Overview of the Practical Sourcebook on Mercury Waste Storage and Disposal

Inception Workshop

Norway ODA Mercury Storage and Disposal Project in the Caribbean

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What is the Sourcebook

- The UNEP Governing Council (GC), in decision 25/5, requested the United Nations Environment Programme (UNEP) to enhance capacity for mercury storage and provide information on the sound management of mercury and mercury wastes.
- The project is a joint initiative of UNEP Chemicals Branch, Division of Technology Industry and Economics (DTIE), UNEP International Environmental Technology Centre (IETC), and the International Solid Waste Association (ISWA) under the UNEP Global Mercury Partnership
- The overall objective is to enhance the capacity of governments, industry, and the public to store and dispose mercury wastes in an environmentally sound manner.
- The Sourcebook should not be used as guidance. Other sources, such as the Basel Convention's 'Technical Guidelines on the Environmentally Sound Management of Wastes Consisting of, Containing, or Contaminated with Mercury or Mercury Compounds

Types of Mercury Wastes

- **Wastes consisting of mercury or mercury compounds:** Include elemental mercury and mercury compounds recovered from waste containing (from mercury added products)or contaminated with mercury as well as excess mercury and *mercury* compounds designated as waste.
- **Wastes containing mercury or mercury compounds:** Include wastes of mercury-added products that easily release mercury into the environment when they are broken, wastes of other mercury-added products and stabilized or solidified wastes containing mercury.
- **Wastes contaminated with mercury or mercury compounds:** Include residues generated from mining processes, industrial processes, or waste treatment processes. Examples are debris and contaminated soil, mercury loaded activated carbon, sludges, tailings, and waste rock.

Mercury Supply Exceeding Demand

- Excess mercury is the amount of mercury supply that exceeds demand for uses allowed under national law and the Minamata Convention.
- As mercury is a naturally occurring element, it cannot be destroyed.
- Excess mercury needs to be stored in an environmentally sound manner or transformed to a form having minimal mobility, and reliably sequestered from the environment.

Sources of Mercury Wastes

- Wastes consisting of mercury or mercury compounds: for example chlor-alkali production with mercury, VCM production, recovery of mercury from natural gas or petroleum refining, recovery of mercury from gold mining.
- Wastes Containing Mercury or Mercury Compounds: mainly come in the form of end-of-life mercury-added products and applications, but also include stabilized/solidified mercury: for example thermometers, dental amalgam, electrical switches, light bulbs
- Sources of Wastes Contaminated with Mercury or Mercury Compounds: are mainly generated via industrial processes using materials with mercury impurities. For example bauxite production, oil and gas refining, primary/secondary smelting, artisanal gold mining, combustion of fuels for electric generation

Environmentally Sound Management

- The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal defines ESM as

  > "taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner which will protect human health and the environment against the adverse effects which may result from such wastes" (Art. 2 para. 8)

- ESM of mercury wastes under the Minamata Convention: Art. 11, para. 3
  - *Managed in an environmentally sound manner, taking into account the guidelines developed under the Basel Convention*
  - *Only recovered, recycled, reclaimed or directly re-used for a use allowed to a Party under this Convention or for environmentally sound disposal pursuant to para. 3 (a)*
  - *For Parties to the Basel Convention, not transported across international boundaries except for the purpose of environmentally sound disposal in conformity with this Art*
  - *where the Basel Convention does not apply to transport across international boundaries, a Party shall allow such transport only after taking into account relevant international rules, standards, and guidelines*

Elements of ESM for Mercury Wastes

- **not mixed with other wastes**
- **not discarded in uncontrolled landfills**
- **not (co-)incinerated without dedicated flue gas cleaning and controls**
- **treated to extract the mercury or to immobilize it in an environmentally sound manner**
- **development and implementation of: 1) public health and safety activities and 2) worker and public health and safety activities which prevent and minimize exposure to mercury wastes**
- **Development and implementation of regulation of mercury waste collection, transport, Storage, treatment and disposal facilities.**

Basel Technical Guidelines: Classification of Recovery Operations

- **'R- operations':** "operations which may lead to resource recovery, recycling, reclamation, direct reuse, or alternative uses".

R4	**Recycling/reclamation of metals and metal compounds**
R5	Recycling/reclamation of other inorganic materials
R8	Recovery of components from catalysts
R12	Exchange of wastes for submission to operations R4, R5, R8 or R13
R13	Accumulation of material intended for operations R4, R5, R8 or R12

Basel Technical Guidelines: Classification of Disposal Operations

- **‘D-operations’** “operations which do not lead to the possibility of resource recovery, recycling, reclamation, direct reuse, or alternative uses”.

D5	Specially-engineered landfill
D9	Physico-chemical treatment
D12	Permanent storage
D13	Blending or mixing prior to submission to D5, D9, D12, D14 or D15
D14	Repackaging prior to submission to D5, D9, D12, D13 or D15
D15	Storage pending any of the operations D5, D9, D12, D13 or D14

Handling, Packaging, Labelling, and Transport of Mercury Wastes

- **Handling:** When handling wastes consisting of elemental mercury, it is important to pay particular attention to the prevention of evaporation and spillage of elemental mercury into the environment.
- **Packaging:** The containers in which mercury wastes are transported provide the most direct barrier to prevent releases
- **Labelling:** Appropriate labelling is also important, to help with the separation of mercury wastes from other wastes and ensure that the hazards of the waste are clearly communicated during transport
- **Transport**: Waste shipment acceptance procedures and consistency controls are keys to successful transport of mercury wastes.

Storage of Mercury Wastes

- The Basel Technical Guidelines list two disposal operations for the storage for mercury wastes, namely R13 and D15:

  R14 – Accumulation of material intended for operations R4, R5, R8 or R12: Mercury wastes may be accumulated with intent to conduct recycling/reclamation or recovery . Such storage is often regulated at the national level, where specific time periods may be set after the expiry of which the mercury wastes must be transported to the appropriate recycling/reclamation or recovery facility

  D15 – Storage pending any of the operations D5, D9, D12, D13 or D14: Mercury wastes may be stored pending physico-chemical treatment or placement into specially engineered landfills or permanent storage.

Storage Options

- **On-site at industrial facilities pending collection**
- **On-site in public institutions pending collections**
- **Off-site in suitable centralized storage facilities or treatment plants pending disposal**
- **Off-site in dedicated facilities specially equipped for storage of elemental mercury for a long period of time pending disposal**

Recovery/Recycling Operations

- Recovery operations are those operations which may lead to resource recovery, recycling, reclamation, direct re-use or alternative uses
- Where the mercury is extracted for subsequent disposal operations, this is referred to as physico-chemical treatment
- Recovery operations may yield mercury-free, sometimes **valuable raw materials** (*e.g.* glass from the recycling of lamps, zinc and iron from the recycling of batteries or silver from the recycling of dental amalgam), as well as mercury

The 3 Basic Steps of Recovery Operations

- Step 1: Pretreatment
- Step 2: Thermal Treatment
- Step 3: Purification

Disposal Operations

- Physico-chemical Treatment (Stabilization/Solidification)
- In stabilization processes, mercury is brought into reaction with chemical agents that convert it into a substance that is thermodynamically more stable, less soluble and less volatile
- In solidification processes mercury wastes are embedded in a solid and stable matrix. **Micro-encapsulation** means mixing the waste with the encasing material. **Macro-encapsulation** means pouring the encasing material over and around the waste mass, thus enclosing it in a solid block

Disposal: Specially Engineered Landfill

- A specially engineered landfill (SEL) is **an environmentally sound system for solid waste disposal and is a site where solid wastes are capped and isolated from each other and from the environment**
- There are concerns that the placement of treated wastes consisting of mercury or mercury compounds in SELs may lead to the leaching of contaminants over a long time period
- Pay particular attention to the measures required to protect groundwater resources from leachate infiltration into the soil.

Permanent Storage (Underground Facilities)

- Mercury wastes, after having been solidified or stabilized, where appropriate, which meet the acceptance criteria for permanent storage may be permanently stored in special containers in designated areas in an underground storage facility such as in salt rock
- Potential host rocks include the following: salt rock, clay formations, hard rock formations
- The sealing and permanent isolation from the biosphere may be achieved through a multi-barrier system
- A long-term, thorough and holistic **site-specific risk and safety assessment** is necessary to provide firm evidence on the isolation potential offered by the barriers and to identify a potential need for additional action.

Export of Mercury Wastes

- Shipments must comply with Minamata Convention, Basel Convention
- The importing country should have the infrastructure to manage the waste in an environmentally sound manner according to its national legislation
- Seek regional solutions in order to avoid unnecessary risks associated with transportation of mercury wastes
- Address issues of ownership, liability and traceability;

Management of Sites Contaminated with Mercury Wastes

- The management of sites contaminated with mercury is a complicated, time consuming and often costly effort.
- Governments should identify and inventory sites contaminated with mercury, ensure that the source of the contamination is contained to prevent any further contamination
- Remediate the site as soon as feasible to reduce exposure to humans and the environment
- At contaminated sites the surface and sub-soil, sediment, surface and ground water may need to be adequately treated.