



Horizon 2020 Initiative to de-pollute the Mediterranean by the year 2020

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in collaboration with UNEP/MAP

Training on mercury management and remediation of contaminated sites

“Mercury sources, mercury inventory and management of wastes.
Basel Mercury Technical Guidelines.”

Almadén, Spain, 18-19 November, 2015

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Article 3

Mercury supply sources and trade

✓ For the purposes of this Article:

(a) “Mercury” includes mixtures of mercury, including alloys, with a mercury concentration of at least 95 per cent by weight.



(b) “Mercury compounds”: mercury (I) chloride (calomel), mercury (II) oxide, mercury (II) sulphate, mercury (II) nitrate, cinnabar and mercury sulphide.

✓ The provisions of this Article shall not apply to:

(a) Mercury or mercury compounds to be used for laboratory-scale research or as a reference standard.

(b) Naturally occurring trace quantities of mercury or mercury compounds in non-mercury metals, ores, or mineral products, including coal, or products derived from these materials, and unintentional trace quantities in chemical products.

(c) Mercury-added products.

Article 3

Mercury supply sources and trade

- ✓ Parties shall not allow primary mercury mining that was not being conducted at the date the Convention enters into force for them.
- ✓ Parties with primary mercury mining that was being conducted within their territory at the date of entry into force of the Convention shall only allow it for a period of up to 15 years after that date.

During this period, mercury from such mining shall only be used in:

- manufacturing of mercury-added products in accordance with Article 4
- manufacturing processes in accordance with Article 5, or
- be disposed in accordance with Article 11, using operations which do not lead to recovery, recycling, reclamation, direct re-use or alternative uses.

Article 3

Mercury supply sources and trade

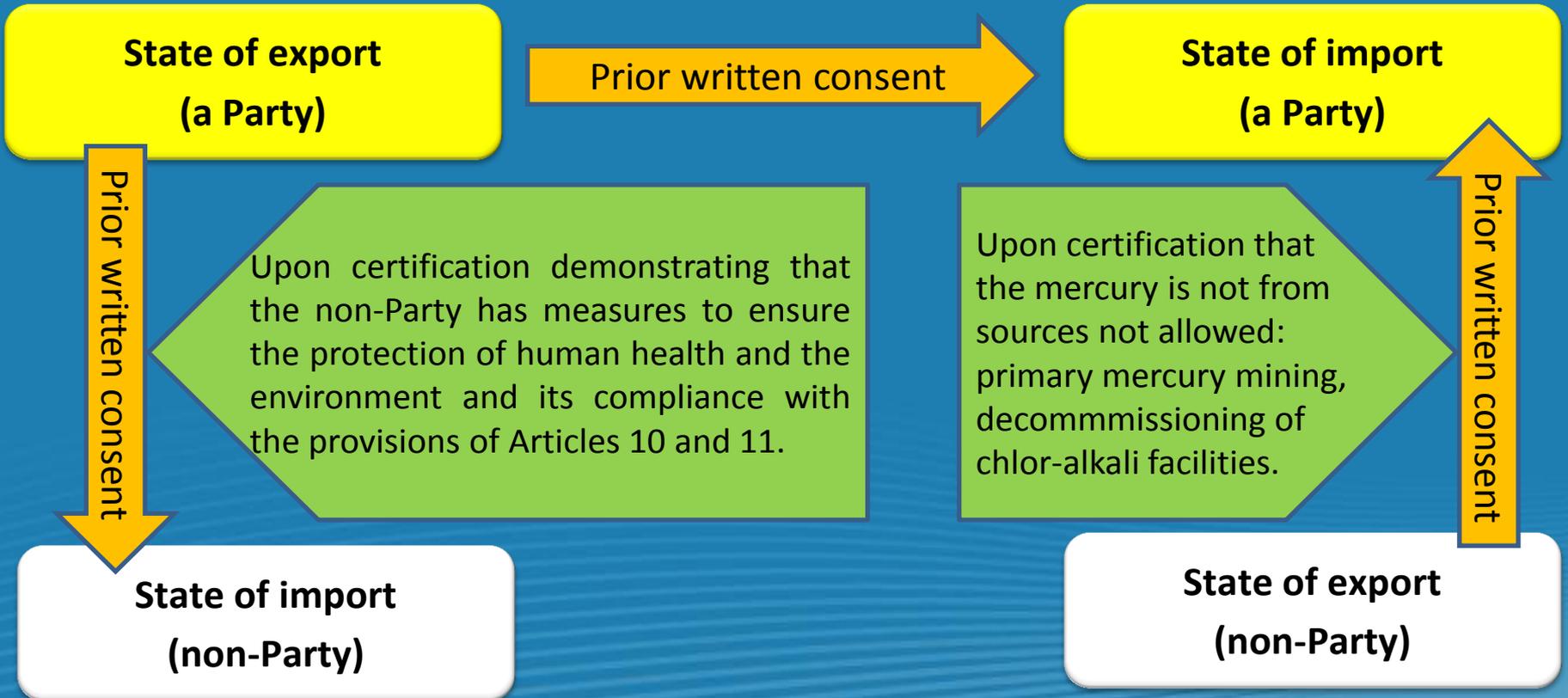
Each Party shall:

- (a) Ensure that the available excess mercury from the decommissioning of chlor-alkali facilities is disposed of in accordance with the guidelines for environmentally sound management referred to in Article 11.3 (a), using operations that do not lead to recovery, recycling, reclamation, direct re-use or alternative uses.
- (b) Endeavour to identify within its territory:
- sources of mercury supply generating stocks exceeding 10 metric tons per year.
 - individual stocks of mercury or mercury compounds exceeding 50 metric tons.

Mercury supply sources and trade

Parties shall only allow the export of mercury to countries that provide a prior written consent, and only for:

- a use allowed to a Party under the Convention or
- environmentally sound interim storage as set out in Article 10.



Article 4

Mercury-added products

- ✓ **Parties shall not allow the manufacture, import or export of mercury-added products listed in Part I of Annex A (batteries; switches and relays; different types of lamps; cosmetics; pesticides, biocides and topical antiseptics; nonelectronic measuring devices including barometers, hygrometers, manometers, thermometers and tensiometers) after a phase-out date (2020), except where the Party has a registered exemption pursuant to Article 6: up to 5 years, that may be extended for another 5 by the Conference of the Parties (COP).**
- ✓ **Parties shall take measures for the mercury-added products listed in Part II of Annex A (dental amalgam).** This Annex includes a list of measures, from which the Party can choose two or more.



Examples of some products that contain mercury.

Article 5

Manufacturing processes in which mercury or mercury compounds are used

- ✓ Parties shall not allow the use of mercury or mercury compounds in the manufacturing processes listed in Part I of Annex B after the phase-out date specified in that Annex for:
 - *acetaldehyde production: 2018*
 - *chlor-alkali production: 2025*except where the Party has a registered exemption pursuant to Article 6 (5 years, that may be extended for another 5 by the COP).

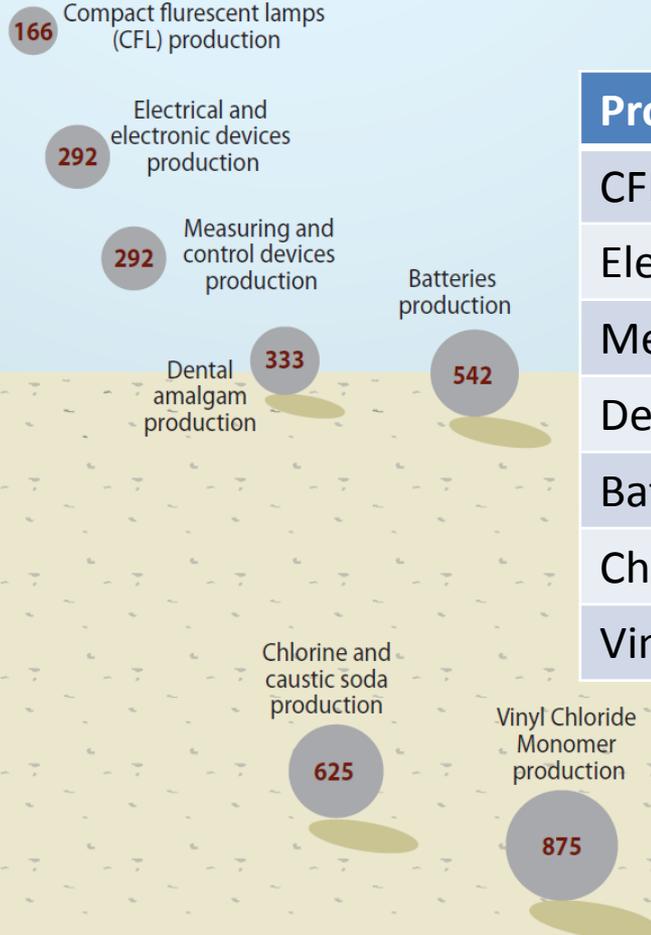
- ✓ Each Party shall take measures to restrict the use of mercury or mercury compounds in the processes listed in Part II of Annex B:
 - *production of vinyl chloride monomer (VCM)*
 - *production of sodium or potassium methylate or ethylate*
 - *production of polyurethane.*

This Annex includes a non-limitative list of measures to be taken.

Mercury in industrial processes and phase-out dates:

INDUSTRIAL MERCURY DEMAND

Tonnes per year, estimates 2005



Product/process	Phase-out date
CFLs	2020
Electrical devices	2020
Measuring devices	2020
Dental amalgam	-----
Batteries	2020
Chlor-alkali	2025
Vinyl Chloride Monomer	-----

Source: "Mercury: time to act"
UNEP, 2013

The Convention allows for reviewing and strengthening measures to control mercury use in products and processes

Article 7

Artisanal and small-scale gold mining

ASGM: artisanal and small-scale gold mining in which mercury amalgamation is used to extract gold from ore.

- ✓ Parties that have ASGM within their territory shall take steps to reduce, and where feasible eliminate, the use of mercury and mercury compounds in, and the emissions and releases to the environment of mercury from, such mining and processing.
- ✓ Parties with “more than insignificant” ASGM in their territory shall notify the Secretariat of the Convention; and shall develop and implement a national action plan in accordance with Annex C, submit it to the Secretariat, and provide periodical reviews.

Article 8 Emissions

Controlling and, where feasible, reducing emissions of mercury and mercury compounds to the atmosphere through measures to control emissions from the point sources listed in Annex D.

- ✓ Parties with relevant sources shall take measures to control emissions and may prepare a national plan.
- ✓ For its new sources, each Party shall require the use of best available techniques (BAT) and best environmental practices (BEP), as soon as practicable but no later than 5 years after the entry into force of the Convention for that Party.
- ✓ For its existing sources, each Party shall implement one or more of a list of five categories of measures (quantified goals, emission limit values, BAT/BEP, multi-pollutant co-benefit strategies, or others), as soon as practicable but no more than 10 years after the entry into force of the Convention.
- ✓ Each Party shall establish, as soon as practicable and no later than 5 years after the entry into force of the Convention, and maintain thereafter, an inventory of emissions from relevant sources.

Annex D:

List of point sources of emissions of mercury and mercury compounds to the atmosphere

Point source category:

- Coal-fired power plants
- Coal-fired industrial boilers;
- Smelting and roasting processes used in the production of non-ferrous metals (lead, zinc, copper and industrial gold)
- Waste incineration facilities;
- Cement clinker production facilities

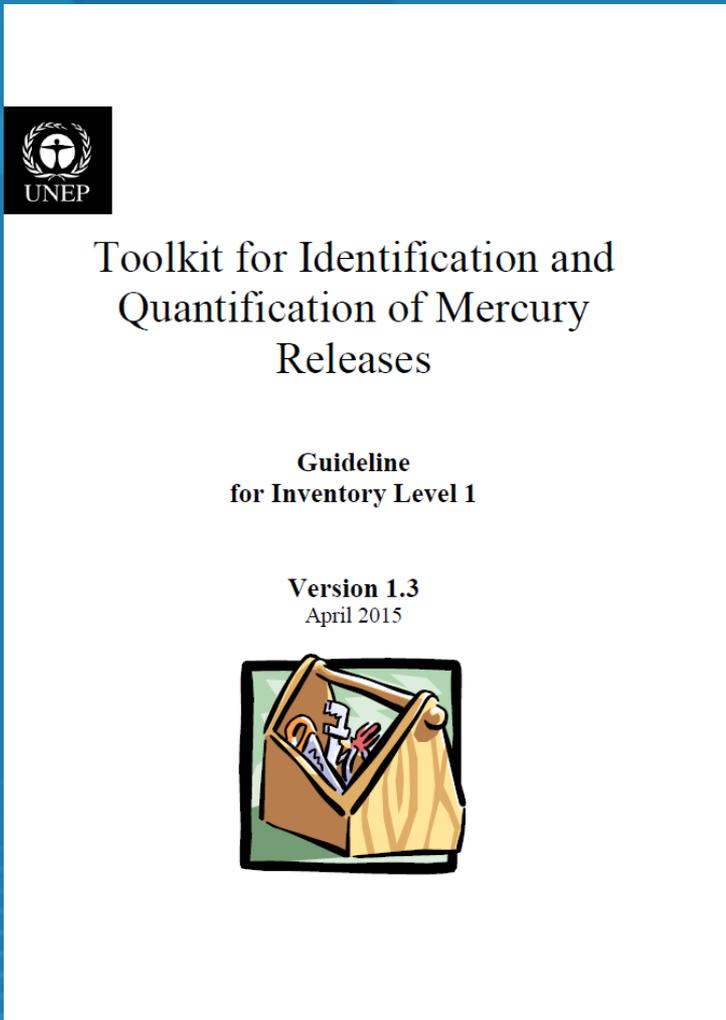


Article 9 Releases

Controlling and, where feasible, reducing releases of mercury and mercury compounds to land and water from the relevant point sources not addressed in other provisions of the Convention.

- ✓ Each Party shall, no later than 3 years after the entry into force of the Convention, and on a regular basis thereafter, identify the relevant point source categories.
- ✓ A Party with relevant sources shall take measures to control releases and may prepare a national plan.
- ✓ The measures, as appropriate, shall include one or more of the following: release limit values, BAT/BEP, multi-pollutant co-benefit strategies, or others.
- ✓ Each Party shall establish, as soon as practicable and no later than 5 years after the entry into force of the Convention, and maintain thereafter, an inventory of releases from relevant sources.

Other sources of mercury emissions and releases



- Combustion/use of petroleum coke and heavy oil
- Combustion/use of diesel, gasoil, petroleum, kerosene
- Combustion/use of natural gas
- Biomass power and heat production, charcoal combustion
- Oil extraction; Oil refining
- Extraction and processing of natural gas
- Alumina production from bauxite (Al production)
- Primary ferrous metal production (pig iron production)
- Pulp and paper production
- Paints with mercury
- Production of recycled mercury ("secondary production")
- Production of recycled ferrous metals (iron and steel)
- Open fire waste burning (on landfills and informally)
- Waste water treatment
- Crematoria; Cemeteries
- Others: religious rituals, traditional medicines, production of lime, tanning, explosives, fireworks...

Article 10

Environmentally sound interim storage of mercury, other than waste mercury

Interim storage of mercury and mercury compounds as defined in Article 3 that do not fall within the definition of mercury wastes set out in Article 11.

- ✓ Parties shall ensure that the interim storage for a use allowed to a Party under the Convention is undertaken in an environmentally sound manner.
- ✓ The Conference of the Parties shall adopt guidelines on the environmentally sound interim storage of such mercury and mercury compounds, taking into account guidelines developed under the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal* and other relevant guidance.

Article 11

Mercury wastes

- ✓ For the purposes of this Convention, mercury wastes means substances or objects consisting of, containing or contaminated with mercury or mercury compounds, in a quantity above the relevant thresholds defined by the COP, in collaboration with the relevant bodies of the Basel Convention in a harmonized manner, that are disposed of, or are intended to be disposed of, or are required to be disposed of by national laws or the Minamata Convention.

- ✓ Parties shall take appropriate measures so that mercury waste is:
 - (a) Managed in an environmentally sound manner, taking into account the guidelines developed under the Basel Convention and in accordance with requirements adopted by the COP in an additional Annex.
 - (b) Only recovered, recycled, reclaimed or directly re-used for a use allowed to a Party under the Minamata Convention or for environmentally sound disposal.
 - (c) For Parties to the Basel Convention, not transported across international boundaries except for the purpose of environmentally sound disposal in conformity with this Article and with that Convention.

Article 12

Contaminated sites

- ✓ Parties shall develop appropriate strategies for identifying and assessing sites contaminated by mercury or mercury compounds.



Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention):

- Protocol for the protection of the Mediterranean Sea against pollution from Land-Based Sources and activities (LBS Protocol)

Decision IG.20/81: Regional Plan on the reduction of inputs in the framework of the implementation of Article 15 of the LBS Protocol:

- ✓ The Parties shall identify existing sites which have been historically contaminated with mercury including at least the old mines and decommissioned Chlor alkali plants.
- ✓ The Parties shall neither open new mines nor re-open old mercury mining sites.

- ✓ Actions to reduce the risks posed by such sites shall be performed in an environmentally sound manner incorporating, where appropriate, an assessment of the risks to human health and the environment.
- ✓ The Conference of the Parties shall adopt guidance on managing contaminated sites. Parties are encouraged to cooperate in developing strategies and implementing activities for identifying, assessing, prioritizing, managing and, as appropriate, remediating contaminated sites.

BASEL CONVENTION ON THE CONTROL OF TRANSBOUNDARY MOVEMENTS OF HAZARDOUS WASTES AND THEIR DISPOSAL

Negotiated under the auspices of the United Nations Environment Programme (UNEP) in the 1980s,



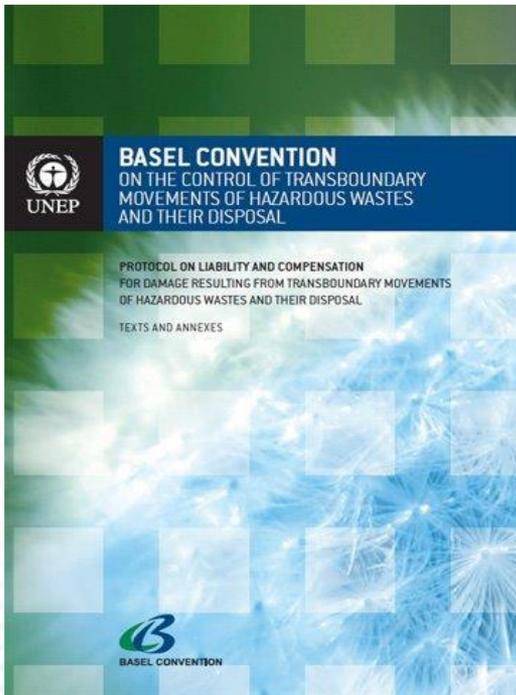
adopted in 1989,



entered into force in 1992.

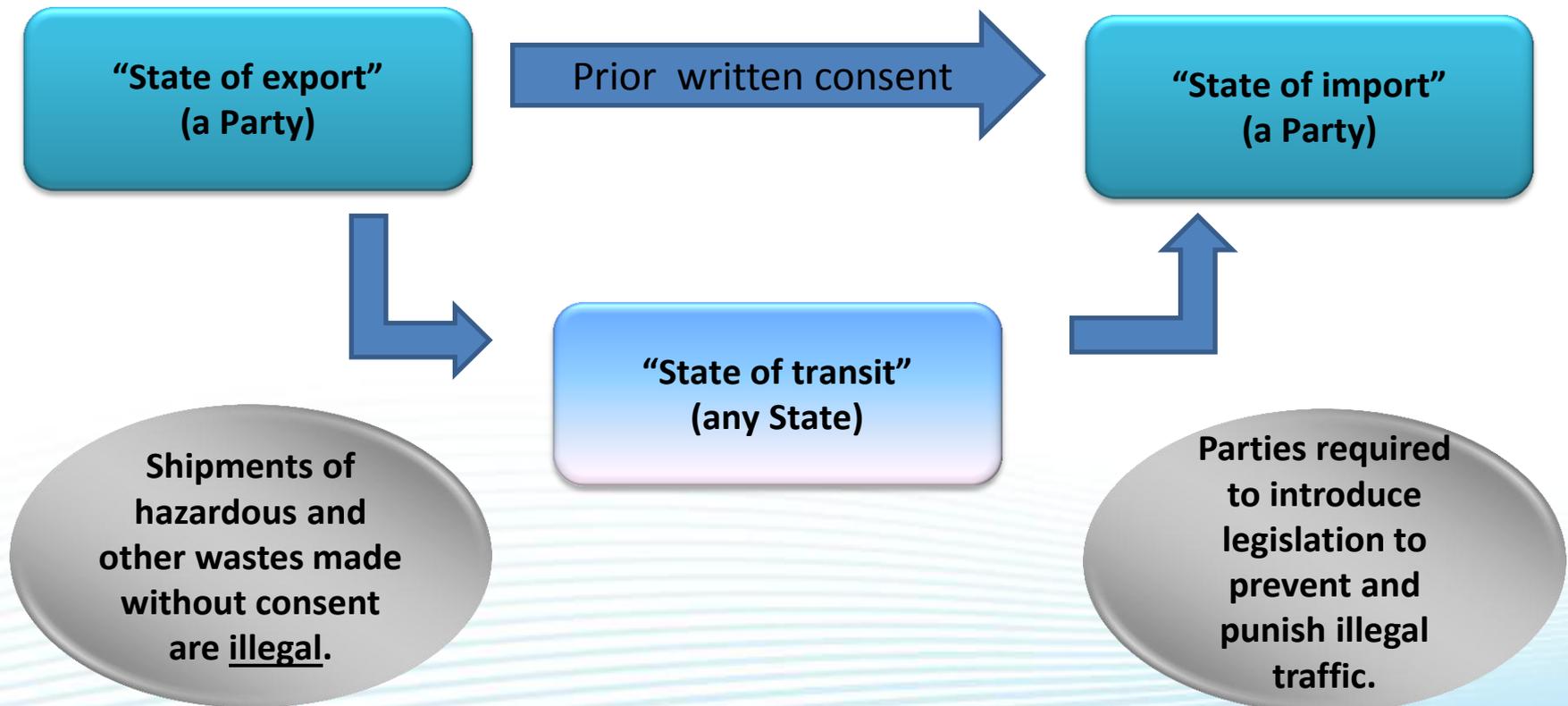


Objective: to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movements and disposal of hazardous and other wastes.



BASEL CONVENTION

The Basel Convention obliges Parties to the management and disposal of wastes in an environmentally sound manner. It regulates the transboundary movements of hazardous and other wastes applying a prior written consent procedure between Parties to the Convention.



BASEL CONVENTION: Technical Guidelines on the environmentally sound management of wastes consisting of, containing or contaminated with mercury or mercury compounds



COPs

The 12th meeting of the Conference of the Parties (COP) to the Basel Convention was held from **4 to 15 May 2015, in Geneva**, Switzerland, together with the 7th COP to the Rotterdam Convention and the 7th COP to the Stockholm Convention.

Decision BC-12/4 includes the adoption of the Technical Guidelines on the Environmentally Sound Management of wastes consisting of, containing or contaminated with mercury or mercury compounds.

Basel Technical Guidelines on mercury wastes

E. Waste prevention and minimization (which are the preferred options):

1. Waste prevention and minimization for industrial processes: measures for the processes that use higher quantities of mercury: artisanal and small-scale gold mining (ASGM), vinyl chloride monomer (VCM) production, and chlor-alkali production.
2. Waste prevention and minimization for mercury-added products:
 - (a) Substitution by mercury-free products
 - (b) Setting maximum limits of mercury content in products
 - (c) Green procurement programmes for large users.
3. Extended producer responsibility (extended to the post-consumer stage of a product's life cycle).

Basel Technical Guidelines on mercury wastes

F. Handling, separation, collection, packaging, labelling, transportation and storage:

- ✓ Handling: particular attention to prevent evaporation and spillage of mercury into the environment. These wastes should not be mixed with any other wastes.
- ✓ Separation and collection: key factors in ESM:
 - Special attention to collection of waste mercury-added products (collection stations or drop-off depots, collection at public places or shops, at households by collectors, coordinated by business associations, take-back collection programmes)
- ✓ Packaging and labelling.
- ✓ Transportation: ESM to avoid accidental spills, and for traceability.
- ✓ Storage: pending collection or disposal operations.



Basel Technical Guidelines on mercury wastes

G. Environmentally sound disposal:

Operations permitted for the Environmentally Sound Management of mercury wastes:

G.1. Recovery operations (R4, R5, R8, R12, R13), which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses.

G.2. Final disposal (D5, D9, D12, D13, D14, D15): operations not leading to recovery of mercury or mercury compounds.

Basel Technical Guidelines on mercury wastes

G.1. Recovery operations:

- (a) Pre-treatment (*e.g.: mechanical crushing, dismantling, air separation, removal of impurities, dewatering, extraction*).
- (b) Recycling/reclamation of mercury or mercury compounds:
 - (i) Thermal treatment (rotary kiln distillation, vacuum thermal processing)
 - (ii) Chemical oxidation (for liquid wastes)
 - (iii) Chemical precipitation
 - (iv) Adsorption treatment (activated carbon, zeolites, exchange resins)
 - (v) Purification: distillation to obtain high purity mercury.

Basel Technical Guidelines on mercury wastes

G.2. Operations not leading to recovery of mercury or mercury compounds:

Wastes consisting of mercury or mercury compounds should be stabilized and/or solidified before final disposal.

The final disposal of mercury wastes should be carried out according to national and local laws and regulations.

(a) Physico-chemical treatment:

(i) Soil washing and acid extraction: for soils and sediments.

(ii) Stabilisation and solidification:

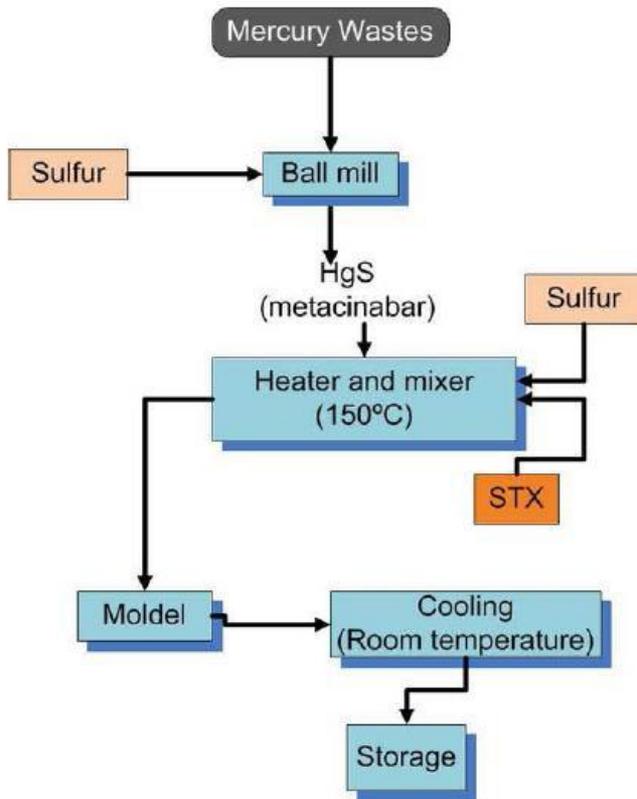
- ✓ Amalgamation: with copper, nickel, zinc and tin.
- ✓ Stabilization as mercury sulphide: HgS is less soluble and has lower volatility than most mercury compounds.
- ✓ Sulphur polymer stabilization and solidification (SPSS): HgS plus a second microencapsulation step.
- ✓ Stabilization and solidification with sulphur microcements.

(b) Disposal in specially engineered landfills.

(c) Disposal in permanent storage (underground facility).

Basel Technical Guidelines on mercury wastes

Sulphur Polymer Stabilisation and Solidification (SPSS):



Two-step process: first, mercury is stabilized with sulphur to form β -HgS, and this HgS is microencapsulated in a polymeric sulphur matrix, obtaining a fluid that is cooled in moulds, to obtain solid monoliths. As a solid, it allows an easier management and storage than HgS dust, and it has Hg emissions much lower than cinnabar.

Basel Technical Guidelines on mercury wastes

Stabilisation and solidification with sulphur microcements:

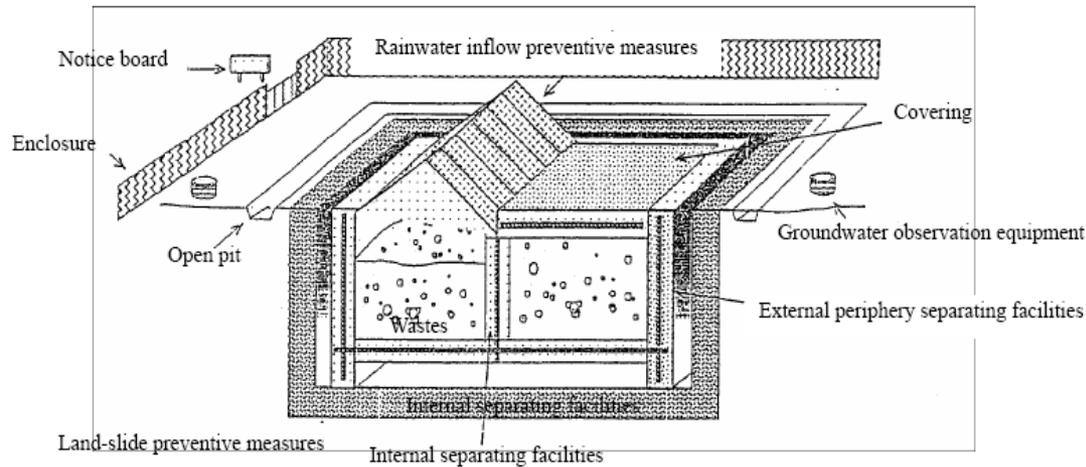


Specially formulated microcement with a controlled particle size and high Hg retention capacity, due to sulphur phases and tailored pH. It is added with a high proportion of water, to act as a colloid.

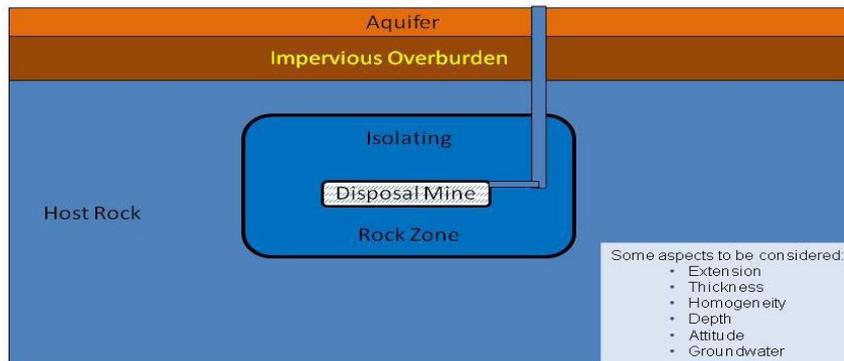
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Basel Technical Guidelines on mercury wastes

Specially engineered landfill:



Underground facility for permanent storage:



Basel Technical Guidelines on mercury wastes

H. Reduction of mercury releases from thermal treatment and landfilling of waste

1. From thermal treatment of waste: Hg containing waste from poorly segregated waste, healthcare facilities... can lead to Hg emissions if combusted. EU Directive on Industrial Emissions, UNECE Convention on Long-Range Transboundary Air Pollution, set limit value of 0.05 mg/m^3 for the emission of Hg for waste incineration.
2. From landfills: daily landfill cover, landfill gas capture systems to capture mercury vapour and methylmercury.

Basel Technical Guidelines on mercury wastes

I. Remediation of contaminated sites

I.1. Identification of contaminated sites:

A mercury-contaminated site can be identified through:

- records of past industrial or other activities,
- observation of the site conditions or attendant contaminant sources,
- observation of operations known to have used or emitted mercury,
- observed adverse effects in humans, flora, or fauna presumably caused by the proximity to the site,
- physical or analytical results showing contaminant levels, and
- reports from the community to the authorities.

Mercury is particularly problematic because of its hazardous vapour phase, its low level of observable effects on animals, and its different levels of toxicity depending on form (mercury vs. methylmercury).

In the emergency response, the priority is to isolate the contamination from the receptors as far as possible, in order to minimize further exposure.

Basel Technical Guidelines on mercury wastes

I.2. Environmentally sound remediation: factors involved:

(a) Environmental factors:

- i. amount of mercury released during operations;
- ii. origin of the contamination;
- iii. chemical state of mercury;
- iv. number, size, and location of mercury hotspots;
- v. for mining operations, the geological properties of the material;
- vi. methylation potential;
- vii. leaching potential of mercury from the contaminated media;
- viii. background Hg contamination (atmospheric deposition not related to local source)
- ix. mercury mobility in aquatic system;
- x. presence and levels of other pollutants, particularly ones that may be treated, or partially treated, by methods applied to mercury;
- xi. local/national/regional clean-up standards: water, soils/sediment, air.

(b) Receptor factors:

- i. bioavailability to aquatic biota, invertebrates, edible plants;
- ii. mercury concentrations in receptors (human, animal and plants) to indicate exposure.

Horizon 2020

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THANK YOU!