsan proposed the process as below.

- Crush and wash lamps in order to recover mercury containing sludge.
- Dispose residue including glass and metallic base in final landfill site in Malaysia.
- Export mercury containing sludge to Japan under the Basel Convention in order to recover the mercury in Itomuka Plant.

Our proposed facility has not been installed in Malaysia yet.

The collaboration among stakeholders like government, municipality, local waste management companies, waste generators, NGOs is important in order to disseminate sound mercury waste management.

Nomura Kohsan continues to disseminate mercury waste management for foreign countries with the local stakeholders.



Thank you!

For more information,
please contact: iwase@nomurakohsan.co.jp
Or visit our website at: www.nkcl.jp



Nomura Kohsan Co., Ltd.

Mercury stabilisation

Security, Traceability
of Treatment &
Practical Applications



MERCURY STABILISATION BATREC IN A NUTSHELL

BATREC is part of SARP Industries and located in Switzerland



5 core activities



*Mercury stabilisation
Mercury containing waste treatment
Oil & Gas Adsorbents recycling
Activated Carbon reactivation
Battery recycling*

Turnover 2020 16 Mio. CHF
Turnover 2021 ~20 Mio. CHF

MERCURY STABILISATION

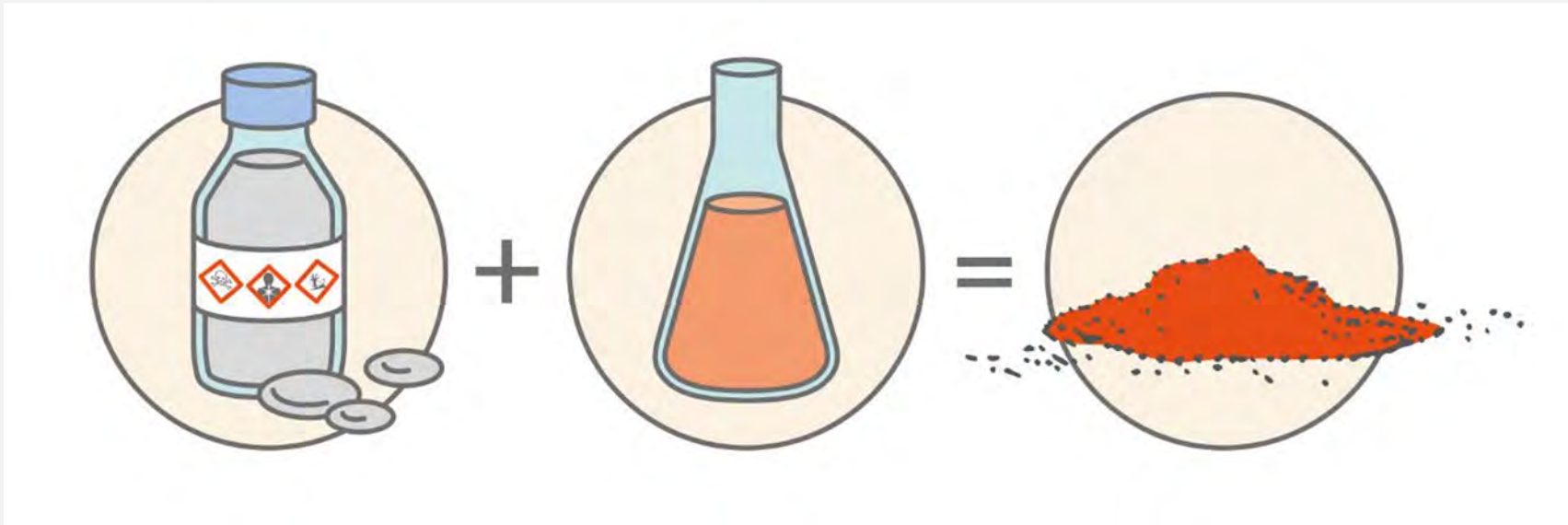
What do we mean by stabilisation?

➔ Conversion of toxic Mercury (Hg) into non-toxic Mercury Sulphide (HgS)

Hg_(l)

S²⁻

HgS_(s)



Metallic Mercury

Stabilisation reagent
(polysulfide)

Cinnabar (HgS)

HgS is

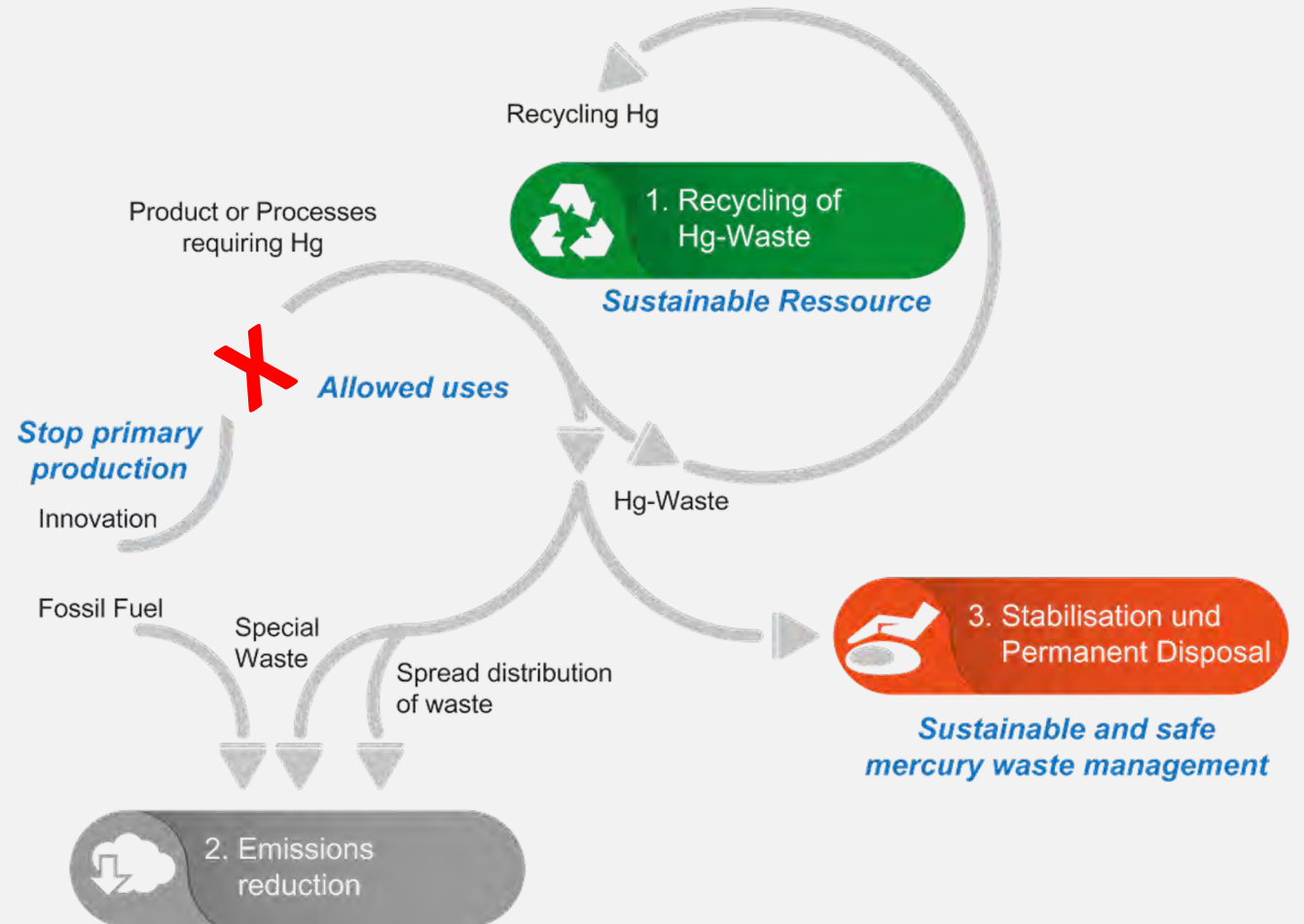
- non toxic
- the most stable Hg compound
- the most insoluble Hg compound

MERCURY STABILISATION

THE MINAMATA CONVENTION

The **MINAMATA CONVENTION** is an international **treaty** developed with the backing of the United Nations Environment Program to **protect human health and the environment from the harmful effects of mercury.**

- 150 countries agreed on:
- the **reduction and phase out of mercury use** in a number of products and processes.
 - implementing **control measures on environmental emissions.**



MERCURY STABILISATION WASTE PRODUCERS

01 Chlor-Alkali industry

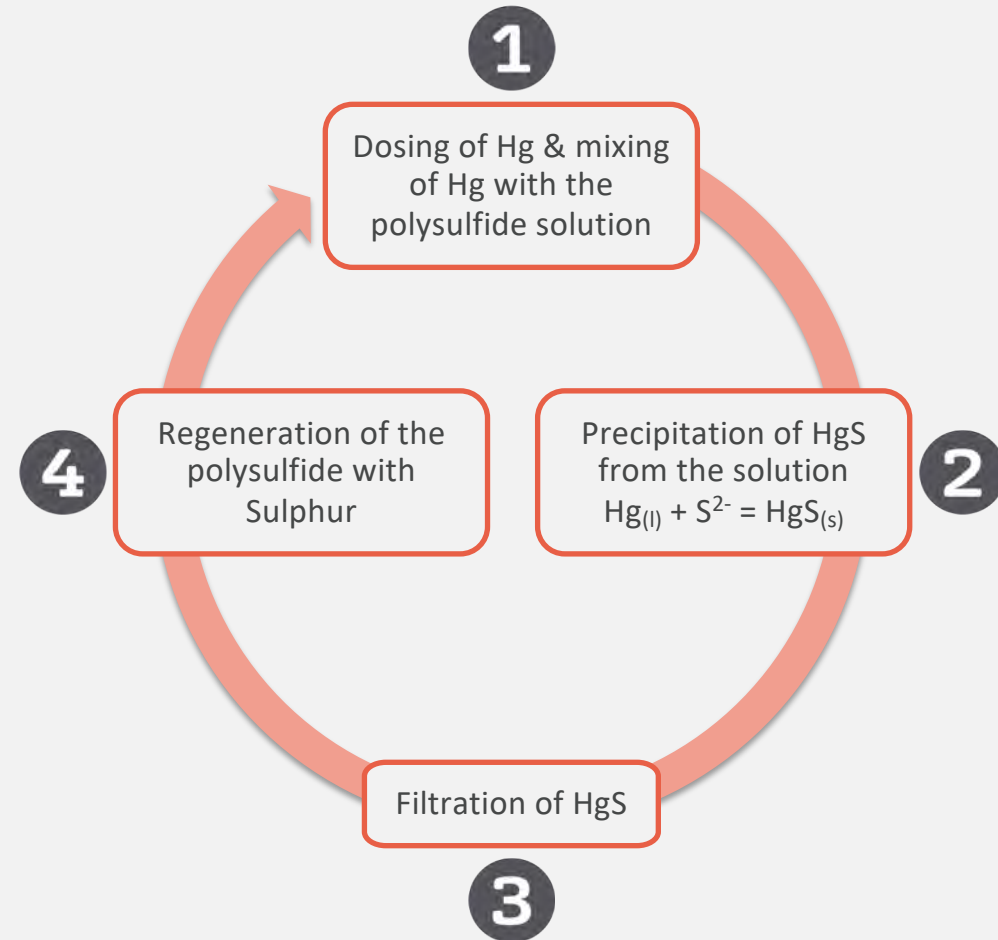
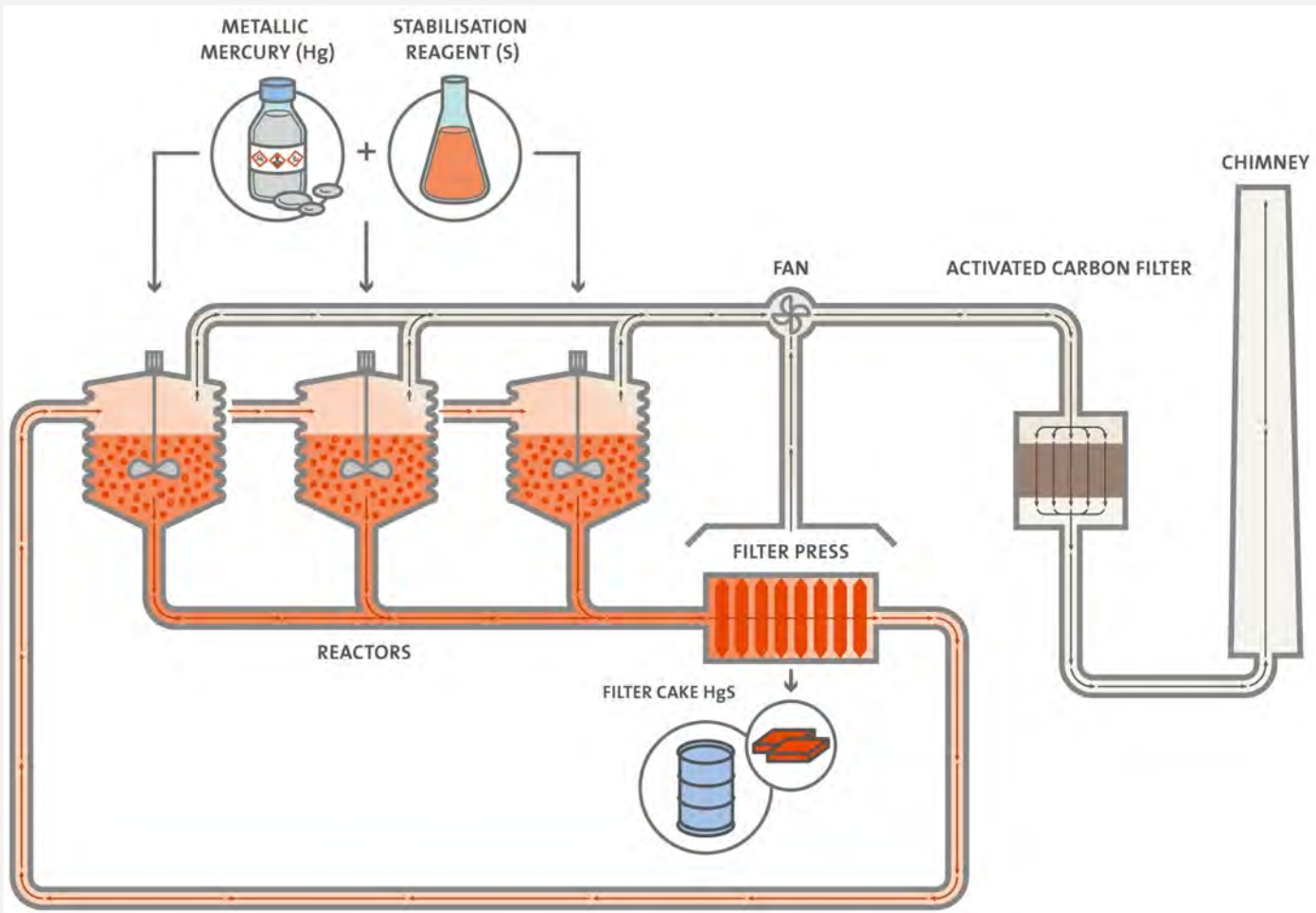
02 Gold Mines

03 Oil & Gas industry (recovered from Hg-wastes)

activities producing Hg waste

- **decommissioning of Hg based Chlor-Alkali plants**
 - *remaining stocks in EU & South America*
- **industrial gold mines**
 - *continuous production worldwide*
- **Hg stocks e.g. in the US**
- **clients who request a safe disposal of the Hg recovered from their wastes**
 - *small volumes but increasing demand*

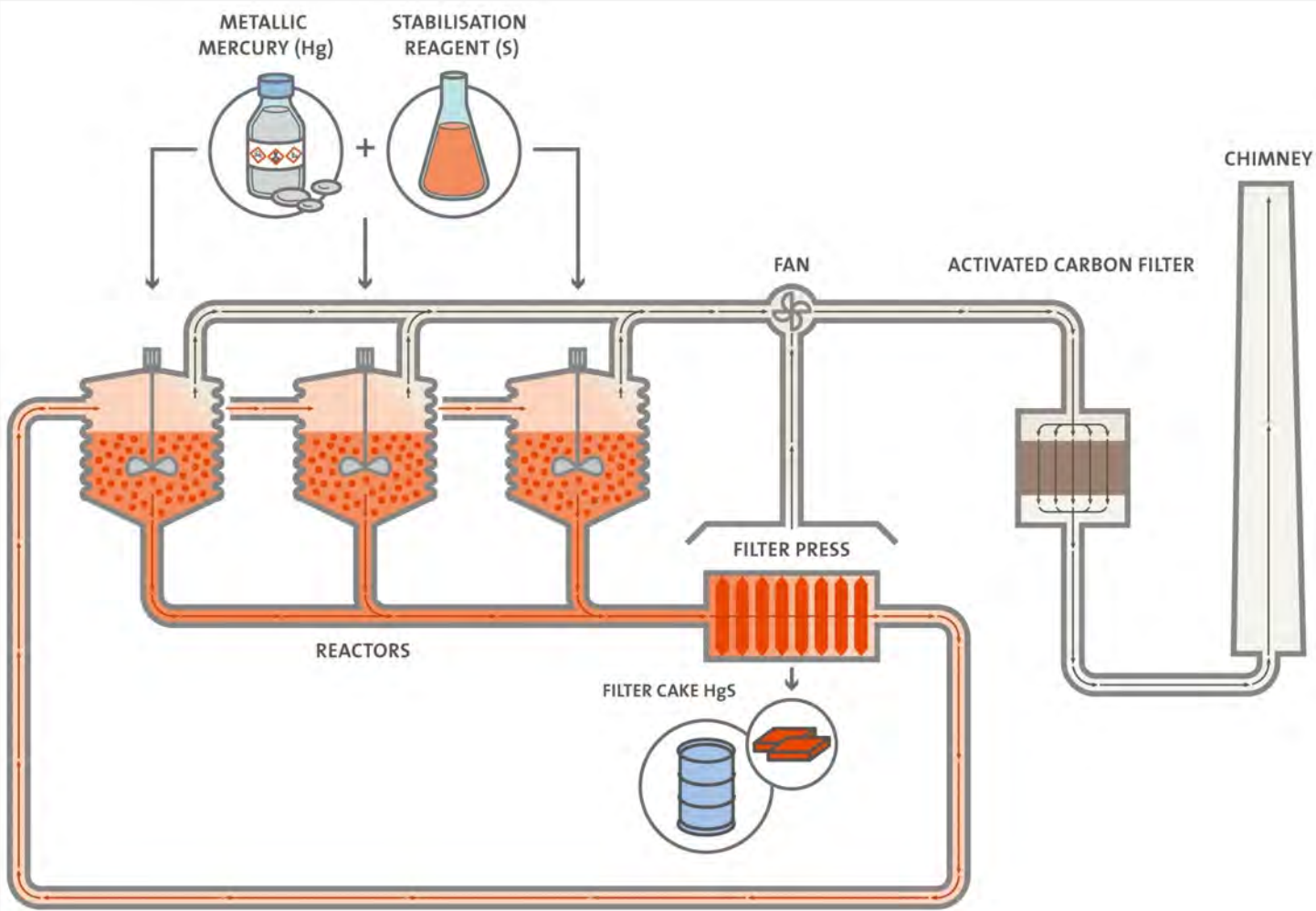
MERCURY STABILISATION STABILISATION PROCESS



MERCURY STABILISATION STABILISATION PROCESS



Europe, US
Australia
South America
China, Japan



MERCURY STABILISATION

MERCURY SULPHIDE (HgS)

mass balance

1'000 kg of Hg turn into **1'190 - 1'250 kg of HgS**

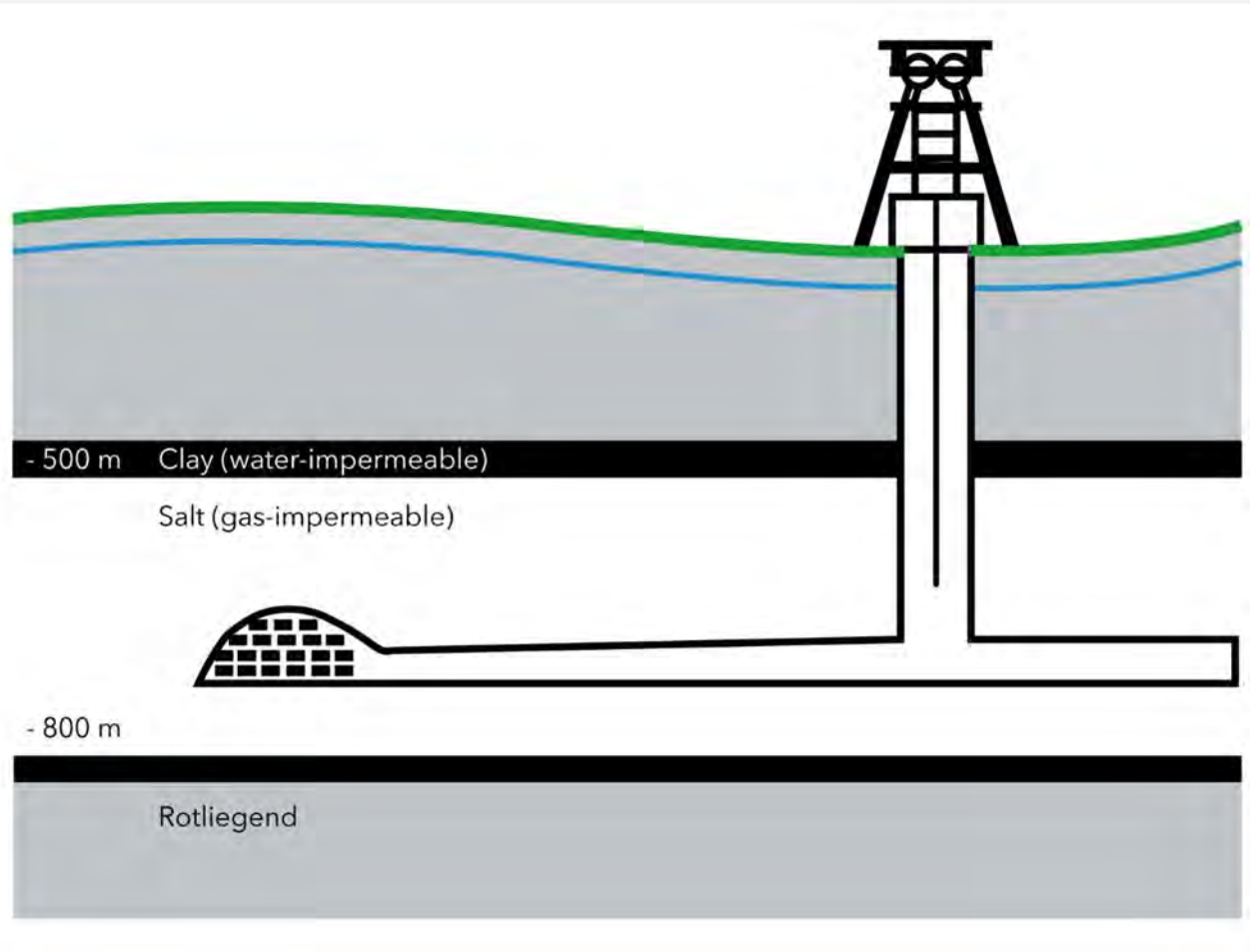
HgS composition

- Hg 80 – 84 %
- HgS 92.8 – 97.4 %
- H₂O 1.0 – 5.0 %
- S 0.7 – 3.0 %
- Na 0.4 – 1.8 %
- metallic Hg < 100 ppm



- fine grain size
- filter cake with a low humidity

MERCURY STABILISATION PERMANENT DISPOSAL of HgS in a K+S SALT MINE



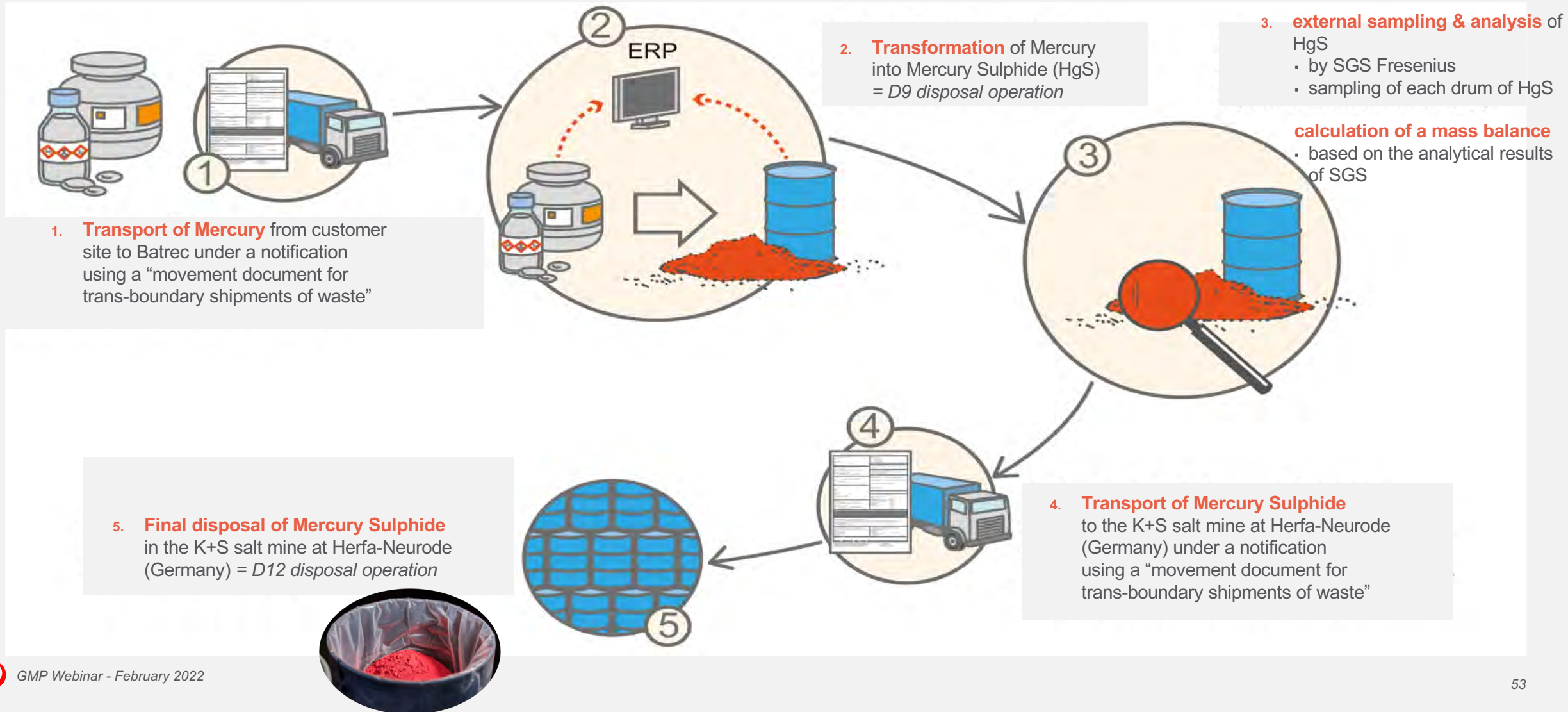
salt mine disposal

- back filling of an excavated salt mine in Germany with (hazardous) waste
- deposit at depths of 500 to 800 m
- no further solidification required
- no requirements concerning leaching behavior



MERCURY STABILISATION

TRACEABILITY is KEY



MERCURY STABILISATION

The Challenge

BATREC offered to the gold mining industry a door to door service consisting of on-site supervision for packing, labelling, loading into maritime containers and international transport prior to Hg stabilization and final secure disposal



200

TONNES
of Mercury



*Successfully meeting the local and international requirements as well as the high quality standards expected from such complex industry resulted into a memorable phrase quoted by the client: **Making the impossible possible!***



BATREC's solution

On-site supervision: packing and labelling of all mercury containers for the export of UN2809 Mercury –according to the international transport regulations ADR and IMDG.

Local handling: handling of the transport risk study including full time custody of the convoy from the mine to the local port.

Traceability from origin: local VEOLIA teams ensured the full traceability of each mercury container from the point of collection at the mine thanks to a dedicated labelling system.

International Transport: appointment and coordination of the road and maritime carriers from the mine to BATREC-CH including all export/import customs clearance.

Health and safety: BATREC-VEOLIA provided training for local staff following strict occupational health protocol.

Traceability to final disposal: BATREC ensured the full traceability from the mine site to the final disposal of HgS in the salt mine – including the provision of a final mass balance/ tracking report.

MERCURY STABILISATION CASE STUDY - CHLOR-ALKALI

The Challenge

BATREC participated in a tender in Eastern Europe to stabilise and dispose more than 140 tons of elemental mercury from an old chlor-alkali plant respecting a schedule requiring weekly transports.



140

TONNES
of Mercury



*Building trust by fully fulfilling customers' needs allowed us to work as **pure partners** instead of standard buyer/supplier !*

BATREC's solution

Administrative handling: preparation of the Basel Convention transboundary notification package and support on the reception of the consents from all competent authorities of the countries involved.

Local operations: support on the container filling operations, support on the correct labelling according to the ADR regulations, provision of special Hg-containers, weekly meeting with the teams reviewing the agreed schedule.

International transport: global coordination of transport involved parties (local teams, carrier, customs offices and BATREC's team).

Waste treatment: transformation of more than 140 tons of elemental mercury into mercury sulfide (HgS) including final disposal in a salt mine using the appropriate technology and having the necessary permits.

Reporting: provision of the necessary detailed report to allow the waste producer to comply with its reporting duties according to Articles 12 and 14 of the Regulation (EU) 2017/852 of the European Parliament and of the Council.

MERCURY STABILISATION FOR FURTHER INFORMATION

or visit us in Switzerland.....



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Yellowfin Tuna, Courtesy NOAA Fisheries, © Photo by Jeff Muir

Questions and Answers



Closing Remarks

*Rodges Ankrah, United States Environmental Protection Agency,
Co-chair of the Global Mercury Partnership Advisory Group*
