Thursday 16 February 2023

13:00 – 15:30 CET

Sound Management and Elimination of Mercury and Mercury Wastes in the Chlor-Alkali Sector

Joint webinar – Mercury Cell Chlor-Alkali Production and Mercury Waste Management Partnership Areas

Webinar on the sound management and elimination of mercury and mercury waste in the Chlor-Alkali sector

1. Opening Remarks

Misuzu Asari, Kyoto University – Japan, Co-lead of the Mercury Waste Management Partnership Area

Webinar on the sound management and elimination of mercury and mercury waste in the Chlor-Alkali sector

2. Introduction

Franz Mayer de la Rosa, UNIDO

Agenda

1. Opening statements
2. Introduction
3. Mercury-cell Chlor-alkali Production Session
   - Overview of the global status of the chlor-alkali sector: focus on Latin America phase-out
   - Overview of the financial support available for decommissioning: Mexico GEF project case study
   - Decommissioning of chlor-alkali sites
4. Waste Management Session
   - Securing and dismantling of mercury electrolysis unit: mercury reconditioning operations
   - The stabilization of mercury and treatment of mercury contaminated wastes from the chlor-alkali industry
   - Solutions for remediating mercury contaminated sites
6. Joint Session
   - Specific International Programme: Iran case study
   - Joint mission of chlor-alkali and waste management partnership areas to Uruguay
7. Closing Statements

Webinar on the sound management and elimination of mercury and mercury waste in the Chlor-Alkali sector

3. Mercury-cell Chlor-alkali Production Session

Moderated by Franz Mayer de la Rosa, UNIDO

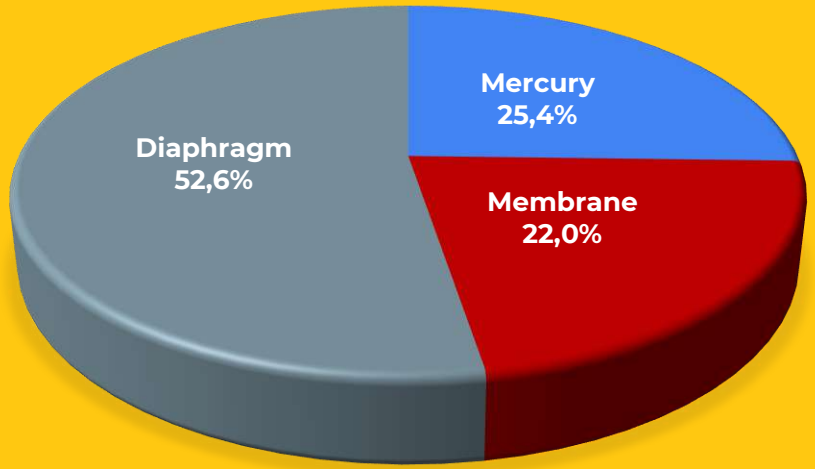
UNEP Global Mercury Partnership
Webinar on Management of Mercury Waste from Chlor-Alkali

16 Feb 2023

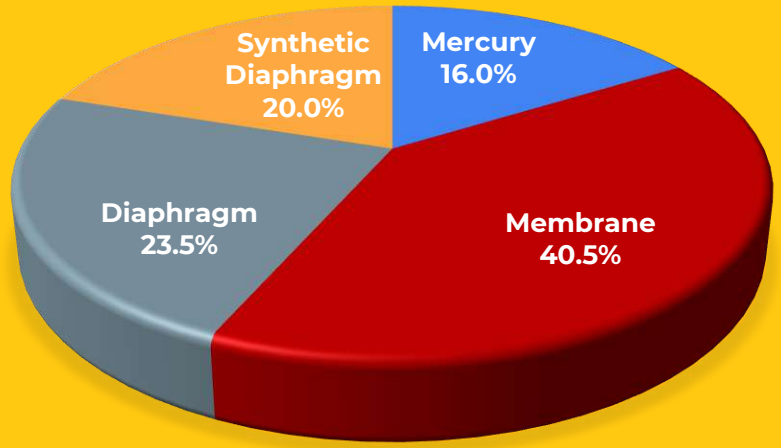
Clorosur

CHLOR-ALKALY MERCURY TECHNOLOGY IN LATIN AMERICA

2008



2022



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CHLOR-ALKALY MERCURY technology in Latin America 2022

Minamata Convention Ratification	
Country	Estimative Phase-out
Argentina	2030
Brazil	2025
Peru	2030
Mexico	2025
Uruguay	2025

Hg Balance – 2021					
	Brazil	Argentina	Uruguay	Mexico	CLOROSUR*
Metallic Mercury in the cells (Kg)	147,339	91,206	20,000	141,260	399,805
Metallic Mercury in inventory (Kg)	23,530	0	3,612	1,522	28,664
Number of cells (mercury)	79	28	22	40	169

* ex Peru

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Main Challenges

- ✓ **Operation of plants until phase-out**
  - ✓ Mercury trading only between chlor-alkali plants
  - ✓ Maintenance of national standards established for safety, health and the environment
- ✓ **Preparation and implementation of the phase-out**
- ✓ **Technical meetings and workshops with companies that specialize in the treatment and safe final disposal of mercury**
  - ✓ Batrec
  - ✓ ECON
  - ✓ Nomura Kosan
  - ✓ Remondis
  - ✓ Tauw
- ✓ **Sensitive communication to stakeholders due the illegal gold panning and gold mining in Amazonia**

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Actions

✓ Exchange of experiences between Chlorosur and Euro Chlor

Content

- ✓ The Demolition
- ✓ Protection of workers
- ✓ Protection of environment
- ✓ Useful documents

Useful documents (Euro Chlor)

- ✓ Env Prot 03 - Guideline for Decommissioning of Mercury Chlor-Alkali Plants
- ✓ Env Prot 11 - Code of Practice - Mercury Housekeeping
- ✓ Env Prot 13 - Guideline for the Minimisation of Mercury Emissions and Wastes from Mercury Chlor-Alkali Plants
- ✓ Env Prot 15 - Management of Mercury Contaminated Sites
- ✓ Env Prot 18 - Guidance for Reporting on the Decommissioning or Conversion of Mercury Cell Chlor-Alkali Plants
- ✓ Health 8 - Mercury DO'S and DON'TS Poster
- ✓ Analytical 3 - Determination of Mercury in Solids
- ✓ Analytical 6 - Determination of Mercury in Gases
- ✓ Analytical 7 - Determination of Mercury in Liquids

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Experience (Cases)

Solvay Indupa – São Paulo/Brazil – 2009
HERMES PROJECT - Santo André

Some relevant information:

- ✓ Installed Capacity: 100,000 MT/Cl2
- ✓ Recovered mercury: 132,000 kgs
- ✓ Destination: 105,000 kgs sent to Mina de Almadén/Spain and 27,000 kgs sold to chlor-alkali plants in Brazil and Argentina

Items taken into account in the disassembly project:

- ✓ Voluntary agreement and authorization from the Safety, Health and Environmental authorities:
- ✓ Strictly according work scheme: flow chart, definition of stages, and formation of teams
- ✓ Disposal of mercury, other materials and waste

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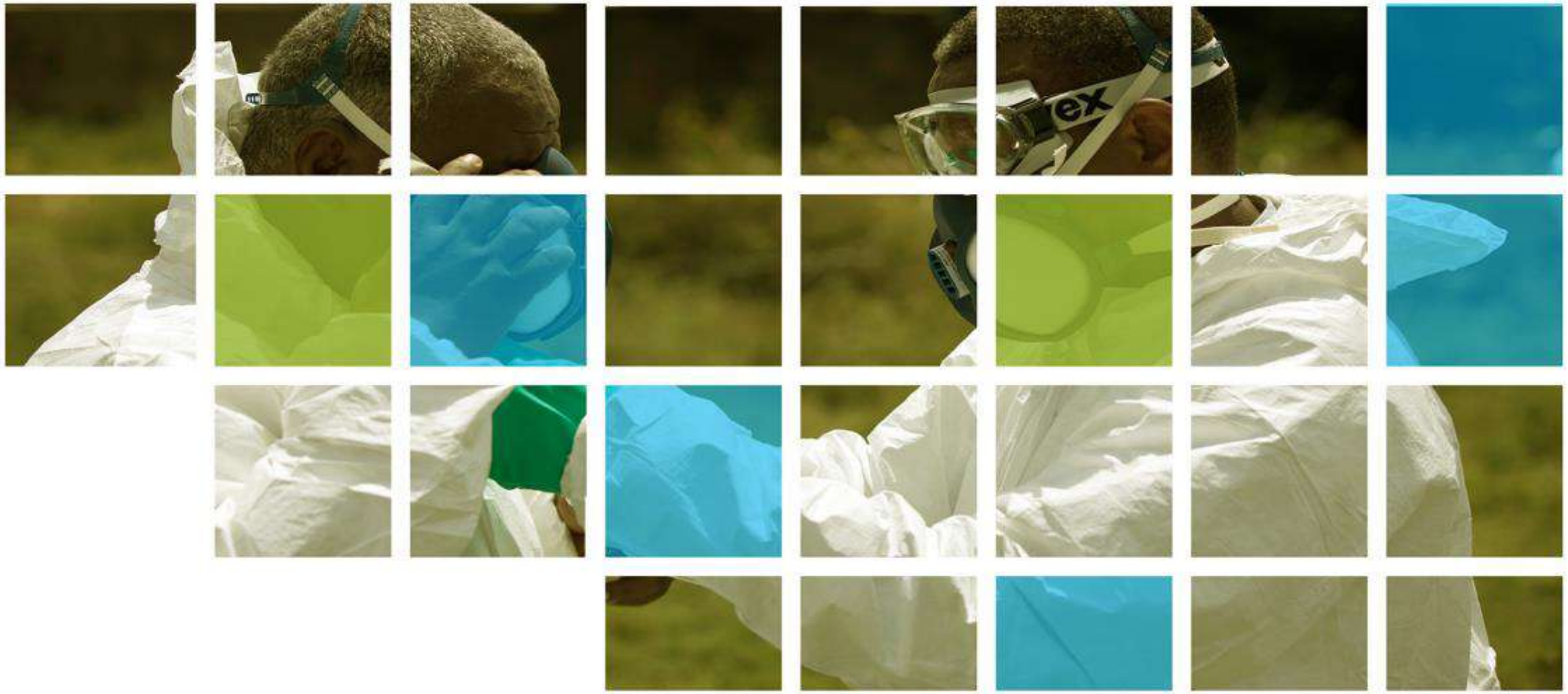
UN environment programme

Chemicals & Waste

Towards a pollution-free planet



Mexico GEF Project Case Study

Overview of financial support available for decommissioning

UN environment programme

Overview

- **Project Title:** Eliminate mercury use and adequately manage mercury and mercury wastes in the chlor-alkali sector in Mexico

- **Objective**: Reduce negative impacts of mercury and mercury wastes from the chloralkali sector on human health and the environment in Mexico

- **Focal Area:** CW 1-1 Strengthen the sound management of industrial chemicals and their waste through better control, and reduction and/or elimination

- **GEF Project Financing**: US $12,000,000
- **Confirmed Co-financing**: US $128,162,215

UN environment programme

Components

Component 1: Improve national capacity to manage chemical facilities and mercury contaminated sites

Component 2: Support for conversion, decommission and remediation

Component 3: Final disposal or transfer of excess mercury

Component 4: Knowledge management and communication

Figure 1. Overhead view of Coatzacoalcos plant construction, September 2021

UN environment programme

Important considerations

- GEF resources will not be used for construction costs related to the conversion or remediation
- CyDSA in coordination with the government of Mexico (Ministry of Environment) will finance the conversion and the remediation works.
- CyDSA, with the help of UNEP Mexico office, has identified co-financing (~USD 120 million) through the issuance of bonds to finance the conversion

UN environment programme

Access to finance

- GEF funds will help Mexico to:
  - Prepare an environmental and health assessment
  - Monitor sources of mercury emissions and releases, and assess contaminated sites
  - Support engineering needs of new plant development
  - Develop remediation plans
  - Provide technical support for the stabilization of excess mercury from the facilities

Figure 2. View of the interior of the plant in Monterrey

UN environment programme

Approach to knowledge management and communication

- Lessons learnt shared with key stakeholders
  - National and international technical workshops
- Clorosur, Abiclor and Eurochlor collaboration is coordinated through GMP partners
- Updated conversion guidelines circulated through international workshop and other channels
- Online Spanish language hazardous waste management course

UN environment programme

Thank you

Ludovic Bernaudat

Portfolio Manager OiC

Chemicals and Health Branch

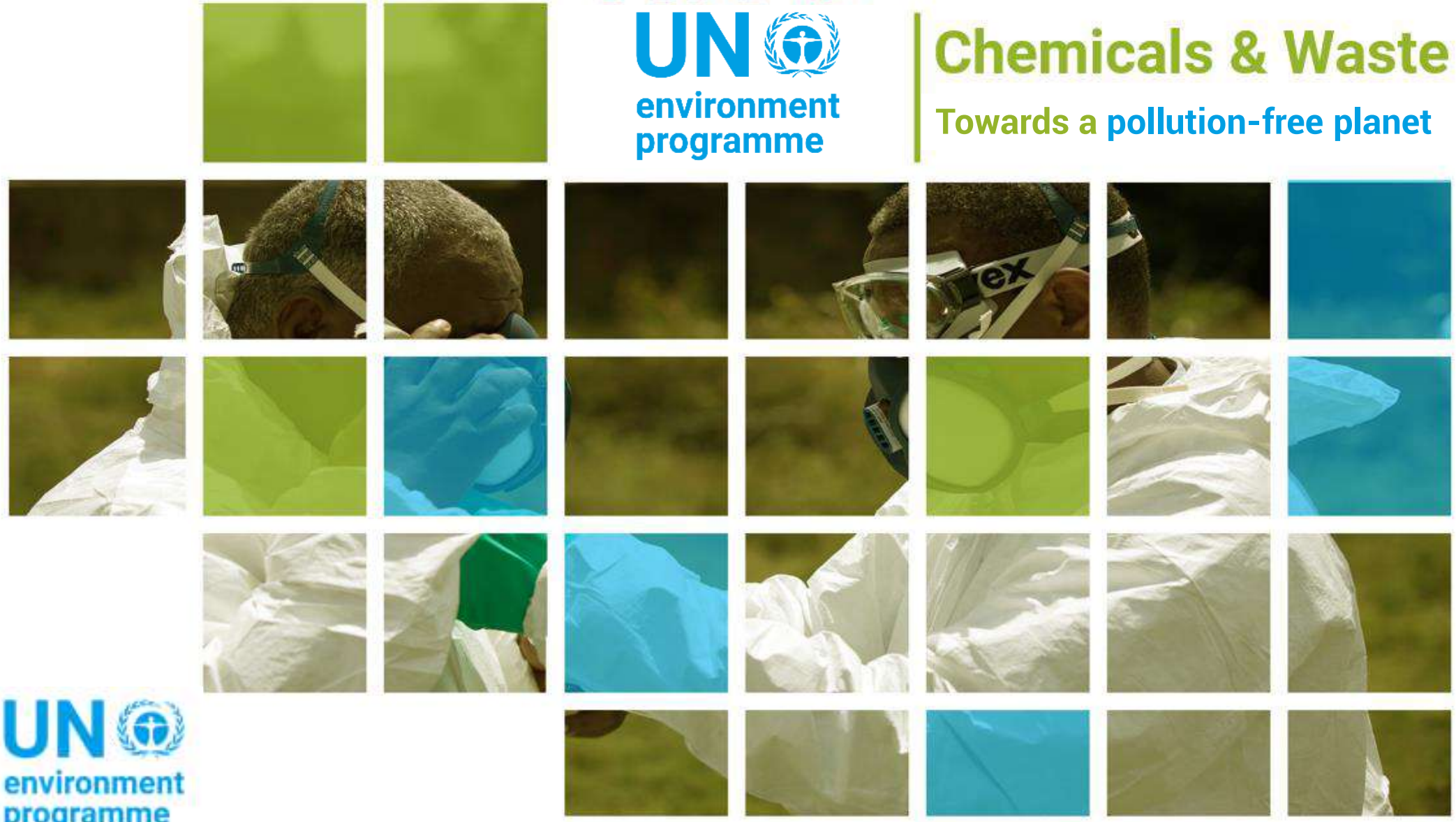
Industry and Economy Division

UN environment programme

UN environment programme

Chemicals & Waste

Towards a pollution-free planet



UN environment programme

Webinar on the sound management and elimination of mercury and mercury waste in the Chlor-Alkali sector

4. Waste Management Session

Moderated by Koji Ono, Ministry of the Environment, Japan, Co-lead of the Mercury Waste Management Partnership Area

CURIUM

TO CURE YOUR ENVIRONMENT

SECURING AND DISMANTLING OF MERCURY ELECTROLYSIS UNIT

MERCURY RECONDITIONING OPERATIONS

ABOUT US

Founded in France in 1994, based in Montagny, CURIUM is a fast-growing company with a large network of partners all around the world.

25	**years of experience**	**18**	**countries we work in**
10	**spoken languages**	**7,7M€**	**annual turnover in 2022**

Our multicultural team is composed of experienced chemists and engineers involved in the management of chemical, radioactive and biological risks, as well as combined risks.

CURIUM
TO CURE YOUR ENVIRONMENT

OUR SKILLS AND SERVICES

CURIUM is a highly qualified team designing solutions for the management of hazardous substances, from technical studies to in-situ works and large scale project management.

ENGINEERING ET CONSULTING

- Technical expertise
- Contamination diagnosis
- Project management assistance
- Laboratory for analyzes and tests

WORKS ON SITE

- Decontamination
- Dismantling / Depollution
- Hazardous waste management
- Management of production change/stop involving hazardous products

ON-CALL & EMERGENCY RESPONSE

- On call 24 hours a day, 7 days a week

-Emergency response due to chemical accident or transport of dangerous substances

- Management of incidents related to hazardous substances

Scan for more details about our services!

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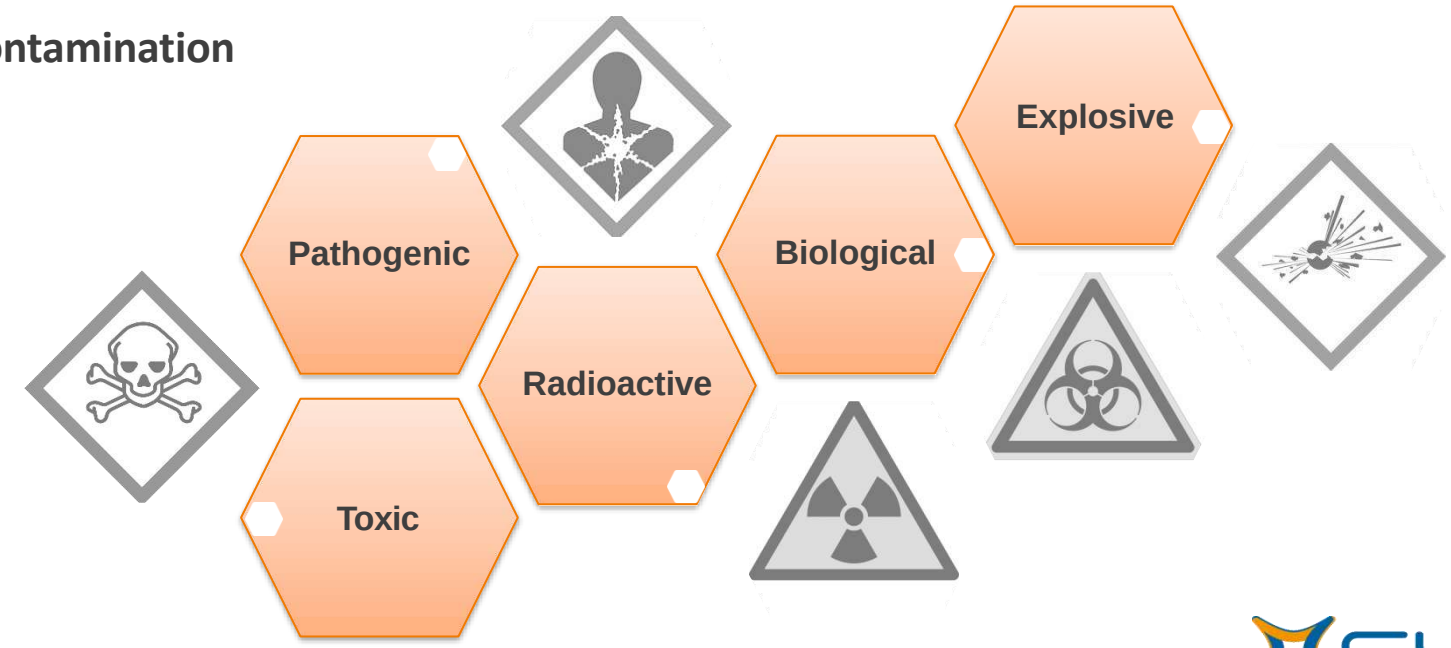
TO CURE YOUR ENVIRONMENT

OUR INTERVENTION CONTEXT

- Risk of impact on the health of employees and subcontractors
- Risk of impact on product quality
- To guarantee decontamination and legal security
- To insure regulatory compliance
- To avoid cross-contamination



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OUR METHODOLOGY

TECHNICAL STUDIES, CONSULTING

CONTAMINATION DIAGNOSTICS

PROJECT MANAGEMENT

ON SITE WORKS

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1. CASE STUDY

SECURING AND DISMANTLING OF MERCURY ELECTROLYSIS UNIT

Project date : 2017 - 2018
Client : Ministry of Environment Tunisia
Location : Kasserine, Tunisia
Site : SNCPA, Alfa pulp producer

Main risks associated with :

- mercury-contaminated site
- collapsed roof of the electrolysis, containing fiber cement
- proximity of hydrogen tank (gasometer)

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1. CASE STUDY

SECURING AND DISMANTLING OF MERCURY ELECTROLYSIS UNIT

CURIUM's mission included:

1. Preliminary studies:
   - mercury, asbestos and lead diagnostic;
   - development of demolition methodologies.

2. Installation of protection for the gasometer and temporary shoring of the electrolysis structure.

3. Mercury emptying out of the electrolysis building (decomposers, pipes and tanks) and preparation of the cleaning area for contaminated materials.

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TO CURE YOUR ENVIRONMENT

1. CASE STUDY

SECURING AND DISMANTLING OF MERCURY ELECTROLYSIS UNIT

CURIUM's mission included:

•Management of demolition strategy for the support process units of the electrolysis room

- Destruction of the upper floors
- Removal of the 10 electrolysis cells
- Cutting of the cells, tanks
- Metal scrap and decontamination
- Demolition of the building

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1. CASE STUDY

SECURING AND DISMANTLING OF MERCURY ELECTROLYSIS UNIT

- ✓ **2,500 m²** of industrial units were dismantled
- ✓ **25 liters** of liquid mercury were collected and transferred to ADR tanks
- ✓ **225 m³** of mercury-stained waste
- ✓ **25 m³** of fiber cement were conditioned
- ✓ **3 buildings** were demolished and an intermediate storage building was constructed

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2. CASE STUDY

MERCURY RECONDITIONING OPERATION

Project goals :

Reconditioning of liquid mercury and emptying of tanks probably containing sludge :

- 80L jugs and 5 tanks containing sludge with more than 8 tons of liquid mercury
- Corroded, damaged containers, inappropriate for transportation of hazardous substances/waste
- Client wished to eliminate the waste, prior to the start of dismantling works on site.

Project date : 2019
Client : Polymer manufacturer
Location : France

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2. CASE STUDY

MERCURY RECONDITIONING OPERATION

Project description :

- Reconditioning operations were carried out on a specifically protected work area, set up before the start of works
- Transfer of mercury by depression
- Removal of remaining mercury below the level of the dip tube with the help of mercury vacuum or vacuum pump
- Conditioning in reception jars

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OUR TECHNICAL MEANS

- ✓ 100m² in-house laboratory & pilot zone with adaptable air treatment (high efficiency filter, gas scrubber, activated carbon)
- ✓ Precision analyses: GC-MS, TOC meter, Gamma spectrometer, Visible spectrometer, ICP-AES
- ✓ Methods and materials for sample preparation (e.g. microwave mineralizer)
- ✓ Mobile laboratory for immediate analyses : portable mercury vapour analyser, XRF spectrometer, rapid chemical and pyrotechnic kits, alpha, beta, gamma, mercury, VOC measuring devices, etc.

OUR CERTIFICATIONS

asn AUTORITÉ DE SÛRETÉ NUCLÉAIRE
Authorisation T690950

MASE AMÉLIORER LA PERFORMANCE SSE
N° RA2022-185
Recognized in Belgium and the Netherlands

vca

CEFRI
Certification N° 1251-E

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UNEP Global Mercury Partnership Webinar - 16 February, 2023

BATREC's experience in Mercury Waste Management

David Hunter, ***Project Manager and Mercury Centre Leader***

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Agenda

- Who we are
- What we do
- Mercury wastes and treatment options
- Specific wastes received from Chlor Alkali
  - Dealing with complexity using experience, investment and flexibility
- Batrecs unique facilities

BATREC and VEOLIA – A global network

BATREC
Swiss quality recycling solutions

BATREC
Swiss quality recycling solutions

85 Nb of Employees

VEOLIA

178,894
Nb of Employees

50
Countries

26,010
Million €
revenue

47
Million tons of waste treated

Veolia Field Services (VFS)

a sister company of Batrec - has global expertise in hazardous wastes management and is able to provide the following tailor made services:

- Packaging
- Conditioning
- Transport
- Regulatory administration

Types of Hg wastes treated at BATREC

Waste received at Batrec

- **Batteries : >95% are coming from the collection in Switzerland, with a few containing mercury (button cells)**
- **Mercury wastes : >95% are coming from abroad under Basel notifications**
  - Hazardous Waste Collectors (all kind of mercury wastes)
  - Chlor alkali (mercury to be stabilized, sludges, devices…)
  - Non ferrous metal industry: Industrial gold mining (mercury to be stabilized, PPE)
  - Oil and gas industry (adsorbents, sludges,…)

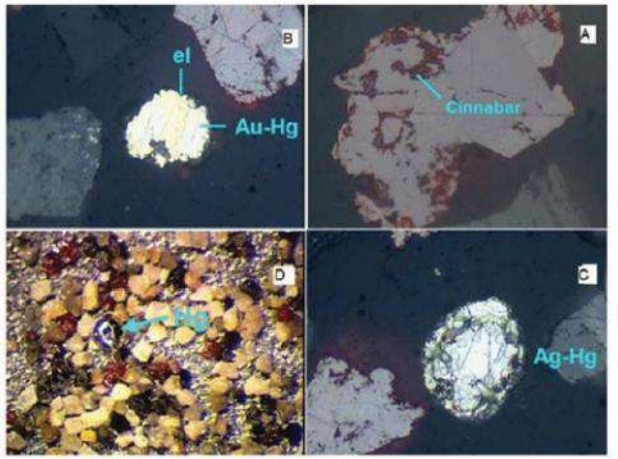


Figure 2– Mercury in form of (A) cinnabar (free and enclosed in other minerals), (B and C) alloys of gold, silver, and mercury, and (D) metallic mercury (AMTEL Institute, 2008)

Waste seldom received at Batrec

- Sites remediation: Soils in high volumes with low Hg contamination (on site treatment, landfill or underground storage)
- Fluorescent lamps and energy-saving bulbs (dedicated facilities)
- Oil and gas industry: oily sludges
- Non ferrous metal industry: Zink industry Hg_2Cl_2 (Calomel from the Boliden Norzink Process) or HgSe (Sulfuric Acid Selenium scrubber)

Mercury waste treating strategy

Sort the waste and/or to analyze it

The treatment method depends on :

- Form of the mercury : elemental or mercury compounds (HgS, Hg2Cl2…)
- Other pollutants : VOC, Sulfur…
- Size and texture of the waste

Batrec uses 4 facilities with different technologies to treat the mercury wastes :

Battery Plant: Pyrolysis	CRP : High temperature treatment	Hg Distillation unit	Mercury stabilization plant
			

- **Homogenous Hg-waste streams like activated carbon or mercury guards can be dealt with using standardised processes**
- **Hg-Sludge, depending on the origin (pH, organic content..), may need a pre-treatment**
- **Mixed Hg-Waste, need manual handling and sorting**

The challenge lies in identifying the right way to treat the waste and also how to deal with the residues (mercury…)

Wastes from the Chlor Alkali Industry – Examples

What is this waste?

- **Complex steel parts**
- Decomposers from Castner–Kellner process
- Heavily contaminated with mercury
- Contain other residual wastes

What do we do?

- Batrec equipped with decontamination facility with specialised technicians
- Roasting of metal parts in retort (internal Hg)
- High pressure water jetting (surface Hg)
- All wastes caught and treated on site

The challenges:

- Caustic residues
- Liquid mercury trapped in pockets of corrosion in steel
- Dismantling requires cutting in the presence of trapped liquid mercury
- Generates concentrated Hg vapour

Wastes from the Chlor Alkali Industry – Examples

Wastes from the Chlor Alkali Industry – Examples

What is this waste?

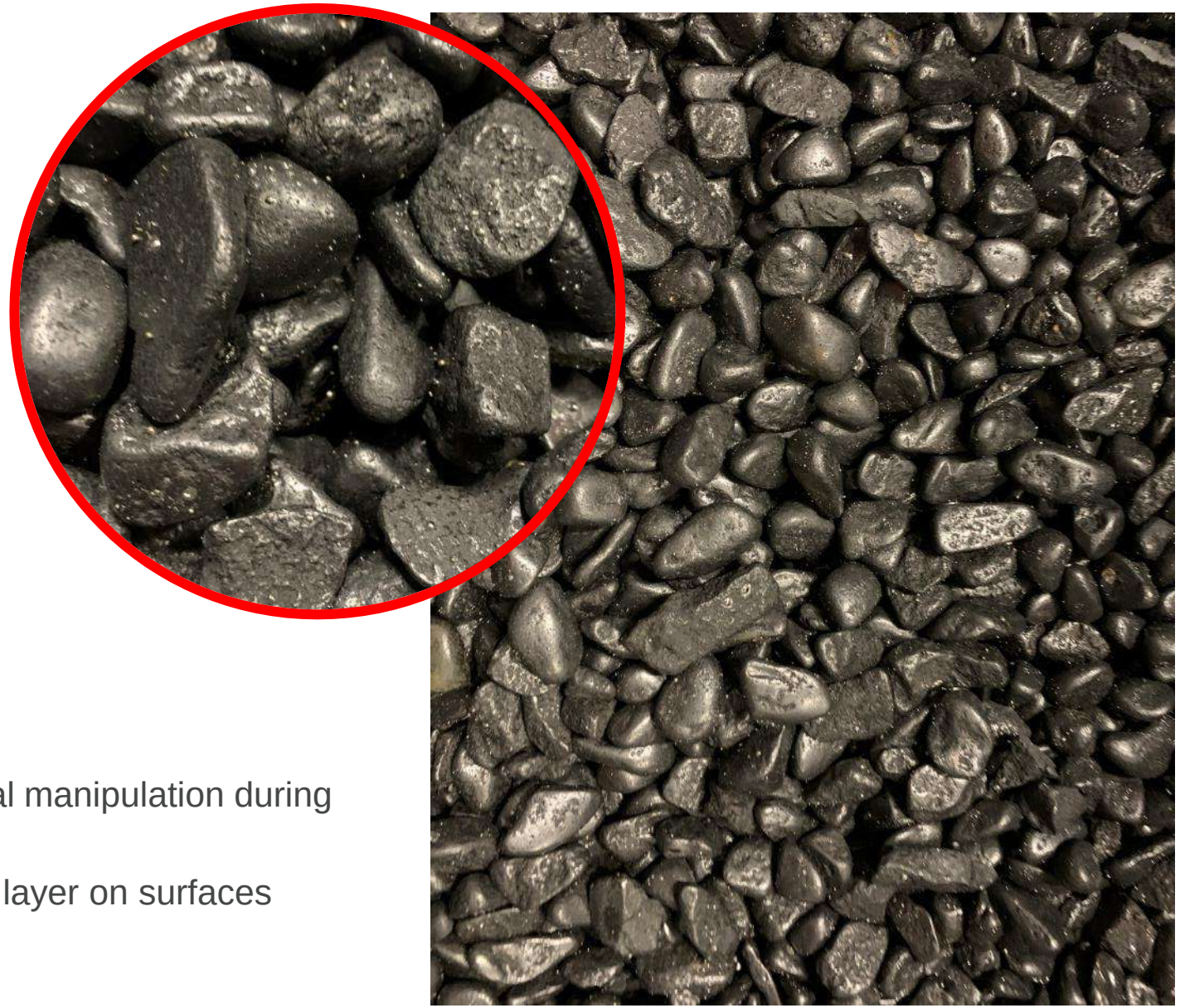
- **Graphite chips**
- Mercury on surface and ingrained

What do we do?

- Slow thermal treatment in CRP roasting ovens
- Mercury distilled and stabilised

The challenges:

- High level of Hg contamination
- Soft porous surface traps Hg
- The soft graphite can rub off with heavy mechanical manipulation during handling and treatment
- Causing mercury contaminated dust and leaving a layer on surfaces
- Gentle mechanical movement best suited



Wastes from the Chlor Alkali Industry – Examples

What is this waste?

- **Demolition waste**
- Often mixed materials

What do we do?

- Sort the waste into catagories
- Sample and assess by catagories
- Treat each stream individually

The challenges:

- Time consuming to sort
- Heterogeneity
- Must be done by train technicians in enclosed sorting room with ventilation
- Every drum can be different
- Each resulting stream needs a separate waste treatment plan

Wastes from the Chlor Alkali Industry – Examples

What is this waste?

- **Ebonite, bitumen or tar**
- Contaminated with mercury
- From process internal surfaces
- From floor materials

What do we do?

- Pyrolysis
- Post combustion of gases
- Clean residues for part

The Challenges:

- Can be high in sulphur
- Sticky when warm
- Can cake onto handling and treatment equipment leaving residues
- High Calorific Value

Wastes from the Chlor Alkali Industry – Examples

What is this waste?

- **Wet sludges**
- Contaminated with mercury
- From process cleaning, remnants of chemicals, mixed wastes, etc

What do we do?

- Individual analysis and planning
- Some pre-treatment necessary
- Thermal treatment

The Challenges:

- Very heterogenious
- Can be highly Caustic
- Often contain waste items mixed with sludge which need to be separated

Wastes from the Chlor Alkali Industry – Examples

What is this waste?

- **Mercury contaminated metal** flasks
- Including full or empty

What do we do?

- Empty the Hg flasks into 2t containers using specially designed hydraulic equipment
- Stabilise the mercury
- Thermally treat the metal by retorting
- Analyse then recycle

The challenges:

- Full flasks too heavy to lift manually (~35kg)
- Flasks have variable shape and condition
- Old flasks may be difficult to open

Treatment of Mercury Wastes

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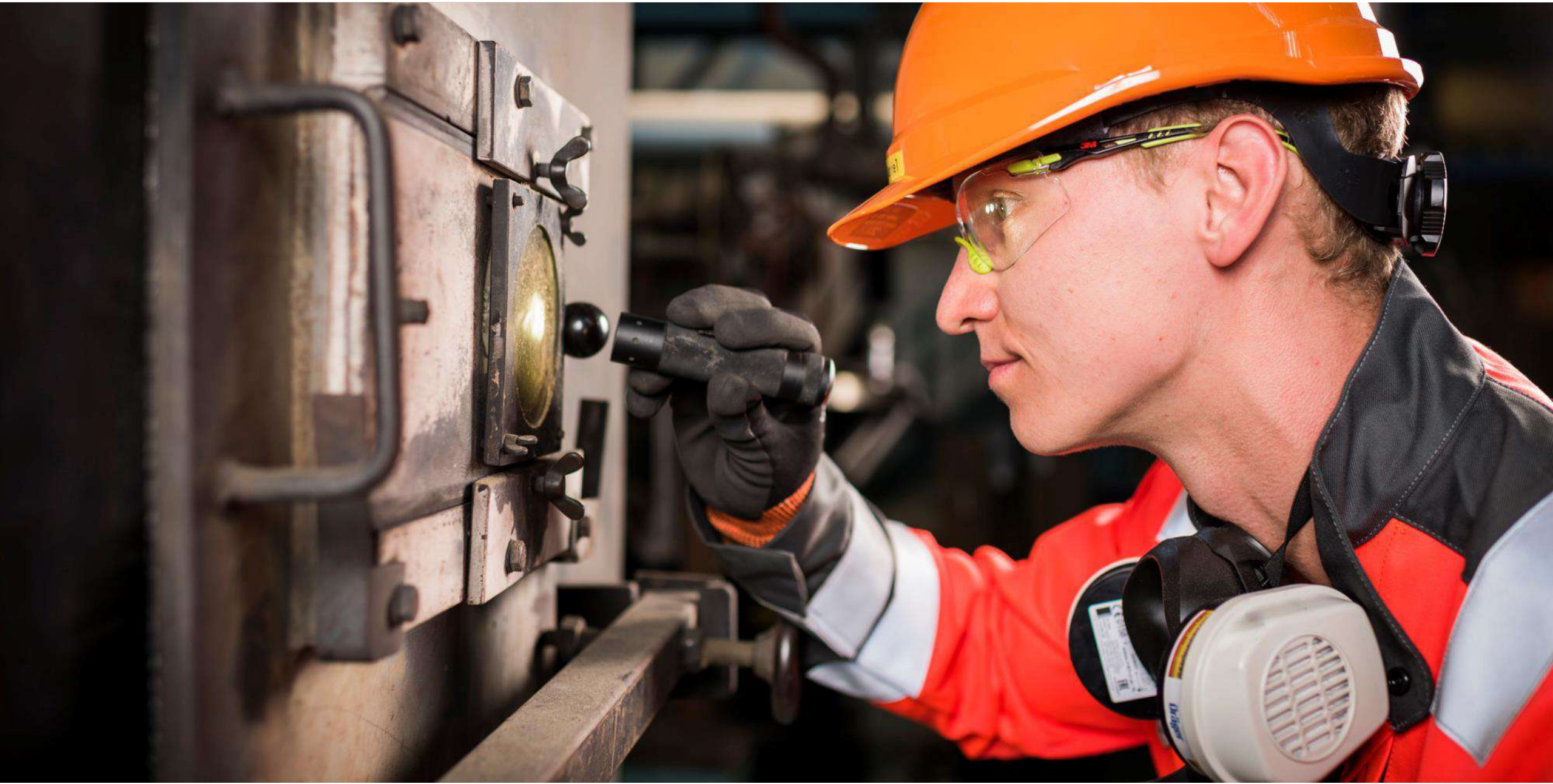
Swiss quality recycling solutions



Mercury Waste High temperature treatment

BATREC
Swiss quality recycling solutions

Mercury Waste High temperature treatment: Process Flow Diagram

BATREC
Swiss quality recycling solutions

1 THERMAL TREATMENT

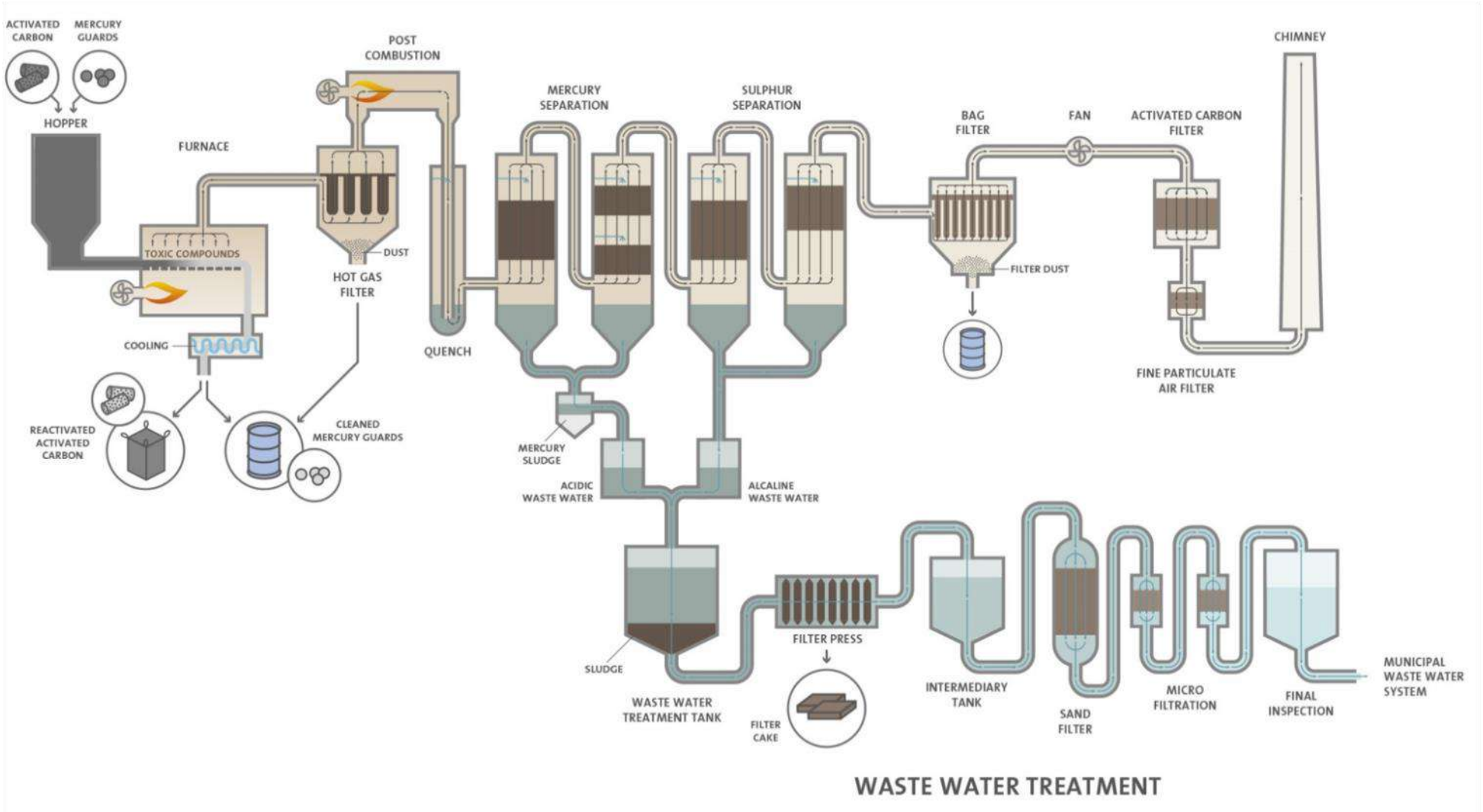
- desorption of the pollutants at 750 – 850°C
- destruction of the organic pollutants in the post-combustion chamber

2 WASTE GAS WET CLEANING

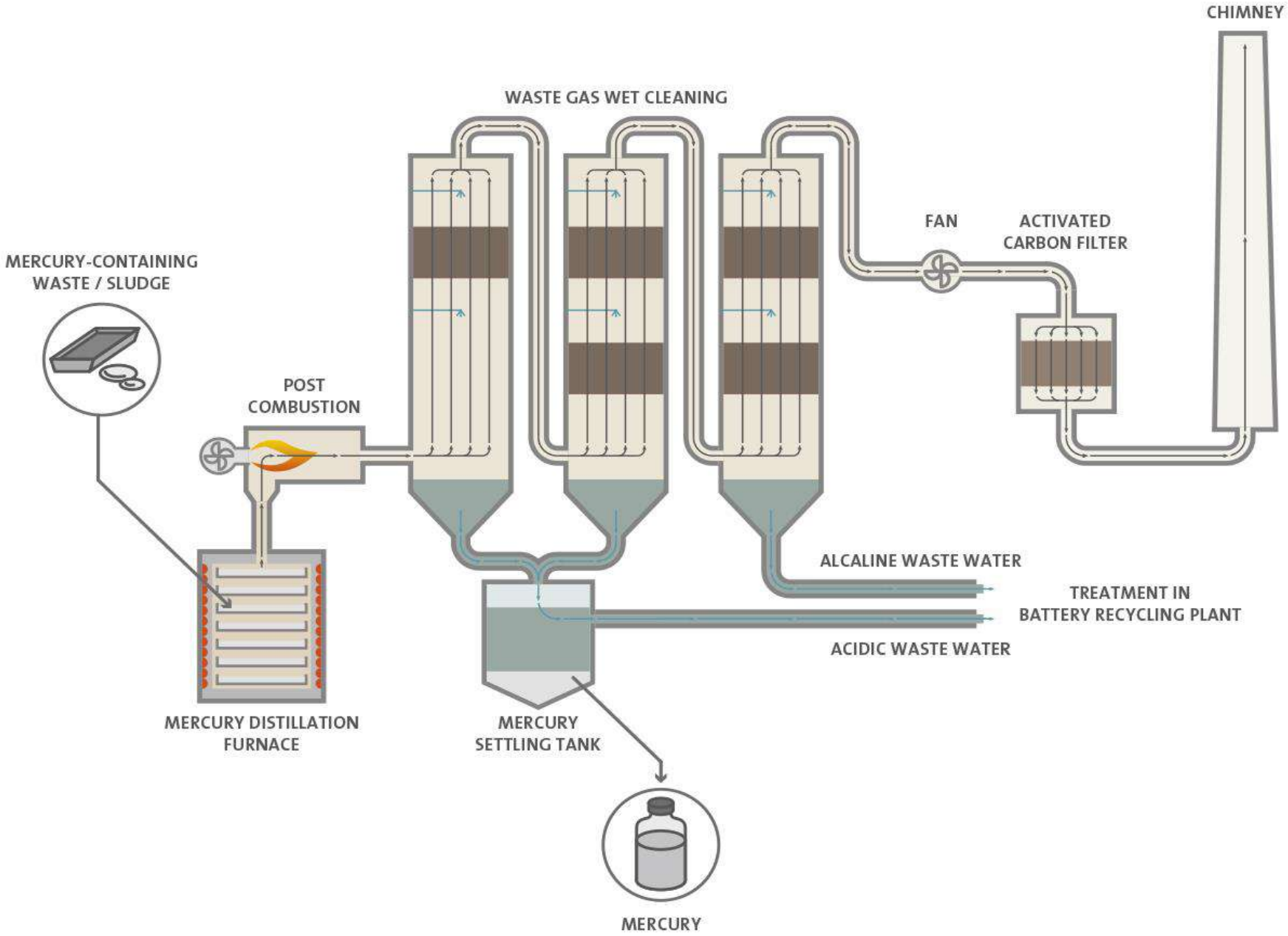
- condensation of Mercury
- removal of Sulfur

3 WASTE GAS DRY CLEANING

- removal of trace level Mercury
- removal of other pollutants and fine dust removal HEPA Filter



Mercury wastes distillation: Process Flow Diagram



Mercury Stabilisation

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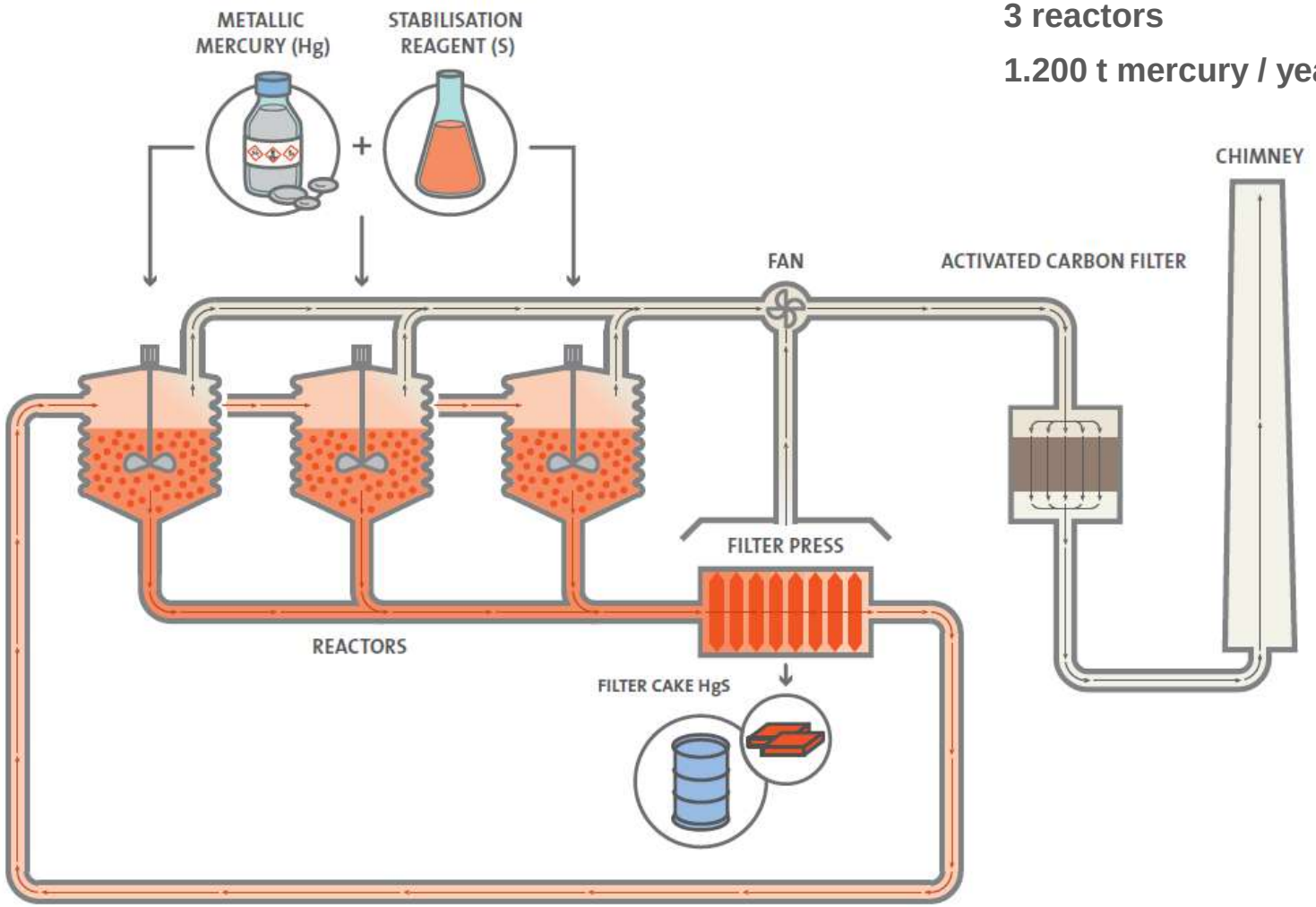
Mercury Stabilisation



Capacity:

625 kg mercury / batch

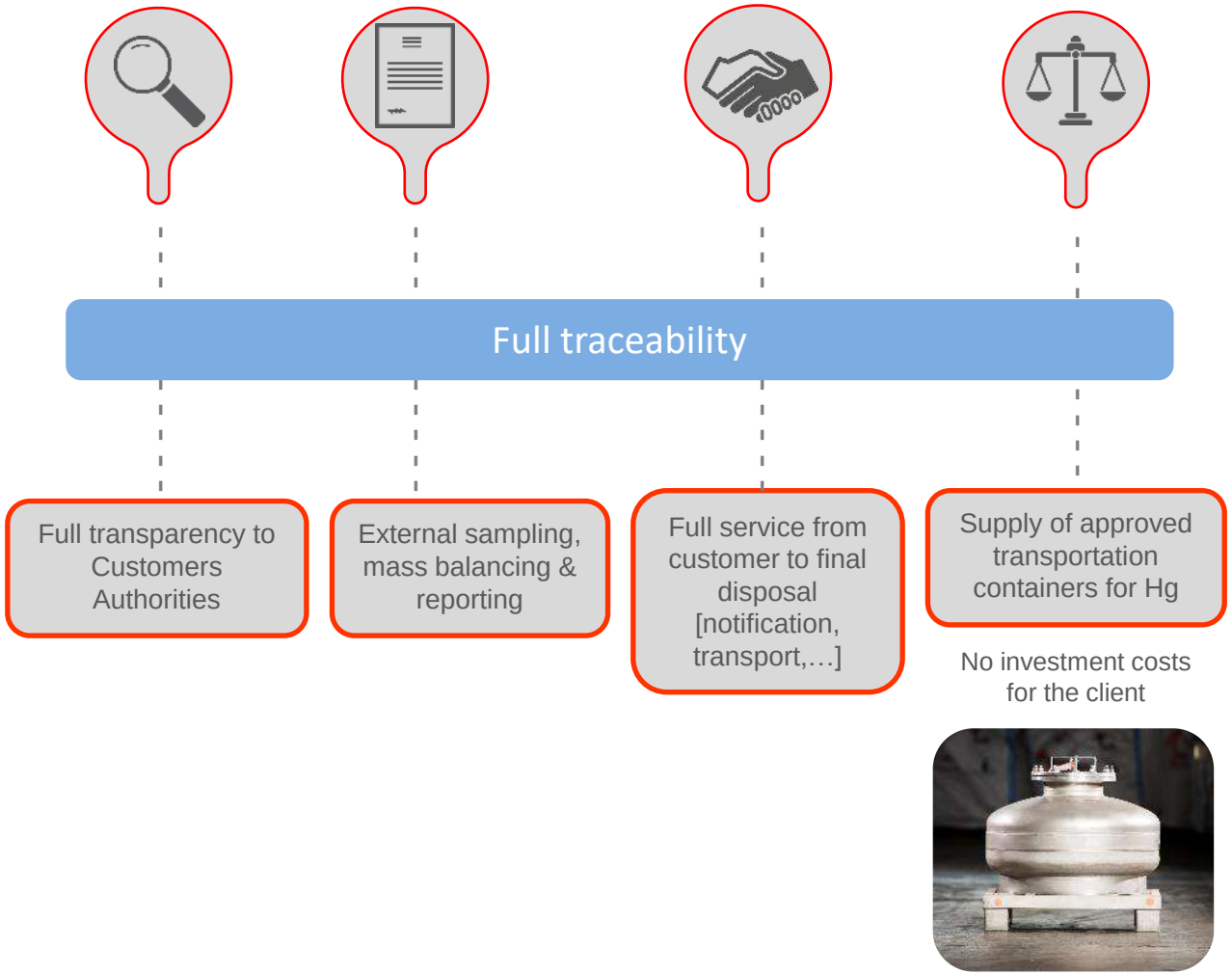
3 reactors

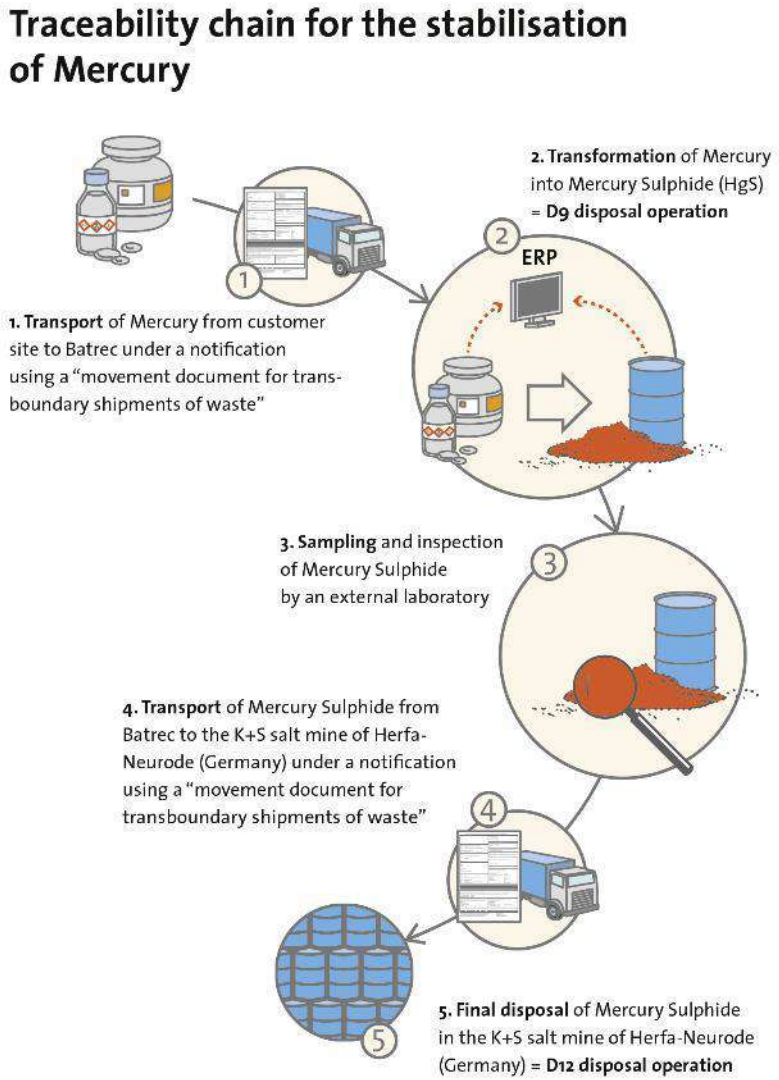
1.200 t mercury / year

Process characteristics

- ✓ batch process
- ✓ wet process at low temperatures in a closed circuit limits the risk of Hg emissions
- ✓ no gaseous Hg in the process
- ✓ stabilisation solution is regenerated
  → *zero effluents produced*
- ✓ simple reactants

Traceability chain for the mercury stabilisation





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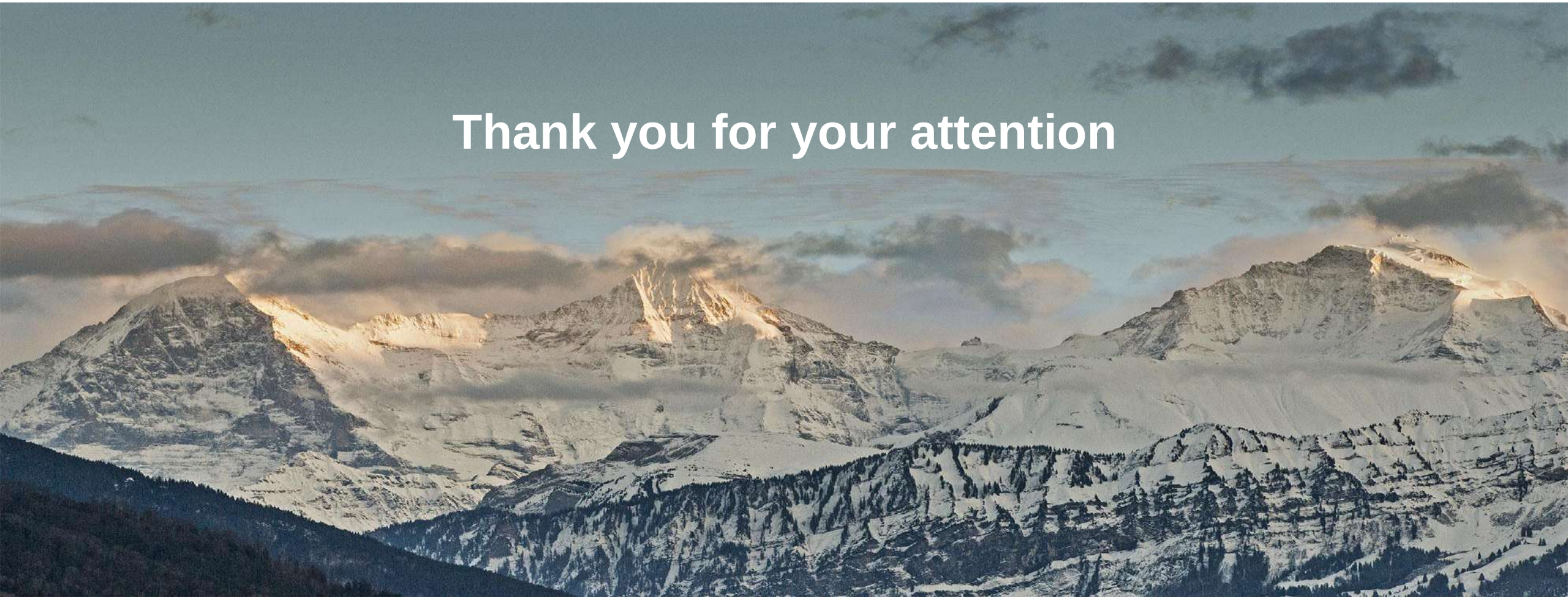
Swiss quality recycling solutions



Thank you for your attention

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econ INDUSTRIES

VacuDry®

Zero Industrial Waste! Profitable. Reliable. Green energy powered.

Agenda

1. Introduction
2. Available on-site treatment technologies
3. VacuDry® technology
4. Mobile Mercury Conversion Unit
5. Conclusions

Introduction

What drives us

- econ provides the most efficient and cleanest solutions to recover resources from industrial hazardous wastes

- VacuDry® is a low temperature vacuum distillation process for safe and efficient recycling of resources from wastes with separation of contaminants like mercury and hydrocarbons

Making clean recyclable materials available for reuse

Supersede landfilling and incineration

Reduce CO_2 emissions

Avoid waste export and large waste transports

Introduction

Who we are

- econ is a family owned business & was founded in 2003 as machinery supplier

- 30 hazardous waste treatment projects (18 VacuDry® units) worldwide, on 3 continents, in 13 different countries

- Involved in international working groups, such as:

UNEP

UNIDO

NICOLE

planetGOLD

MINAMATA CONVENTION ON MERCURY

Worldwide recognized for our unique VacuDry® solution to recover resources from industrial hazardous wastes

Introduction

Highlights of the past few years

2015

World's largest drill cutting recycling plant

VacuDry® recycles 14,000 tons p.a. synthetic drilling oil from 70,000 tons waste.

2016

Mobile Mercury Conversion Unit

World's first mobile solution for the on-site stabilization of mercury.

Since then more than 500 t of mercury were stabilized to mercury sulfide on-site.

2018

1st mercury recovery facility of the southern hemisphere

In Australia econ's VacuDry® terminated 3,000 tons p.a. mercury waste export.

2021

VacuDry® at +2000m above sea level

Commissioning of a VacuDry® plant at over 2000 m above sea level.

For the clean up of a mercury contaminated area in India.

2022

NORM waste treatment center

Ongoing delivery of a VacuDry® plant for NORM waste treatment to Saudi Arabia by end of 2022

Currently manufacturing two VacuDry® units for Greece

Available on-site treatment technologies

Contaminated soils with Hg

VacuDry®

VacuDry® - vacuum distillation

- For soils & sludges cont. with elemental mercury, HCH compounds and other pollutants
- Max. 400 °C
- Low vacuum < 50 mbar(abs)
- Advanced and flexible treatment technology

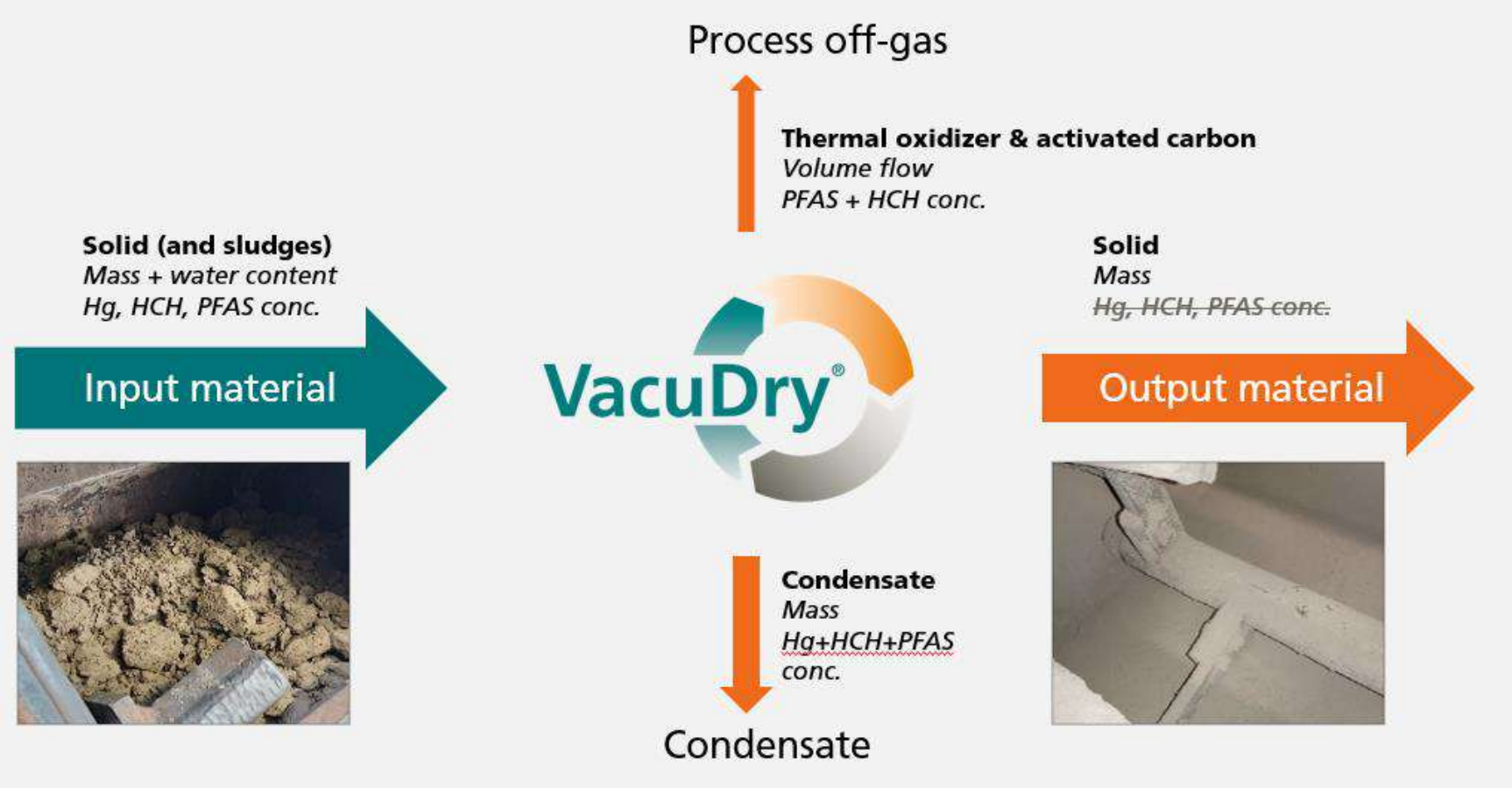
MMCU

Mobile Mercury Conversion Unit

- Conversion of pure elemental Hg to HgS (cinnabar)
- max. 200 °C
- Atmospheric pressure
- Completely seal system

VacuDry® technology

Concept

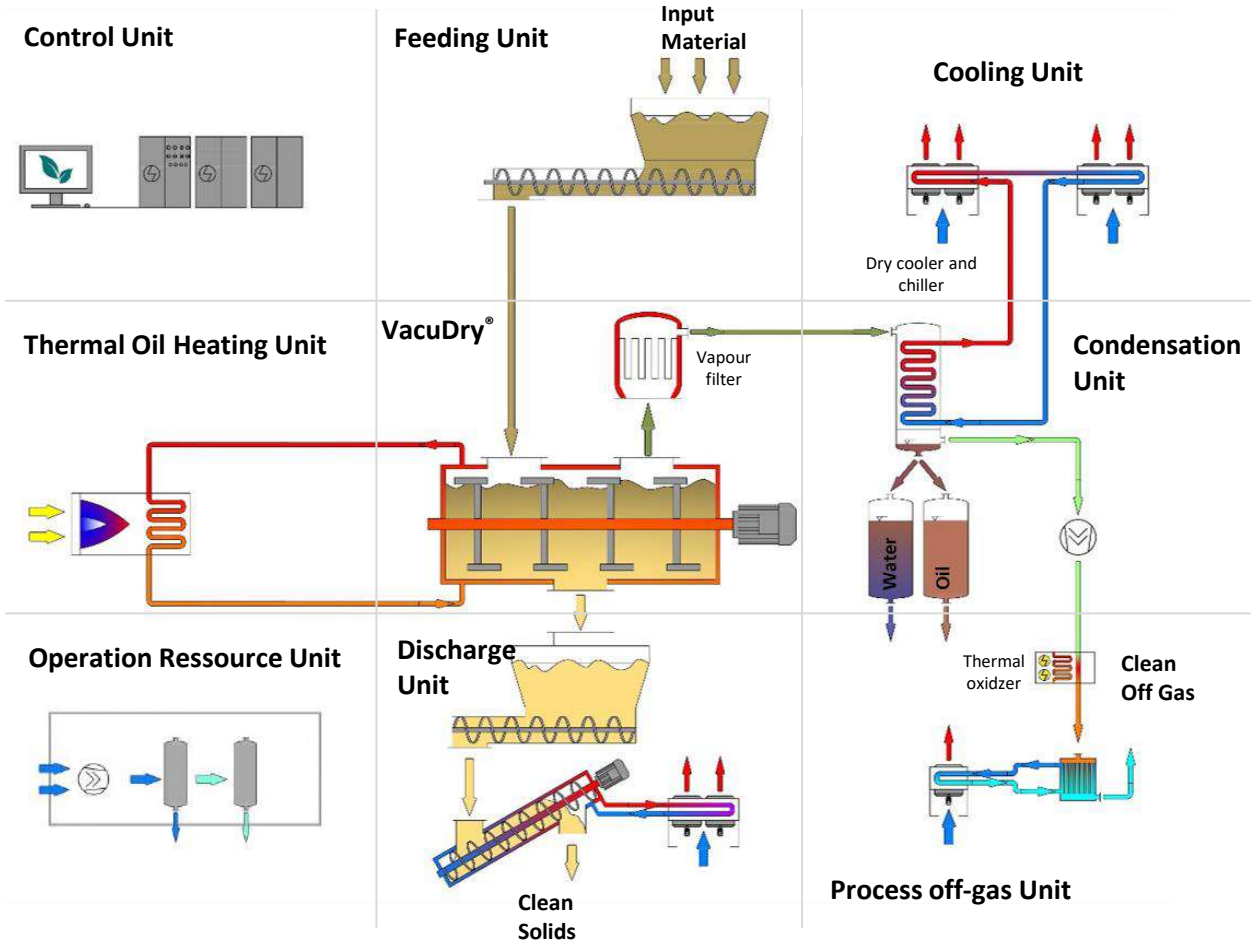


We separate substances having a boiling point of up to ~ 450 °C.

Or, we decompose substances and evaporate the volatile parts.

VacuDry® technology

VacuDry® Flowchart



Working principle

Contaminated soils & sludges

Treatment (VacuDry®)

Recovered resources

VacuDry® is a physical separation by vacuum distillation with the highest quality of recovered resources due to the vacuum and low temperature treatment

VacuDry® for on site remediation (France)

70,000 tons of mercury & PAH contaminated soil and building rubble had to be cleaned in an industrial facility in the south of France

Plant set up:

- Vacuum dryer type: VacuDry® 12 000
- Batch size: 8,400 litres
- Heating system: Thermal oil Unit – Natural Gas
- Operating pressure: 50 mbar (abs)

Composition (input material)	Water	Mercury	Solids (soil)
	6.1%	> 50 ppm	93.9%

Batch time	255 min	Min. Pressure	50 mbar (abs)
Max. material temp.	350 °C	Max. heating temp.	380 °C

Input material

[Hg]: > 50 ppm

Condensate

Output material

[Hg]: < 1 ppm

VacuDry® for on site remediation (India)

In order to treat mercury contaminated soil derived from a former thermometer factory in India, it was necessary to implement a technology that would allow for on-site, ex situ remediation rather transporting contaminated material over long distances.

Plant set up:

- Vacuum dryer type: VacuDry® 3 000
- Batch size: 2,800 litres
- Heating system: Thermal oil heating unit – operated by electricity
- Operating pressure: 50 mbar(abs)

Composition (input material)	Water	Mercury	Solids (soil)
	17.5%	> 80 ppm	82.5%

Batch time	255 min	Min. Pressure	50 mbar (abs)
Max. material temp.	350 °C	Max. heating temp.	380 °C

Input material

[Hg]: > 80 ppm

Condensate

Output material

[Hg]: < 1 ppm

Mobile Mercury Conversion Unit

Concept - Conversion process

Elemental Mercury

Elemental Sulphur

Mobile Mercury Conversion Unit

Mercury sulphide (HgS)

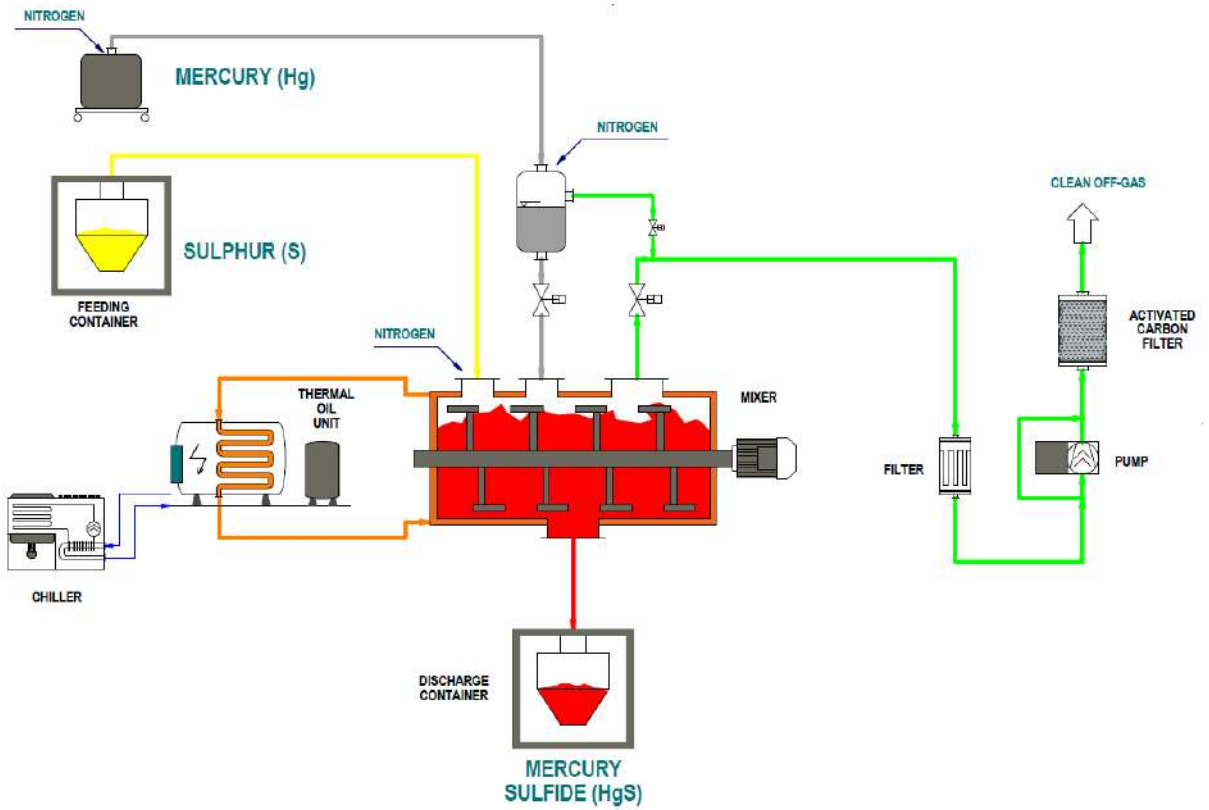
Non toxic, stable and insoluble compound

Conversion of pure elemental mercury (Hg) to mercury sulphide (HgS / cinnabar)

Mobile Mercury Conversion Unit

For final disposal of pure elemental mercury

MMCU Flowchart



Specifications

- Nitrogen atmosphere, safe and hermetically closed mixer
- Operation under ambient pressure
- Mercury and sulphur are fed to the mixer
- Liquid phase chemical reaction
- Low off-gas flow during stabilization process

An inert atmosphere and a liquid phase chemical reaction ensure safe operations

Mobile Mercury Conversion Unit

On-site mercury conversion references

UK – chlor-alkali plant:

400 tons Hg converted to HgS on-site

Poland – chlor-alkali plant:

130 tons Hg converted to HgS on-site

econ stabilised on-site more than 500t of Hg to HgS for safe final disposal

Conclusions

Hg contaminated soil treatment using econ technology

- Proven on-site treatment solution, from the treatment of Hg contaminated soil to the stabilisation of the recovered mercury for its safe final disposal.
- On site treatment reduces significantly logistics costs and avoids unpredicted transport risks during the waste mobilization from site to site.
- High flexible system that allows treatment of different kind of waste: liquid, pasty, solid
- High degree of decontamination (>95%) of solid waste, enabling it to be re-used as backfill material during the site remediation.
- Very low carbon footprint due to advanced technology and the use of renewable energy supply

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Webinar on the sound management and elimination of mercury and mercury waste in the Chlor-Alkali sector

5. Joint Session

Moderated by Koji Ono, Ministry of the Environment, Japan, Co-lead of the Mercury Waste Management Partnership Area

Specific International Programme (SIP) project in Iran: “Implementing of Minamata Convention on Mercury Management in Chlor-Alkali Plants in the Petrochemical Industry"

Global Mercury Partnership Webinar on the sound management and elimination of mercury and mercury waste in the chlor-alkali sector

Thursday, 16 February 2023

Marianne Bailey and Irene Rizzo
Minamata Convention Secretariat

MINAMATA CONVENTION ON MERCURY

Specific International Programme: Snapshot

Overview of Specific International Programme

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- The Specific International Programme to support Capacity Building and Technical Assistance (SIP) is **one of the two components of the financial mechanism** of the Minamata Convention on Mercury, together with the Global Environment Facility (GEF).
- It was **defined by Article 13 of the Convention** to deliver direct capacity-building and technical assistance to **developing country Parties and Parties with economies in transition**
- Applications for SIP funding can **only be submitted by Parties** to the Minamata Convention
- The SIP **supports Parties in implementing specific obligations** under the Convention, including Article 5 on Manufacturing processes in which mercury or mercury compounds are used
- Priority implementation **needs are defined by the applicants**
- The SIP supports projects to be carried out on a **regional, sub-regional or inter-regional** basis, in addition to **national** projects
- The SIP can provide support **from USD 50,000 to USD 250,000** per project

Overview of SIP Projects after three Rounds

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Please see our **SIP MATTERS** newsletter for information on the **progress of the projects**, see LINK .

Contributions to the Specific Trust Fund from Norway, Switzerland, Sweden, Germany, the United States, Austria, the United Kingdom, the Netherlands, Denmark, and France

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The first SIP project in the Islamic Republic of Iran

Overview of the Iran SIP First Round project

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IRAN

Specific International Programme - 2018 Round

Implementing the Minamata Convention on Mercury: Management of Chlor-Alkali Plants in the Petrochemical Industry

PROJECT OBJECTIVE

The objective of the project is to assist the Islamic Republic of Iran in decommissioning activities of chlor-alkali plants in order to enforce policy and strategic decision making.

PROJECT SUMMARY

One of the major sources of mercury in the Islamic Republic of Iran are the chlor-alkali plants in the petrochemical industry. According to the UNEP Global Mercury Assessment in 2013, the global anthropogenic emissions of mercury from the chlor-alkali industry was 6% of the total emissions. In the Islamic Republic of Iran, the petrochemical industry consumes a large amount of mercury.

There is an urgent need to set, customize and strengthen guidelines and promote adequate clean technology in major industries. The objective of this project is therefore to develop guidelines for minimization of mercury emissions and wastes and build capacity to manage mercury contaminated sites in the petrochemical industry in Iran to protect human health and the environment. The outcomes of this project will support Iran in implementing the Minamata Convention on Mercury – specifically Articles 1, 5, 14 and 16 by providing the necessary technical guidance, capacity building and awareness-raising.

BUDGET	DURATION	RELEVANT ARTICLES	IMPLEMENTATION ENTITY	PARTNERS
USD 100,000 Applicant contribution USD 45,000	**1 June 2020 - 31 August 2021**	**Article 1** - objective **Article 5** - mercury use in manufacturing processes **Article 14** - capacity-building, technical assistance & technology transfer **Article 16** - health	Research Institute of Petroleum Industry	Ministry of Petroleum (RIPI)

- SIP First Round
- Duration: 15 months
- Started: 5 May 2020
- Ended: 4 August 2021
- SIP Budget: USD 100,000
- Applicant contribution: USD 45,000
- Focus on Article 5 and Annex B, also support Articles 3, 11, 12, 14, 16

Iran SIP project outputs

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Project outcome: to develop a guideline on the process of shutting down the mercury chlor-alkali plant, as well as on waste management and site decontamination in the petrochemical industry (Abadan)

PROJECT RESULTS

MEASURE 1
Conducting an inventory of mercury pollution in chlor-alkali plants.

MEASURE 2
Undertaking a health risk assessment to identify the population groups most at risk.

MEASURE 3
Developing guidance for decontamination, demolition, disposal of mercury wastes, and contaminated site management of chlor-alkali plants.

MEASURE 4
Periodic monitoring and review of progress.

PROJECT MANAGEMENT

A steering committee will be established consisting of the project manager, coordinator, NGOs representatives, international and national consultants, projects management unit representative, national staff in industry and university. The day-to-day management and administration of the project will be handled by the project coordinator from the ministry of petroleum represented by Research Institute of Petroleum Industry (RIPI).

RELEVANT SDGs

Contact

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Department for Chemical and Biologic Conventions
Department of Environment / Research Institute of Petroleum Industry - Iran
etemadn@ripi.ir

Secretariat of the Minamata Convention on Mercury
E-mail: MEA-MinamataSecretariat@un.org

- **Small Scale Funding Agreement** between UNEP, represented by the Secretariat of the Minamata Convention and the Ministry of Foreign Affairs of the Islamic Republic of Iran.
- The project was **executed by the Research Institute of Petroleum Industry**

Details about the Abadan chlor-alkali plant

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Unit 300, Chlor-Alkali
Feed: NaCl 150 TPD
Production Capacity: Chlorine 80 TPD

Caustic Soda 90 TPD
Operation Period: 1993-today

Site visits

The project team visited this site periodically to **collect samples** of mercury contamination in different media including soil, water and air.

Mercury Sampling and Analyses

The collected samples were sent to RIPI labs to be **analysed** after stabilization. The analysis methods were developed and performed using the atomic absorption spectroscopy.

- Speciation:
  - Metallic Mercury
  - Solid Mercury Compound such as HgO
  - Dissolved Mercury such as {HgCl4}-2

Health and Safety Risk Assessment in decommissioning the chlor-alkali plant in Iran

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Health protection of workers during demolition:

- Base Line Study
- Medical Examination & biomonitoring
- Questionnaire
- Job Hazard Analysis (JHA) as a tool for risk assessment focusing on gender and mercury
- Written Action Plan

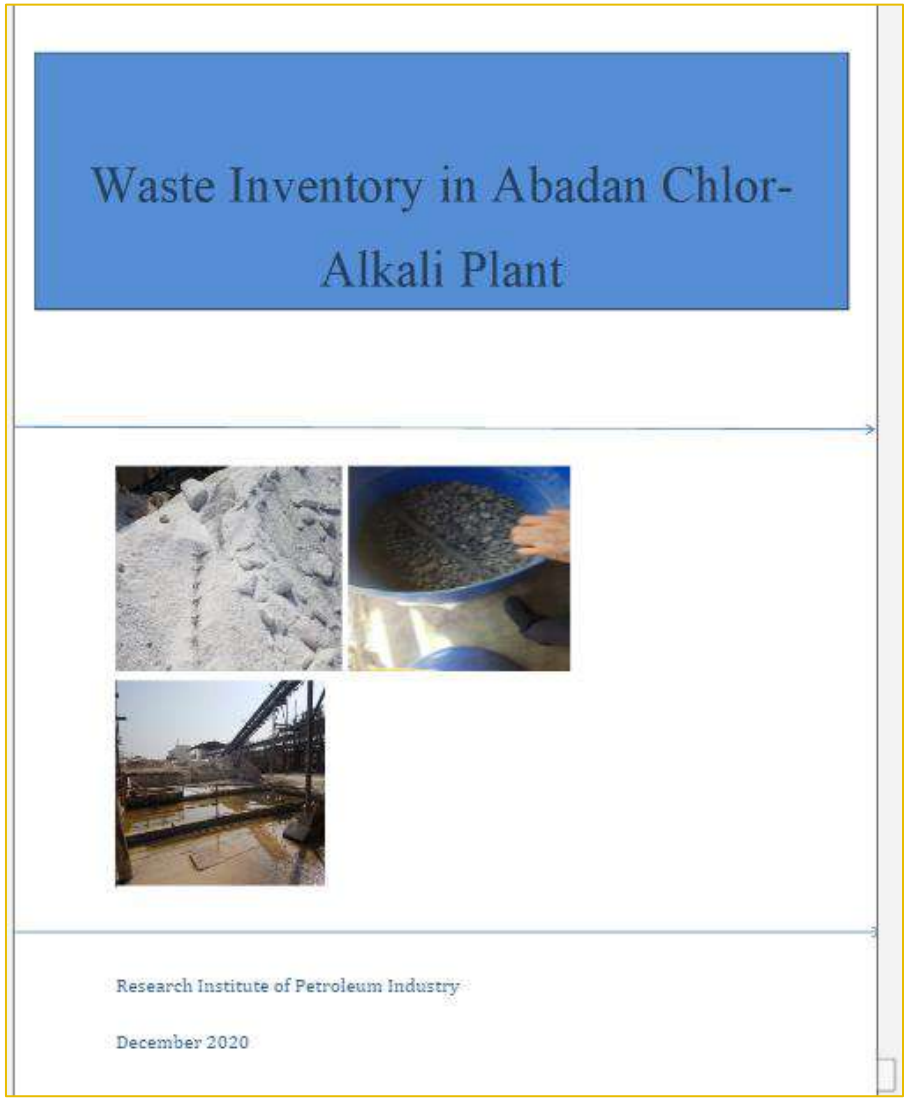
4.3. Job Hazard Analysis (JHA) Technique

A Job Hazard Analysis (JHA) is a technique that aims at identifying and controlling as well as evaluating hazards associated with tasks (steps) within a specific job or activity to eliminate or mitigate them prior to starting the actual work. The many benefits of Job Hazard Analysis include [28]:

- Setting performance standards
- Standardization of operations based on acceptable safe practices and Personal Protective Equipment (PPE)
- Provision a form of training documentation regarding the employee's knowledge of the job requirements
- Reducing injuries
- Reducing absenteeism
- Increasing productivity
- Increasing morale
- Protecting employees
- Assistance in standard-specific compliance (e.g., Personal Protective Equipment [PPE], Hazard Communication, etc…..)

To conduct a JHA, it is best to involve workers who do or will do the jobs being analyzed and

Waste stream



Stream	Source and Comments	Quantity
1	Waste sludge from brine purifcation	5 ton/day
2	Cartridge filter (used for wastewater filtration)	32 pieces
3	Activated carbon (used for wastewater dechlorination)	500 kilograms
4	Resin (there are two resin vessel)	500 kilograms in each vessel
5	Effluent from chlor-alkali unit	30-40 m^3/day
6	Graphite used in decomposers (there are 20 decomposers)	500 kilograms in each decomposers
7	Activated carbon from caustic filters (there are 58 carbon filters)	160-165 kilograms in each filters
8	Demister (used for removal of liquid droplets from hydrogen stream)	3 elements
9	Activated carbon used for mercury removal from hydrogen stream	500 kilograms
10	Polypropylene packing used for chlorine neutralization	2" packing: 20000 pieces 3" packing: 2000 pieces
11	Demister (used for removal of liquid droplets from chlorine stream)	Two layers of fibers with a diameter of 0.5 m and a height of 3 m
12	Spent sulfuric acid from chlorine drying towers	-
13	Hydrogen from decomposer contains mercury vapor	25.2 Nm^3/day

Contaminated materials

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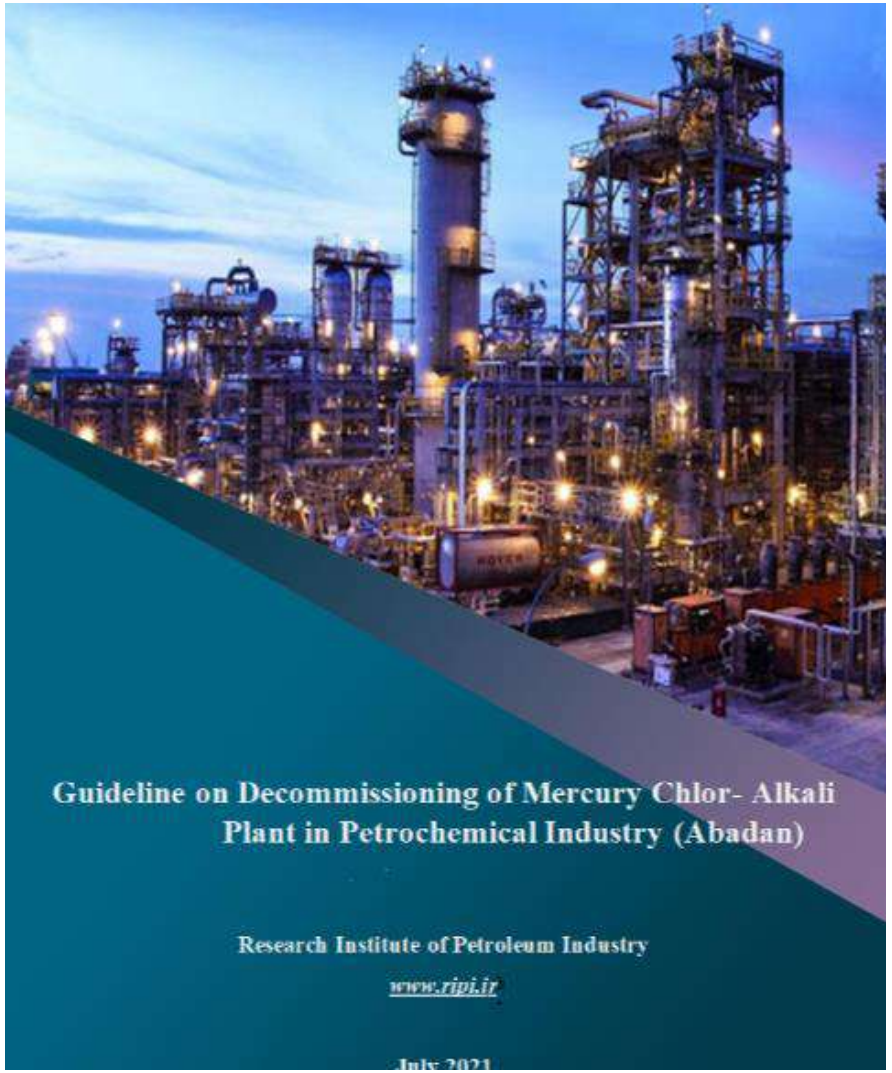
No.	Contaminated materials
1	Sludge from storage tanks and sumps
2	Sludge from settling catch pits, drains etc.
3	Cartridge filters
4	Activated carbon from filters
5	Ion exchange resin
6	Sulphurised charcoal from hydrogen purification
7	Graphite from decomposers
8	Demister filter
9	Polypropylene packing from packed towers
10	Rubber/packing
11	Brick work/concrete
12	Ebonite-lined cell components (anodes covers, end boxes, side walls, pipework)
13	Steel (cells, decomposers, scrap components from baffles, H2 coolers, base plates, Hg pumps, pipework)
14	copper conductors
15	cell sealant (layers concrete)
16	asphalt
17	concrete and subfloor
18	wood
19	soil
20	decomposer lagging (thermal insulation)

Iran SIP project results

- Established the project team and the Project Steering Committee
- Conducted site visits to the Abadan chlor-alkali plant
- Collected and analyzed samples to develop an inventory on mercury waste and contaminated materials
- Undertook a gender-based health and safety risk assessment to identify the population groups most at risk
- Developed guidelines on decommissioning of the plant, including environmentally sound management of its mercury wastes
- Monitored project implementation; reported to the Secretariat; conducted terminal review



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Thank you for your attention

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#MakeMercuryHistory

Joint mission of chlor-alkali and waste management partnership areas to Uruguay (March 2018)

We are most grateful for Ministry of Housing, Territorial Planning and Environment (MVOTMA), U.S. Environmental Protection Agency (EPA), Ministry of the Environment, Government of Japan (MOEJ), chlor-alkali & hazardous waste industries for their valuable contributions

Overseas Environmental Cooperation Center, Japan (OECC)

Yayoi Hayashi

Framework of the Joint Mission

- Framework of the Joint Mission
  - To stop mercury use is not the only issue (although the issue is big enough in fact), but also to appropriately manage the excess mercury (metal mercury) is a main concern (Not allowed to reuse or recycled for other purpose under the Minamata Convention).
  - In addition, to manage the waste contaminated with mercury (plant debris, soil pollution) is another issue.

  ⇒ Collaboration between Chlor-alkali and Waste Management Areas.
- Why Latin America & Why EPA & MOEJ collaboration
  - Mercury process was still remaining in the region
  - EPA as one of the Co-lead of GMP Chlor-alkali Area was willing to understand more about the situations on the ground.
  - MOEJ was promoting the technical assistance in “one package” combining the expertise of mercury-free process (ion-exchange membrane) and waste management.
  - EPA and MOEJ, based on a voluntary cooperation framework, consulted each other and the countries interested in receiving the joint mission. Uruguay was identified as a result.

Objectives & Participants of the Joint Mission

- Objective: Fact Finding
  - To find out the current status towards mercury-free chlor-alkali process on the ground
  - To identify needs, e.g., technical, legislative, financial, etc.
  - With an emphasize to study throughout the steps from installing a new manufacturing process to excess mercury management, decommissioning, mercury waste treatment and hazard control of environmental mercury contamination
- Participating experts and coordinators from EPA and Japan
  - EPA as a GMP Chlor-alkali Area Lead.
  - Ion-membrane technical expert (from a Japanese chlor-alkali maker, also a manufacturer of ion-exchange membranes)
  - Mercury waste management technical expert (from a Japanese hazardous waste treatment company)
  - A coordinator for environmental cooperation study (from a Japanese public agency)

Visits & Main Topics (March 2018)

Visit	Main topics
Chlor-alkali industry (main office and plant)	Planning towards mercury-free process, waste management current status / future needs
Security landfill (designated landfill for hazardous industrial waste)	Hazardous waste treatment / disposal criteria especially related to mercury waste
One of the private financial institutions	Financial tools potentially available for the chlor-alkali industry
Ministry of Industry, Energy and Mining	Governmental support for private industry (mercury-free process saves energy, for example)
Ministry of Housing, Territorial Planning and Environment (MVOTMA)	Mercury management policies and measures for the chlor-alkali industry

Main Findings (as of March 2018)

- ✓ The chlor-alkali industry was well informed of the mercury-free process (ion-exchange membrane)
- ✓ The engineered landfill was ready to dispose of the waste contaminated with mercury according to the national standards
- ✓ The environmental contamination with relatively high mercury concentration needed to be solved (the contaminated marsh was under temporary control at that time)
- ✓ The primary challenge was the financial investment required to build a new chlor-alkali process
- ✓ Excess mercury (elemental mercury) needed to be appropriately managed (finally disposed of at some point in the future)

Thank you

Webinar on the sound management and elimination of mercury and mercury waste in the Chlor-Alkali sector

7. Closing statement

Ozunimi Iti, UNIDO, Co-lead of the Mercury cell Chlor-alkali Production Partnership Area

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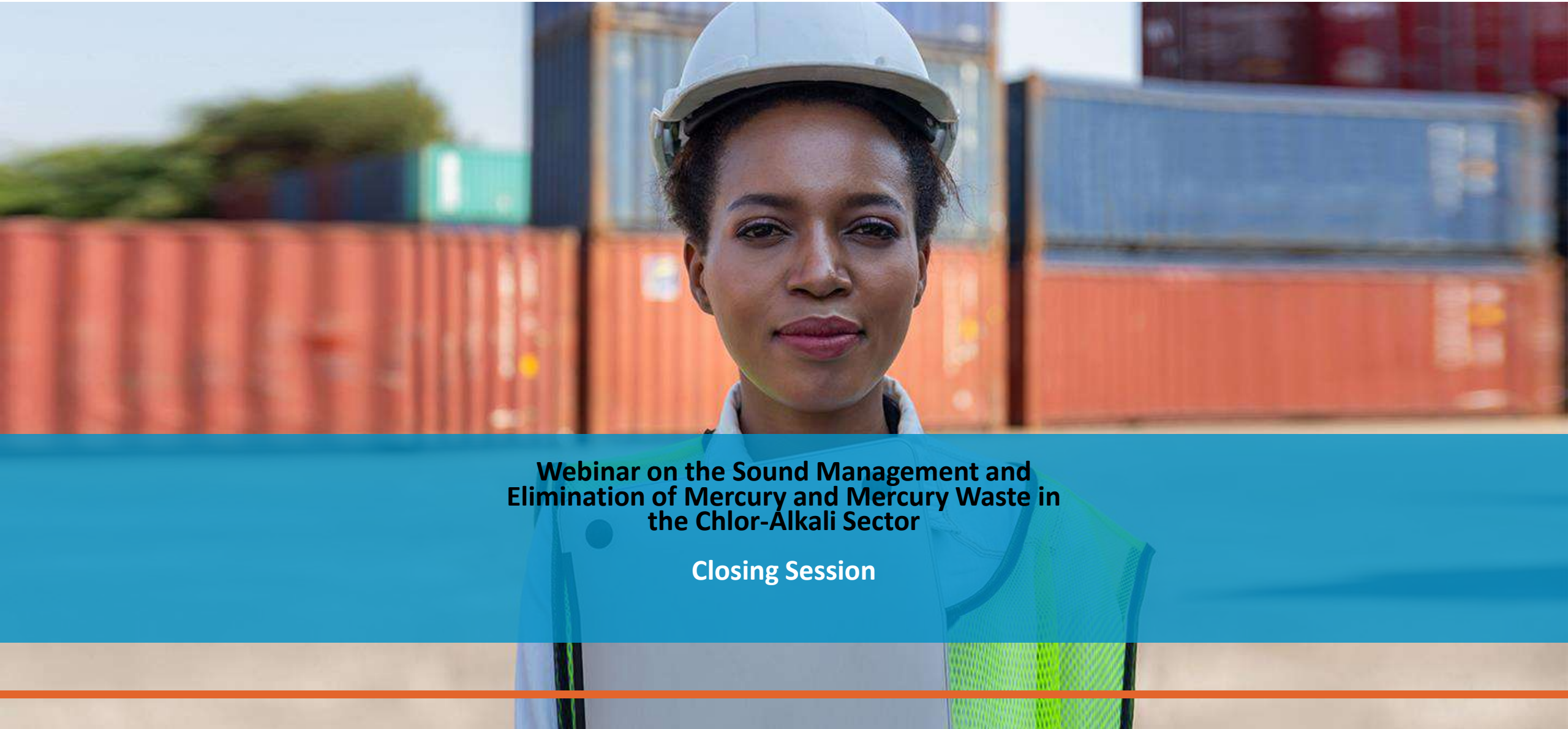
SUSTAINABLE DEVELOPMENT GOALS



Webinar on the Sound Management and Elimination of Mercury and Mercury Waste in the Chlor-Alkali Sector

Closing Session

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Links to Information Resources and Financial Support

https://worldchlorine.org/
https://www.unep.org/globalmercurypartnership/
https://www.thegef.org/what-we-do/topics/chemicals-and-waste
https://www.greenclimate.fund/theme/mitigation
https://www.mercuryconvention.org/en/implementation/specific-international-programme

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Links to Technology Providers

https://www.tauw.com/webinar-mercury-contaminated-site-management-industry/
https://batrec.ch/en/mercury-treatment/regulatory-context/
https://www.econindustries.com/industries/chlorine-industry
https://curium.world/en/solutions/demantelement-depollution/
https://nkcl.jp/
https://www.rvagroup.org/

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THANK YOU!

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THANK YOU!

www.unep.org/globalmercurypartnership