United Nations
Industrial Development Organization

Schweizerische Eidgenossenschaft
Confédération suisse
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Swiss Confederation

NO TIME TO WASTE:

International expert group meeting on the sustainable management of mercury waste

TEAM

Editorial team: Gabriela Eigenmann (project manager), Alice Miller (editor), Iñaki Rodriguez Lazaro

Design: Adelaida Contreras

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Contents

Mr. Li Yong

Director General of UNIDO

I sincerely hope that this expert group meeting not only helps us to better understand the different elements and integrated approaches of mercury waste management, but also facilitates the exchange of knowledge and expertise, the transfer of technologies and enhances cooperation among all of us.

Executive Secretary, Minamata Convention on Mercury

The environmentally sound management of mercury waste is a fundamental challenge that we all face! We can stop using mercury in factories, replace products using mercury, control the emission of mercury, etc. but mercury will not disappear from the environment, it will go into the waste stream.

Ms. Rossana Silva Repetto

Permanent Representative of Switzerland to UNIDO

Switzerland supports a number of countries in different regions in their ratification of the Convention and in their early implementation. To do so it is excellent to be able to work with competent partners like UNIDO. My government will remain committed to further improve the international chemicals and waste governance to ensure change on the ground.

His Excellency Ambassador
Claude Wild

Executive summary

The international expert group meeting on managing mercury waste was held on 10 and 11 September 2018 in Vienna, Austria. It brought together **more than 75 participants** from the private sector, Member States, international organizations, academia, regional organizations and civil society to discuss the management of mercury waste.

The meeting covered three key topics: **interim disposal, mercury waste treatment** and **final disposal.** The discussions had three aims: to present the **current status of mercury waste management;** to facilitate **an exchange of knowledge and technology transfer** between stakeholders; and to begin to **build a roadmap** for an integrated approach to mercury waste management.

WHAT WE FOUND

Preventing the use of mercury in products and processes is **crucial** in order to reduce the generation of new mercury waste. For now, an environmentally sound strategy is needed to deal with current mercury waste.

The current situation sees many challenges in developing countries and economies in transition, where a **lack of appropriate infrastructure and systems** for environmentally sound management (ESM) of hazardous waste creates obstacles.

Facilities are needed to address **different hazardous waste streams,** including mercury waste. **Better management** is needed for effective collection, segregation, transport, storage, treatment and final disposal. **The private sector** has technologies to ensure the environmentally sound management and disposal of waste, but transport and costs still represent challenges for many countries. **An integrated and coordinated approach is needed.**

Beginning of the end: First, the facts

INTRODUCTION TO MERCURY WASTE

Mercury is a chemical element that is highly toxic to humans and the environment. It is released into the environment through natural sources and human activities, and it cannot be destroyed. Mercury waste is hazardous waste that needs to be carefully managed to prevent emissions and releases into the environment.

PRODUCTS:

At the meeting, the United Nations University (UNU) presented a new study on forecast mercury waste generation for the next 15 to 20 years. The study covered only mercury-added products, not industrial processes or other sources. It showed that mercury waste in 2017 totaled 1,300 kilotons (kt) and is expected to peak in 2025 with a total of 1,550 kt. Thanks to actions under the Minamata Convention, the total should decrease to 190 tons by 2035. The executive summary of the study is available as an annex to this publication.

EMISSIONS:

If mercury waste is not dealt with in an environmentally sound manner, it can lead to releases of mercury into the environment. In 2015, it was estimated that over 160 tons of mercury were emitted. This is around 7.5 per cent of the total global mercury emissions of approximately 2,220 tons (UN Environment, Global Mercury Assessment, 2018).

MERCURY SUPPLY:

The second largest source of mercury supply is from product and waste recycling. In 2015, the amount of recycled mercury made available to the commercial sector was estimated to be 1,040 to 1,410 tons (UN Environment, Global Mercury Supply, Trade and Demand, 2017).

WHICH INTERNATIONAL AGREEMENTS COVER MERCURY WASTE?

The Minamata Convention

Under Article 11 of the Minamata Convention on Mercury, each party needs to ensure environmentally sound management (ESM) of mercury waste, in accordance with the guidelines developed by the Basel Convention. The Minamata Convention has the option to adopt additional requirements. Recycling, reuse and recovery of mercury is only for the uses permitted under the Convention. Transboundary movements must be in line with the regulations of the Basel Convention. The definition of mercury waste thresholds, as required by the Minamata Convention, will be discussed along with further guidelines at the second Conference of the Parties in November 2018.

Under Article 3, excess mercury from decommissioned chlor-alkali facilities must be disposed of in an environmentally sound manner.

The Basel Convention

Mercury waste is classified as hazardous waste under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The Convention restricts and regulates transboundary movements of hazardous wastes; written consent from all states is required before transboundary movements can proceed. Technical guidelines for mercury waste were developed and adopted by the Parties to the Basel Convention. The first Conference of the Parties to the Minamata Convention also recommended the use of these guidelines.

A draft manual on Extended Producer Responsibility (EPR) and financing schemes for environmentally sound management of hazardous waste can be found on the Basel Convention website.

The Global Mercury Partnership (GMP), UNEP

The GMP involves stakeholders from governments, industry, non-governmental organizations, and academia. The Waste Management Area (WMA) has 92 partners, including UNIDO. The WMA is committed to three outcomes: (i) information sharing, (ii) dissemination of technical information, and (iii) the implementation of project-based activities.

Safe and sound: Hazardous waste management with UNIDO

UNIDO has helped to manage hazardous waste – whether it be mercury, persistent organic pollutants or ozone depleting substances – all over the world.

Waste is part of our green industry initiative, where we support more sustainable industries and the creation of sustainable industrial service providers. Our goal is to safeguard the environment while helping industry to develop in innovative and more resourceful ways.

Our Department of Environment works on **industrial resource efficiency, circular economy** and **multilateral environmental agreements,** like the Minamata Convention on Mercury. **We have built close working relationships** with governments, the private sector, key financial institutions, donor countries, international and regional organizations, academia and NGOs.

Our experience and expertise in the waste management sector includes:

- Sustainable management of resources to prevent and reduce waste generation
- Development of relevant regulations and policy
- Facilitation of waste collection and transport systems
- Recycling and reuse of non-hazardous components (e.g. from e-waste)
- Storage, treatment and disposal or destruction of different waste streams containing persistent organic pollutants, ozone depleting substances and mercury (e.g. e-waste, medical waste, obsolete pesticides)
- Promotion of best available techniques and best environmental practices in waste destruction operations
- Remediation of mercury-contaminated sites
- Facilitation of exchange and knowledge transfer

In the waiting room:
Interim disposal of mercury waste
(pending collection or final disposal)

We began with the challenges faced by countries and the private sector on the matter of interim disposal. Discussions showed that there is no one-fits-all solution.

THROUGHOUT THE MEETING WE HEARD FROM PARTICIPANTS FROM THE PRIVATE SECTOR. WE HAVE COMPILED DATA ON ALL OF THE COMPANIES WHO PARTICIPATED, AND YOU CAN READ ABOUT WHERE AND HOW THEY WORK IN APPENDIX II.

NOMURA KOHSAN: Nomura Kohsan have 40 years of experience in mercury waste management. Currently, there are administrative challenges to obtaining consent from transit countries for transboundary movements of hazardous waste. Some options to address this might be the identification of the threshold of mercury waste, better inventory control, monitoring of transboundary movement of mercury waste and pre-treatment.

CEBU COMMON TREATMENT FACILITY: Cebu Common Treatment Facility Inc. in the Philippines is a private treatment facility to deal with interim mercury waste. Cebu Common Treatment Facility primarily focuses on bulb crushing. The bulbs are crushed in the Philippines and the waste goes to Nomura Kohsan for final disposal. Two primary challenges were highlighted. The first was **transport difficulties.** In the export process, it takes a long time to get consent from transition countries. The second problem was the **assurance** of return of investment. Currently the consumer pays for treatment, but under new regulations the company is responsible for collection, segregation, dismantling and packaging of waste.

WE ALSO HEARD FROM DEVELOPING COUNTRIES AND ECONOMIES IN TRANSITION ABOUT THEIR SPECIFIC NEEDS AND CHALLENGES IN MANAGING MERCURY WASTE.

VIET NAM: In Viet Nam, a treatment facility requires a license to treat hazardous waste. A distinction is made between industrial and household waste. Only 40 per cent of hazardous waste in Viet Nam is treated. For example, 70 per cent of medical waste is burned, and 30 per cent is buried. Co-processing in cement kilns of hazardous waste takes place. The main challenges include: lack of specific regulations and guidelines; limited human and financial resources; small treatment facilities; and insufficient treatment technology, mostly involving burning.

Brainstorm:

The meeting broke into small groups to tackle some key questions.

WHAT ARE THE MAIN CHALLENGES TO ENSURE SAFE AND SOUND INTERIM STORAGE?

- Limited human and financial resources
- Lack of country specific guidelines
- Question of who is responsible: government, producer, consumer, international organizations.
- Low levels of awareness
- Costs:
  - The cheapest solutions that do not take into account all externalities are still more attractive to governments than investing money in state-of-the-art technologies.
  - Small countries struggle because it is difficult to make small volumes profitable.

IS A REGIONAL APPROACH USEFUL?

- A regional approach allows for the storage of larger volumes of waste, and the sharing of costs. The issue of regulation and policy remains.
- Regionally based investments could ensure that waste volumes are economically feasible.
- Training should occur at the regional level.
- Transporting hazardous waste is still a major obstacle in developing countries, since its import is often banned for protective reasons. Transport and shipment challenges will improve with accumulated experience.

HOW CAN WE MEET THESE CHALLENGES?

Prevention is vital. If we cut down on the use of mercury, we cut down on waste.

Once the waste is created, all parts of the management process must be coordinated.

Regulations:

- A sound and clear regulatory framework must be set up to clarify the responsibilities for hazardous waste. Sound legislation is needed from procurement and design of hazard-free products to final disposal of waste.
- Clear standards need to be endorsed by governments, industry and communities.
- Stronger involvement of governments is needed at all stages.

On the ground:

- Create an inventory. Keep clear records of where products are, and what will end up as waste. Monitoring is key.
- Regular inspections are required. Facilities must be secure, so mercury waste does not disappear. The time period for storage should be specified.
- Guidelines such as the Basel mercury waste guidelines for the construction of facilities, blueprints of sites, and/or regulation of sites, must be translated into additional languages for the countries concerned.
- Further awareness raising and educational activities must be carried out, as well as training and sharing of experience. Local people, including collectors and producers, must be educated about the risks. Benefits for communities and society should be demonstrated.

Costs and shipments:

- Extended Producer Responsibility (EPR) fees and payments should be introduced.
- Particular types of waste should be treated locally. When possible, it is cheaper to treat the waste where it is generated.
- For other types of hazardous waste with low mercury content, shipment may be considered depending on location, availability of treatment facility and distance.
- Availability and costs of mobile treatment plants should be also investigated and compared with shipment costs and the required time for special permits.

Treat it right: Mercury waste treatment

Technologies for mercury waste treatment exist. Waste is clearly being generated and needs to be treated. The question is how to bring together the waste and the technology, and how to fund treatment. A regional approach is key.

NIGERIA: The Government of Nigeria faces many challenges, such as low level of public awareness, poor quality of treatment and recycling activities, large informal sector, use of inappropriate technology and inadequate technical capacity.

WE HEARD FROM A NUMBER OF PRIVATE COMPANIES PROVIDING A WIDE RANGE OF TREATMENT AND STORAGE OPTIONS AROUND THE WORLD.

The companies were: **BATREC INDUSTRIE AG, BEST MERCURY TECHNOLOGY (BMT), CEBU COMMON TREATMENT FACILITY INC., ECON INDUSTRIES, LAMPS4U FZCO, NOMURA KOHSAN CO. LTD., MINAS DE ALMADÉN Y ARRAYANES S.A. (MAYASA), RECLITE (PTY) LTD. and REMONDIS QR GmbH.** All of these companies highlighted their particular areas of work, which can be seen in **Appendix II.**

Question of costs: The costs for treatment were roughly estimated to be between €100 and €300 per ton in European countries, depending on the composition and total volume of the waste to be treated. The final cost would depend on multiple factors in each case.

Brainstorm:

The meeting broke into small groups to tackle key questions.

WHAT ARE THE REALISTIC OPTIONS FOR MERCURY TREATMENT IN DEVELOPING COUNTRIES AND ECONOMIES IN TRANSITION THAT ADHERE TO THE MINAMATA AND BASEL CONVENTIONS?

Again, prevention is key. Poor product quality is an issue, particularly in developing countries. Separation, collection and monitoring need to be addressed. Much of the discussion revolved around whether or not to treat waste locally or to export waste.

Local vs. export

- A local option is better for the environment and to ensure safe operations. Mercury treatment requires a skilled workforce.
- A local treatment facility is only feasible if there is more than 1,000 tons of industrial waste per year. Otherwise an alternative to local treatment is needed.
- A mobile solution may not be able to ensure maintenance and technical quality. Although a mobile solution may work in one country, there is no guarantee it will work for another, as treatment providers would need to find reliable partners in the country.
- Some interim treatment locally or regionally could make transport less risky and less expensive.
- Type and quantity of waste (e.g. waste products, sludge, liquid) helps to determine the approach. "Easier" mercury waste may be handled, while the rest needs to be exported.
- In selected cases, some pre-treatment may be done locally/nationally – and then treated waste (also with reduced volumes) can be sent to a treatment and disposal facility.
- For artisanal gold mining and other contaminated sites, it may not be practical to ship waste. Remediation on-site is a more realistic option.
- In developing countries, legislation often facilitates the export of hazardous waste, but bans its import for protective reasons. For a regional approach, the question of export for treatment/disposal needs to address this hurdle carefully.

COULD A REGIONAL APPROACH BE USEFUL? WHAT IS NEEDED FOR THIS?

- Because mercury treatment may not be economically feasible for a country, it could be better to have a regional mercury treatment platform, involving all stakeholders in the process.

- Worldwide mapping is required to see what capabilities exist. Mapping should include treatment facilities for different types of waste so governments know the options. Larger countries may be advanced enough to develop mercury waste treatment facilities to serve their local market and supplement with regional volumes.

- During the meeting it was suggested that the Minamata Secretariat and the Secretariat for the Basel, Rotterdam and Stockholm Conventions could host a database of service providers with expertise for treatment so that developing countries and economies in transition know who to contact.

- Existing unions and private sector associations should be used.

- Specific guidance is being drafted for the Basel Convention on transit transboundary movements, to be submitted to the next Conference of the Parties to the Basel Convention. These new guidelines should help to facilitate the process of prior informed consent. The draft is currently on the Basel Convention website (UNEP/CHW/CC.13/8).

ARE THERE CO-BENEFITS WITH THE TREATMENT OF OTHER WASTES?

- An integrated solution for all hazardous waste would be both useful and feasible.
- Interim storage of multiple wastes is possible.
- Benefits include sharing know-how on laboratory expertise, collecting and processing of waste, storage, inventory and sharing costs.

WHAT IS NEEDED TO MAINSTREAM HAZARDOUS WASTE TREATMENT?

- Governments and businesses need specific guidelines to cover the entire process taking into account the national and local circumstances.
- In some cases, multiple governments could solve the problem of hazardous wastes on a larger scale. A multipurpose plant may be an option.
- For countries that have no wastes treatment infrastructure, a hazardous waste facility can be a solution if relevant funds are available. If funds are limited, a step-by-step approach can be developed, beginning with a small facility.

WHAT ARE THE FUNDING SOURCES?

- Before EPR or any form of eco-taxation can be applied, a collection and treatment scheme and relevant regulations must be in place.

Extended Producer Responsibility

- EPR is a feasible solution.
- It was noted that EPR can be challenging for some developing countries, due to informal practices. It should be developed in accordance with national circumstances.
- Consumers are very price sensitive; the waste can enter the black market if the price rise is too high. A temporary deposit may be a sound solution.

Other potential options

- A different form of eco-taxation could finance treatment. This may be explored as a potential funding source at community level.

- GEF could be a funding source for pilot projects at national and regional level.

- GEF or other international donors will not encourage projects that aim to recycle or recover mercury for the market.

- The financing of treatment for mercury waste that already exists is also a significant challenge. Governments of developing countries and economies in transition, jointly with local communities and in partnership with the private sector should address international assistance for other types of waste (such as historically generated, "legacy" waste). Involvement of different stakeholders must be considered.

End game: Final disposal

The options for final disposal are limited. The best solution appears to be a regional approach.

Technical options for final disposal are available and recommended in the guidelines of the Basel Convention. Mercury waste can be disposed of underground in salt mines, in deep rock depository, in specially engineered landfills, or in carbon steel flasks.

For developing countries and economies in transition, the options discussed for final disposal were pre-treatment to export for final disposal, specially designed sanitary landfills (where a specific threshold is required and mercury is encapsulated in concrete or stabilized), or final disposal underground, which is costly and complicated. In some cases, regional cooperation – export from one developing country to another – presents its own challenges.

WE HEARD FROM COUNTRIES AND COMPANIES TACKLING THE ISSUE OF FINAL DISPOSAL.

COSTA RICA: In Costa Rica, there is no final disposal site, so waste needs to be exported. This is the situation of most developing countries, and it presents a wide range of challenges.

RECLITE: In South Africa, mercury is encapsulated in concrete and disposed of in specific landfills. Disposal treatment is administered at the landfill site. A government-controlled EPR scheme functions in South Africa, providing around 30 per cent of the funds.

K + S: Located in Germany, the salt mines provide underground final disposal for mercury waste. Because there is no humidity in the mines, there is no corrosion. The company's main clients are from the chemical industry in Europe, including chlor-alkali facilities. The salt mines are still the main income source for the company. When asked about costs, K+S gave a rough estimate of around €190 to €260 per ton of mercury waste for final disposal.

Brainstorm:

The meeting broke into small groups to tackle some key questions.

HOW CAN WE ADDRESS THE CHALLENGES FOR FINAL DISPOSAL?

- For developing countries and economies in transition, a comprehensive approach for hazardous waste makes sense for all stages of waste management.
- Regional cooperation is beneficial for everyone, particularly in countries where mercury waste generation is low.
- Technologies for ESM treatment of mercury and other hazardous wastes exist and function.
- How to collect the waste, bring it together and fund the treatment/disposal costs are the key challenges.
- There is no one-fits-all solution to arrange treatment and final disposal.
- EPR needs to be adapted to the developing country context.
- It was stated that final disposal options could be a possible solution for developing countries to avoid export, but the challenge would be to ensure environmentally sound management, control and monitoring.
- Awareness raising on hazardous waste management needs to occur among all stakeholders.
- UNIDO should build on existing experience and expertise and take a comprehensive approach to work with partners to ensure the ESM of hazardous waste management.

At last: Conclusion

This meeting is part of a much larger conversation. It is intended to complement discussions that are already occurring as part of the Global Mercury Partnership, the Basel Convention and the Minamata Convention.

For all stages of mercury waste management, we found the following:

Prevention remains the key issue. If we do not generate waste, we do not need to manage it. **Product design** is also a major factor to avoid the use of hazardous components.

Technology is available for treatment, but this technology is mostly applicable for developed countries. **We need to find solutions for developing countries and economies in transition.** This might mean local solutions.

A regional approach is useful for most situations, but the specific circumstances of each case must be considered.

Likewise, **an integrated approach** – where mercury waste is considered along with other hazardous wastes – is likely to be useful, depending on specific conditions.

Strengthening public-private partnerships (PPP) is crucial for successful mercury waste management. This is not only because of access to technology from the private sector, but also because of the cooperation required for Extended Producer Responsibility (EPR) schemes.

Appropriate funding and business models are important, particularly for developing countries, both for local and regional solutions as well as to ensure the sustainability of integrated approaches to hazardous waste management.

Awareness raising is needed at all levels. Communities, industries and governments need to be aware of the risks of mercury, as well as the benefits of environmentally sound disposal for human health and the environment.

For the future, **pilot projects** could be developed to **test regional and integrated approaches.**

Thank you to everyone who took part in the meeting. We look forward to continuing the conversation.

Annexes

International expert group meeting on sustainable management of mercury waste

PROGRAMME

UNIDO headquarters, Vienna International Centre (VIC)

Monday, 10 September 2018

Lunch offered by UNIDO

Opening of the event

- **Mr. Li Yong**, Director General, UNIDO
- **H.E. Ambassador Claude Wild**, Permanent Representative of Switzerland to UNIDO
- **Ms. Rossana Silva Repetto**, Executive Secretary, Minamata Convention on Mercury
- Message from **Ms. –––Tamami Umeda**, Director General, Environmental Health Department, Ministry of the Environment of Japan (read by Mr. Mick Saito, Environmental Health Department)

Session 1: Setting the scene on mercury waste management

- *UNIDO: Industrial waste management,* **Mr. Alhilali,** Chief, Emerging Compliance Regimes (ECR) Division, UNIDO
- *Mercury waste volume,* **Ms. D'Angelo,** United Nations University (UNU)
- *Technical guidelines on ESM of wastes,* **Ms. Cenni,** Secretariat of the Basel, Rotterdam and Stockholm Conventions
- *Management of waste under the Minamata Convention,* **Mr. Toda,** Secretariat of the Minamata Convention
- *Report of the meeting of the Waste Management Area of the Global Mercury Partnership,* **Ms. Asari,** Kyoto University, Japan

Session 2: Interim disposal of mercury waste (pending collection or final disposal)

- Introduction by moderator
- *Perspective from the private sector:* **Mr. Fujiwara,** CEO, Nomura Kohsan
- *Perspective from developing countries:* **Mr. Thang,** Government of Viet Nam
- *Perspective from the private sector:* **Mr. Locson,** Cebu Common Treatment Facility Inc.

- Discussion in breakout groups
- *What are the key elements to ensure that mercury does not disappear and is stored in an environmentally sound manner before it is treated for final disposal?*
- *What are the major challenges to ensure such safe and sound storage?*
- *What are the options to address them? Is a regional approach useful?*
- Report back by breakout groups and open discussion

Session 3: Mercury waste treatment

- Introduction by moderator
- *Challenges faced by African countries:* **Mr. Olubunmi,** Government of Nigeria
- *Presentations from companies:*
  - **Mr. Humez,** Batrec Industrie
  - **Mr. Dubbeldam,** Best Mercury Technology (BMT)

Wrap up and conclusion of the first day

- **Mr. Sicars,** Director, Department of Environment, UNIDO

Dinner reception hosted by the Government of Switzerland

Tuesday, 11 September 2018

Overview of the first day

- **Mr. Alhilali,** Chief, ECR Division, UNIDO

Session 3: Mercury waste treatment (cont.)

- *Presentations from companies:*
- **Mr. Schmidt,** Econ Industries
    - **Mr. Patel,** LAMPS4U
    - **Mr. Carrasco,** Mayasa
    - **Mr. Hiroki,** Nomura Kohsan
    - **Mr. Pakulat,** Remondis QR
- Discussion in breakout groups
- *For developing countries and economies in transition, what are the realistic options for mercury treatment that conform to the Minamata and Basel Conventions?*
- *How can they be realized?*
- *Could a regional approach be beneficial? Are there co-benefits with the treatment of other wastes?*
- *What are the funding sources (Extended Producer Responsibility or other options?)*
- Report back by breakout groups and open discussion

Session 4: Mercury waste final disposal

- Introduction by moderator
- *Perspective from developing countries: Costa Rica,* **Mr. Morales,** Government of Costa Rica
- *Perspective from the private sector:* **Mr. Steinbach,** K+S (Germany)
- *Perspective from the private sector:* **Ms. Schröder,** Reclite (South Africa)
- Open discussion
- *What is the best way to address the challenges of final disposal, including transboundary movements?*
- *What are the advantages and disadvantages of exporting waste for final disposal?*
- *Do we need more final disposal facilities and specially engineered landfills?*
- *Is a regional approach feasible?*

Conclusions and way forward

- **Mr. Alhilali,** Chief, ECR Division, UNIDO

Lunch offered by UNIDO

TABLE OF COMPANIES Hg WASTE TREATMENT

COMPANY	E-WASTE TREATMENT	HG WASTE TREATMENT TECHNOLOGIES							
		Stabilization (Hg into HgS)	Treatment other than stabilization	Site remediation	Interim storage of mercury waste	Final disposal	Mobile treatment solutions	Final disposal site	Other stages in the waste management than treatment and final disposal
BATREC INDUSTRIE AG	✓	✓	✓						✓
BEST MERCURY TECHNOLOGY (BMT)	✓	✓	✓	✓*	✓	✓	✓		✓
CEBU COMMON TREATMENT FACILITY, INC.	✓				✓				
ECON INDUSTRIES SERVICES GMBH		✓	✓	✓		✓	✓		
K+S AKTIENGESELLSCHAFT								✓	
LAMPS4U FZCO	✓						✓		✓
MAYASA		✓	✓	✓	✓	✓			✓
NOMURA KOHSAN CO., LTD.	✓	✓	✓	**	✓	***	****		*****
RECLITE (PTY) LTD		✓			✓	✓			******
REMONDIS QR GMBH		✓	✓	✓	✓	✓			✓

* (On upstream assets, downstream sites and assets, yards)

** Depends on local condition

*** Processes Hg for final disposal but no final disposal of Hg collected from imported waste, due to legal restrictions

**** Stabilization service

***** Nomura treats all types of mercury wastes. Transportation agent can also be arranged by Nomura

****** Collection and transportation, treatment.

BATREC INDUSTRIE AG

Places where they work
Worldwide

Location
Switzerland

Parent company
Veolia

Quantity Hg treated per year (tons per year)
c. 5,000 tons

Lamps recycling

BEST MERCURY TECHNOLOGY (BMT)

Places where they work
Worldwide
mostly Oil & Gas up & downstream companies, government

Location
Netherlands,Thailand, Australia and Malaysia

Parent company
BMT Holding BV

Quantity Hg treated per year (tons per year)
c. 5,000 tons
(mainly from Oil & Gas up- and downstream)

Lamps recycling

CEBU COMMON TREATMENT FACILITY, INC.

Places where they work
Philippines

Location
Philippines

Quantity Hg treated per year (tons per year)
c. 5,000 tons

Lamps recycling

ECON INDUSTRIES SERVICES GMBH

Places where they work
Worldwide

Location
Germany

Lamps recycling

K+S AKTIENGESELLSCHAFT

Places where they work
Mainly Europe

Location
Germany

Lamps recycling

LAMPS4U FZCO

Places where they work
USA, Arab States

Location
United Arab Emirates

Quantity Hg treated per year (tons per year)
0.04 tons

Lamps recycling

MAYASA

Places where they work
Europe, LAC, North Africa

Location
Spain

Parent company
Government of Spain

Quantity Hg treated per year (tons per year)
300 tons

Lamps recycling

NOMURA KOHSAN CO., LTD.

Places where they work
Asia

Location
Japan

Quantity Hg treated per year (tons per year)
40,000 tons

Lamps recycling

RECLITE (PTY) LTD

Places where they work
South Africa

Location
South Africa

Quantity Hg treated per year (tons per year)
0.1 tons

Lamps recycling

REM ONDIS QR GMBH

Places where they work
Worldwide

Location
Germany

Parent company
REMONDIS SE & Co. KG

Quantity Hg treated per year (tons per year)
see below (*)

Lamps recycling

(*) Quantity Hg treated per year if known (capacity, tons)

WASTE TYPE	TREATMANT CAPACITY	TECHNOLOGY
* liquid Hg	800 t/y	stabilization
* Hg waste	10,000 t/y	distillation

Hg waste = e.g. sludge, soil, slurry, liquids (no chemicals), spent absorbent, catalysts

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UNITED NATIONS
UNIVERSITY
UNU-VIE SCYCLE
Sustainable Cycles Programme

Waste mercury perspective, 2010-2035: from global to regional

Executive Summary

This study was funded by the Government of Switzerland.

The report has been developed by a team from UNU – SCYCLE, coordinated by Ruediger Kuehr and composed of Kees Baldé, Elena D'Angelo, Vanessa Forti, Susan Van den Brink, and in close cooperation with the UNIDO team, coordinated by Gabi Eigenmann.

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As corresponding author you can refer to Elena D'Angelo - dangelo@vie.unu.edu

LIST OF ACRONYMS

ASEAN	Association of Southeast Asian Nations
ASM	Artisanal and Small-Scale Mining
BCRC	Basel Convention Coordination Center
CEIT	Countries with Economies In Transition
CFLs	Compact Fluorescent Lamps
Comtrade	United Nations International Trade Statistics Database
COP	Conference of Parties
CPC	Central Product Classification
DC	Developing Country
EAs	Enabling Activities
EEE	Electric and Electronic Equipment
ESM	Environmentally Sound Management
EPR	Extended Producer Responsibility
EU	European Union
FDP	Flat Panel Display
FMEnv	Federal Ministry of Environment (Nigeria)
g	Grams
GC	Governing Council
GEF	Global Environment Facility
Hg	Mercury
HS	Harmonized Commodity Description and Coding System
kt	Thousand metric tonnes
Ca.	Capita
IOMC	Inter-Organization Programme for the Sound Management of Chemicals
ISWA	International Solid Waste Association
LFLs	Linear Fluorescent Lamps
MIA	Minamata Initial Assessment
Mt	Million metric tonnes
NAFDAC	National Agency For Food & Drug Administration and Control
NEWMOA	Northeast Waste Management Officials' Association
non-EEEs	non-Electric and Electronic Equipment
OECD	Organisation for Economic Cooperation and Development
PPP	Purchasing Power Parity
RoHS	Restriction of Hazardous Substances
SCYCLE	Sustainable Cycles
SON	Standard Organization of Nigeria
t	tonne
UN Environment	United Nations Environment
UNEP	United Nations Environmental Programme
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
UNITAR	United Nations Institute for Training and Research
UNU	United Nations University
VINACHEMIA	Vietnam Chemicals Agency
WEEE	Waste Electrical and Electronic Equipment
WHO	World Health Organization
ZMWG	Zero Mercury Working Group

**Within the report, the following terminology is adopted.*
Waste mercury → refers to the Hg content of the mercury added product
Mercury added product waste → refers total waste generated from Hg added products

EXECUTIVE SUMMARY

The adoption of the Minamata Convention on Mercury represents a milestone for chemical safety, to protect the human health and the environment. It is a demonstration of the important role of a multilateral treaty responding to a threat with global dimension. The Convention, in fact, contains provisions that relate to the entire life cycle of mercury, including controls and reductions across a range of products, processes, and industries in which mercury is used, released, or emitted.

In the hope of supporting the Convention Parties in implementing the provisions in a more coordinated matter, this report provides a forecast of the volume of waste mercury in electronic and electric products, and in a set of other non-electronic product categories, in the next 15-20 years.

In fact, a better understanding of the volumes of waste mercury, and its distribution worldwide, guides governments and relevant bodies in the development of regional and global policies to adopt measures to manage mercury waste in an environmentally sound manner as required by the Minamata Convention.

The forecasts of the waste mercury generated worldwide were developed based on an internationally recognized methodology and measurement framework to compile e-waste statistics developed by the Sustainable Cycles (SCYCLE) Programme of UNU. In this study ‘waste mercury’ only refers to mercury-added products, both electric and electronic equipment (EEE) (lamps, screens and small IT) and non-EEE (thermometers, barometers, hygrometers). It does not consider other sources such as waste mercury generated by the chlor-alkali industry, the cement industry, the natural gas extraction, and the Artisanal and Small-Scale Mining (ASM), which are regulated by Article 4 of the Minamata Convention on Mercury. From a methodological point of view, the quantitative estimate of waste mercury, for a range of EEE and non-EEE products for which the data were available, has been integrated with an assessment of legal provisions and data on consumption or trade related to the remaining set of products (batteries, cosmetics, pesticides, biocides, manometers, sphygmomanometers). In order to gain a general outlook on waste mercury, at both the global and regional levels, sales of electric and electronic products and non-measuring devices were calculated from the UN-Comtrade database. Weibull functions were then used to calculate waste from mercury-added products and an assessment of the waste mercury embedded in those products was possible, taking into account their composition. The overall analysis thus provides a comprehensive estimate of waste mercury worldwide until 2035.

In 2017, 6.2 million metric tonnes (Mt) of mercury-added product waste were generated worldwide, of which around 1,300 tonnes were waste mercury (the mercury content of the mercury-added product waste) – namely approximately 0.18 grams per capita. The global quantity of waste of mercury added EEE plus non-electronic measuring devices was 4.1 Mt in 2010. As a general trend, it gradually increased by an average of 7% per year until 2018, reaching a 2018-2025 plateau of around 6.4 Mt. After 2025, the mercury-added product waste is expected to decrease rapidly, as this is the final phase-out date for all the parties of the Convention. In fact, while the phase-out date for banning the manufacturing, import, or export of mercury-added products has been set at year 2020, certain countries have already asked for an extension, for both part of and for the entire range of relevant products. Thus, for the purpose of this report, 2025 has been considered as the average date in which countries will not be producing/exporting/importing mercury-added products anymore.

Similarly, the amount of mercury contained in waste products is expected to slowly grow until 2025 - up to a maximum of about 1550 t of mercury– and then decrease rapidly in response to the Convention’s ban on production, export and import. It is estimated that in 2035 the mercury content of waste products will be around 190 t: that is only 12% of the mercury content of waste products that is expected to be generated in 2025. (see Fig.1 and Fig. 2)

Fig. 1 Global mercury-added product waste - time series (Mt)

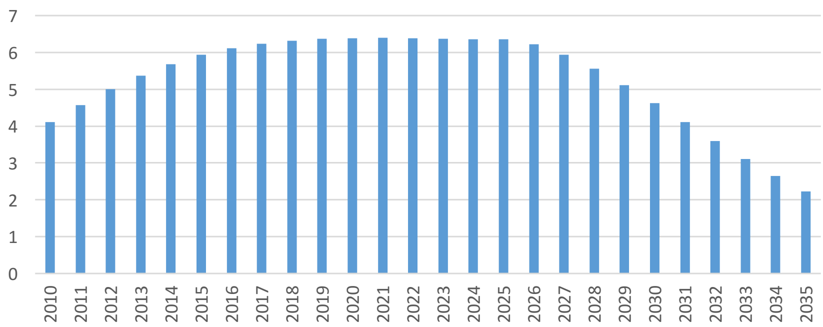
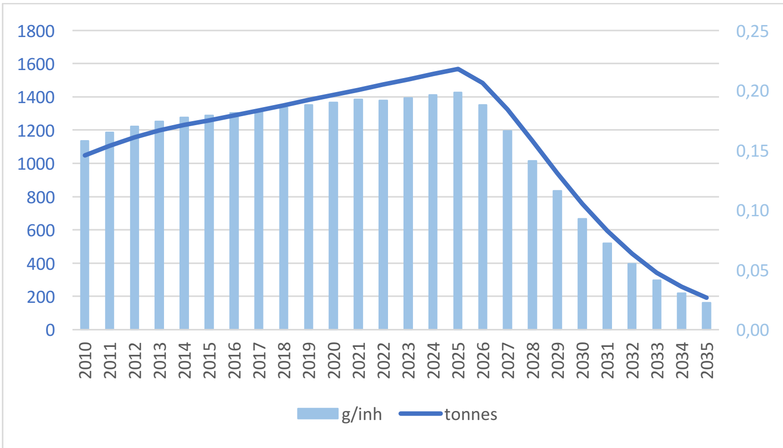


Fig. 2 Global mercury content in the mercury-added waste – time series (tonnes mercury and g mercury /ca.)



The highest quantities of waste mercury are estimated to derive from non-measuring devices, which constitute most of the total waste mercury in terms of total quantities. The analysis also illustrated that the generated waste mercury in thermometers is relatively low, in comparison to that of hygrometers and barometers, and the decrease of waste volume from 2025 will therefore be lower than the decrease of hygrometers and barometers. For lamps, most of the generated waste in 2017 is from straight tube fluorescent lamps (39 tonnes); the generated waste from special lamps is estimated at 19 tonnes. The data shows both a smooth increase until 2025 and then a rapid decrease in the following 10 years.

An overview of the amount of waste mercury by geographical region, in g/ca. and tonnes, is illustrated in the graphics below (Fig.3 and Fig.4); while the list of countries is further detailed in Annex 1 and Annex 2 provides data on waste mercury per region in 2017.
The graphics below immediately show that in 2017 Americas is the continent that generate the highest amount of waste mercury in absolute quantity - equivalent to 439 t; and Americas and Europe are just behind Oceania in grams per capita. Oceania is estimated to generate considerable amount of waste mercury per capita (0.6 g/ca, in 2017) due to the relatively high per capita consumption of mercury added products.

Fig 3 - Waste mercury generation per continent - time series (tonnes)

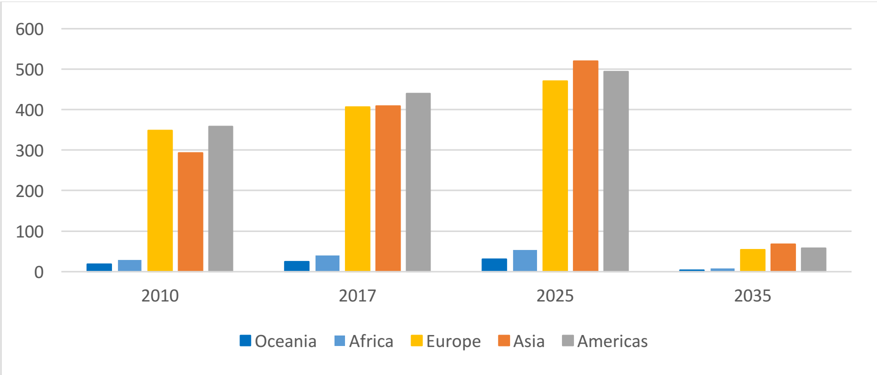
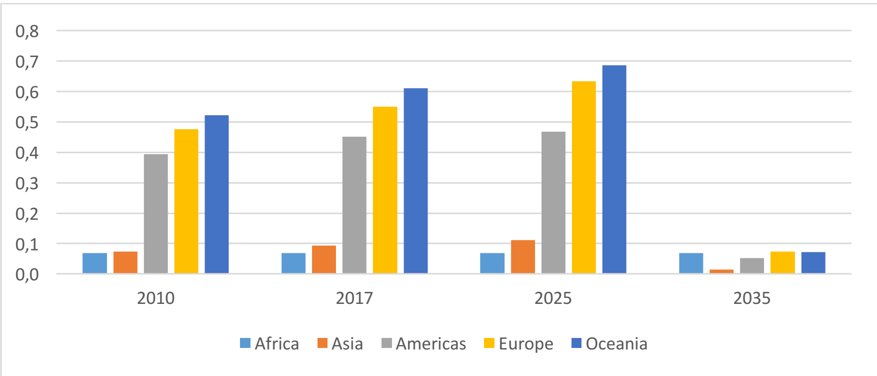


Fig. 4 - Waste mercury generation by geographical region - time series (g/ca.)



In addition to the study of the mercury-added products electric and electronic equipment (EEE) (lamps, screens and small IT) and non-EEE (thermometers, barometers, hygrometers), a literature assessment was made for the mercury-containing product categories ‘pesticides, biocides, topical antiseptics’, ‘manometers, sphygmomanometers’ and ‘cosmetics’. For these categories there were no matching HS code in the Comtrade database, or the HS codes were too general and not representative of the products containing mercury. The assessment assembles information on the mercury content of the products, relevant regulations and production and consumption estimates from non-governmental organisations, intergovernmental organisations, scientific literature and recycling companies.

The analysis of the mercury content per product showed that the ratio of mercury content varies because there are different product brands and different types of manufacturing of the product. The different indications of mercury per product complicates the quantification of waste mercury, as only an average can be used with analyzing these products. As mentioned, the Minamata Convention prohibits the manufacturing, import, or export of the above product categories from 2020 or 2025. It was found that in many countries the use of these mercury-containing products is already banned and is expected to be phased out in the coming years. This confirms that the trend in consumption is generally decreasing. However, there are countries that are the exception, and where mercury could still be used or in waste stocks. Because the phase out of these categories is only in certain countries and regions, a global analysis based on relevant regulations was not possible. The closest comparable estimate to the generated waste mercury in these products is from UN Environment (2017), who estimated the total consumption of batteries and of mercury compounds (including cosmetics, pesticides, and fungicides) was between 374 t and 796 t in 2015.

Recommendations

Based on this research on the generation of waste mercury from 2010 to 2035, the following recommendations have been developed:

- The projections of waste mercury volumes, developed here, could be further extended to analyse environmental impacts by linking the estimates of waste from mercury-added product to estimates of mercury releases from mining, soil contamination, etc.

- For some of the products listed by the Minamata Convention, there was no matching code in the *Harmonized Commodity Description and Coding System* (HS), which is used in trade statistics. Many of the codes were too general and did not specify products containing mercury. Further work to develop HS codes, that specifically identifies mercury-added products, would greatly facilitate monitoring of these products and wastes.
- More information on mercury is needed in specific product categories, such as the evolution over time of the average concentration of mercury in non-electronic measuring devices, cosmetics, switches, relays, etc. Such information could be integrated easily with the developed methodology. It should be coordinated with the main international, national, and regional organizations and other groups (e.g., governments, IOs, NGOs, recycling companies, etc.) working in this field.

- For many countries, it might not be easy to conduct inventories of mercury-added product manufacturing and trade, especially because, for many of the products, official trade data will not differentiate between mercury and mercury-unit. According to a number of UN agencies working in this field, there is still a wide gap between the provisions of the Minamata Convention and the current waste mercury management practice. Even though waste mercury is already present in regulatory frameworks worldwide, many developing countries usually do not have the capacity to implement specific provisions: thus the environmentally sound management of hazardous wastes itself remains the main challenge. Within the framework of ongoing work under the Minamata Convention on Mercury and the Basel Convention on hazardous wastes, countries should be supported and encouraged to conduct additional assessments and to develop national and regional statistics on mercury production, consumption, and disposal of waste from mercury-added product. A set of performance indicators should be developed, possibly in line with the methodological approach adopted and presented in this study. For instance, the methodology and outcomes of this study could be adapted into a toolkit to inform policymakers about mercury in their countries, and to allow them to improve the accuracy of their national data.

- A cooperation mechanism on monitoring global mercury trends, such as following the model of the Global E-waste Statistics Partnership (GESP), is encouraged. Such a mechanism could make global and regional data available to the general public and policymakers. It can contribute to the development of a harmonized methodology, provide estimates if national data are lacking, and provide a framework to monitor mercury-added products and waste disposal. It could also develop guidelines and build capacity in specific countries in support of a fact-based policymaking process.

- In addition to improving forecasts, the actual achievements from countries on the management of mercury-containing waste is an essential next step to monitor the effectiveness on the policies, of which the presented methodology provides a good framework to monitor. Developing arrangements on comparable monitoring data and an effective evaluation framework could also complement the ongoing work under the Minamata Convention. Moreover, it might also assist countries in their reporting obligation, both under the Basel and Minamata Convention.

- At the same time, by building upon other monitoring measures utilized in this field by international organizations such as UN Environment, a set of more detailed performance indicators could be established and regularly monitored in an organized manner. The Mercury Inventory Toolkit could improve data in the future, as it provides a standardized methodology and accompanying database for the development of consistent national and regional mercury inventories. When a large number of countries provide data through the toolkit, a global picture of mercury consumption can be achieved.

- Finally, the assessment and prevention of illegal transboundary movement and dumping of mercury waste–similar to what previously occurred in the field of e-waste—should be encouraged. In general, a more comprehensive approach to address the challenges of environmentally sound management of hazardous wastes should be considered.

Annex 1: List of countries considered in quantitative analysis

Country	Region
Afghanistan	Asia
Angola	Africa
Albania	Europe
United Arab Emirates	Asia
Argentina	Americas
Armenia	Asia
Antigua and Barbuda	Americas
Australia	Oceania
Austria	Europe
Azerbaijan	Asia
Burundi	Africa
Belgium	Europe
Benin	Africa
Burkina Faso	Africa
Bangladesh	Asia
Bulgaria	Europe
Bahrain	Asia
Bahamas	Americas
Bosnia and Herzegovina	Europe
Belarus	Europe
Belize	Americas
Bolivia (Plurinational State of)	Americas
Brazil	Americas
Barbados	Americas
Brunei Darussalam	Asia
Bhutan	Asia
Botswana	Africa
Central African Republic	Africa
Canada	Americas
Switzerland	Europe
Chile	Americas
China	Asia
Côte d'Ivoire	Africa
Cameroon	Africa
Congo	Africa
Colombia	Americas
Comoros	Africa
Cape Verde	Africa
Costa Rica	Americas
Cyprus	Asia
Czech Republic	Europe
Germany	Europe
Djibouti	Africa
Dominica	Americas
Denmark	Europe
Dominican Republic	Americas
Algeria	Africa
Ecuador	Americas
Egypt	Africa
Eritrea	Africa
Spain	Europe
Estonia	Europe
Ethiopia	Africa
Finland	Europe
Fiji	Oceania
France	Europe
Micronesia (Federated States of)	Oceania
Gabon	Africa
United Kingdom of Great Britain and Northern Ireland	Europe
Georgia	Asia
Ghana	Africa
Guinea	Africa
Gambia	Africa
Guinea-Bissau	Africa
Greece	Europe
Grenada	Americas
Guatemala	Americas
Guyana	Americas
China, Hong Kong Special Administrative Region	Asia
Honduras	Americas
Croatia	Europe
Hungary	Europe
Indonesia	Asia
India	Asia
Ireland	Europe
Iran (Islamic Republic of)	Asia
Iraq	Asia
Iceland	Europe
Israel	Asia
Italy	Europe
Jamaica	Americas
Jordan	Asia
Japan	Asia
Kazakhstan	Asia
Kenya	Africa
Kyrgyzstan	Asia
Cambodia	Asia
Kiribati	Oceania
Saint Kitts and Nevis	Americas
Republic of Korea	Asia
Kuwait	Asia
Lao People's Democratic Republic	Asia
Lebanon	Asia
Libya	Africa
Saint Lucia	Americas
Sri Lanka	Asia
Lesotho	Africa
Lithuania	Europe
Luxembourg	Europe
Latvia	Europe
China, Macao Special Administrative Region	Asia
Morocco	Africa
Republic of Moldova	Europe
Madagascar	Africa
Maldives	Asia
Mexico	Americas

The former Yugoslav Republic of Macedonia	Europe
Mali	Africa
Malta	Europe
Myanmar	Asia
Montenegro	Europe
Mongolia	Asia
Mozambique	Africa
Mauritania	Africa
Mauritius	Africa
Malawi	Africa
Malaysia	Asia
Namibia	Africa
Niger	Africa
Nigeria	Africa
Nicaragua	Americas
Netherlands	Europe
Norway	Europe
Nepal	Asia
New Zealand	Oceania
Oman	Asia
Pakistan	Asia
Panama	Americas
Peru	Americas
Philippines	Asia
Palau	Oceania
Papua New Guinea	Oceania
Poland	Europe
Portugal	Europe
Paraguay	Americas
Qatar	Asia
Romania	Europe
Russian Federation	Europe
Rwanda	Africa
Saudi Arabia	Asia
Sudan	Africa
Senegal	Africa
Singapore	Asia
Solomon Islands	Oceania
Sierra Leone	Africa
El Salvador	Americas
Serbia	Europe
Sao Tome and Principe	Africa
Suriname	Americas
Slovakia	Europe
Slovenia	Europe
Sweden	Europe
Swaziland	Africa
Seychelles	Africa
Chad	Africa
Togo	Africa
Thailand	Asia
Turkmenistan	Asia
Timor-Leste	Asia
Tonga	Oceania
Trinidad and Tobago	Americas
Tunisia	Africa
Turkey	Asia
Tuvalu	Oceania
United Republic of Tanzania	Africa
Uganda	Africa
Ukraine	Europe
Uruguay	Americas

United States of America	Americas
Saint Vincent and the Grenadines	Americas
Venezuela (Bolivarian Republic of)	Americas
Viet Nam	Asia
Vanuatu	Oceania
Samoa	Oceania
Yemen	Asia
South Africa	Africa
Zambia	Africa
Zimbabwe	Africa

Annex 2: Waste mercury per region in 2017

Continent	Region	Mercury waste (g/inh.)	Mercury waste (t)
World		0.18	1319
Africa	Eastern Africa	0.01	5
	Middle Africa	0.03	2
	Northern Africa	0.08	19
	Southern Africa	0.16	10
	Western Africa	0.01	5
Americas	Caribbean	0.19	3
	Central America	0.25	44
	Northern America	0.82	297
	South America	0.23	95
Asia	Central Asia	0.24	7
	Eastern Asia	0.14	219
	South-Eastern Asia	0.08	50
	Southern Asia	0.03	49
	Western Asia	0.35	83
Europe	Eastern Europe	0.30	88
	Northern Europe	0.69	72
	Southern Europe	0.59	90
	Western Europe	0.81	157
Oceania	Australia and New Zealand	0.82	24
	Melanesia	0.01	0.1
	Micronesia	0.03	0.01
	Polynesia	0.02	0.01

United Nations
Industrial Development Organization

Vienna International Centre · P.O. Box 300 · 1400 Vienna · Austria
Tel.: (+43-1) 26026-0 · E-mail: info@unido.org
www.unido.org