Underground storage for mercury waste final disposal

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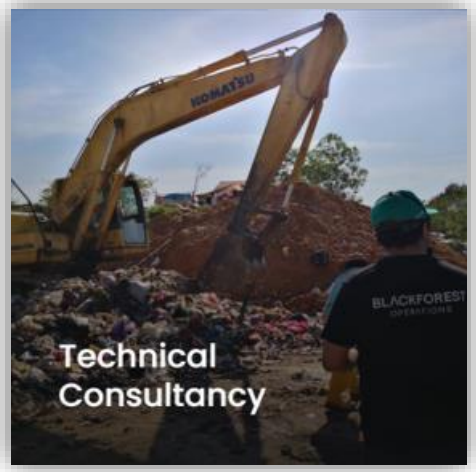
ABOUT BFS

BlackForest Solutions (BFS) is a Berlin-based company active in more than 60 countries.

We transfer technical waste management knowledge worldwide to support our partners to find solutions for their waste management problem.



Legislation

- Minamata Convention
  → Worldwide ban on Mercury products and waste

- European Mercury Regulation (EC) 2017/ 852
  →more strict implementation of MC within European Union

- Basel Convention
  → Regulation on international transport of hazardous waste

Mercury Wastes

The Minamata Convention and the Basel Convention Technical Guidelines categories mercury wastes into three different types of wastes:

Consisting of mercury or mercury compounds	• surplus stock of mercury in certain activities like chlor-alkali plants, ASGM
Containing of mercury or mercury compounds	• wastes of mercury added products such as light bulbs, batteries
Contaminated with mercury or mercury compounds	• residues from mining processes, industrial processes, waste treatment

Process prior to treatment

Upon generation, mercury-containing wastes are handled according to the company's, national, and international regulations until their handover to facilities. The main steps of the process prior to treatment of mercury-containing wastes involve their:

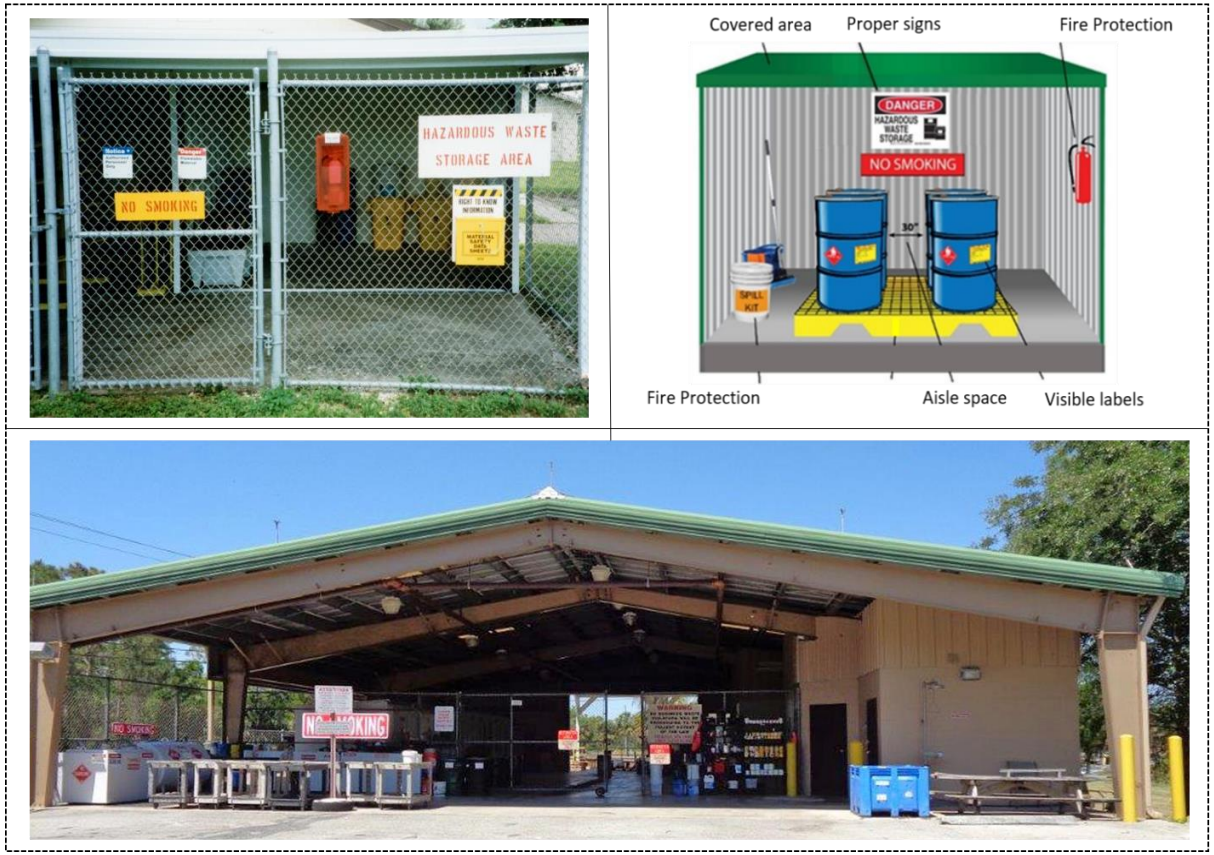
a. Separation
b. Storage
c. Collection
d. Transport
e. Treatment (stabilization and final underground storage)

Separation

Separating Waste Mercury Added Products from Other Waste

Source: BFS 2021

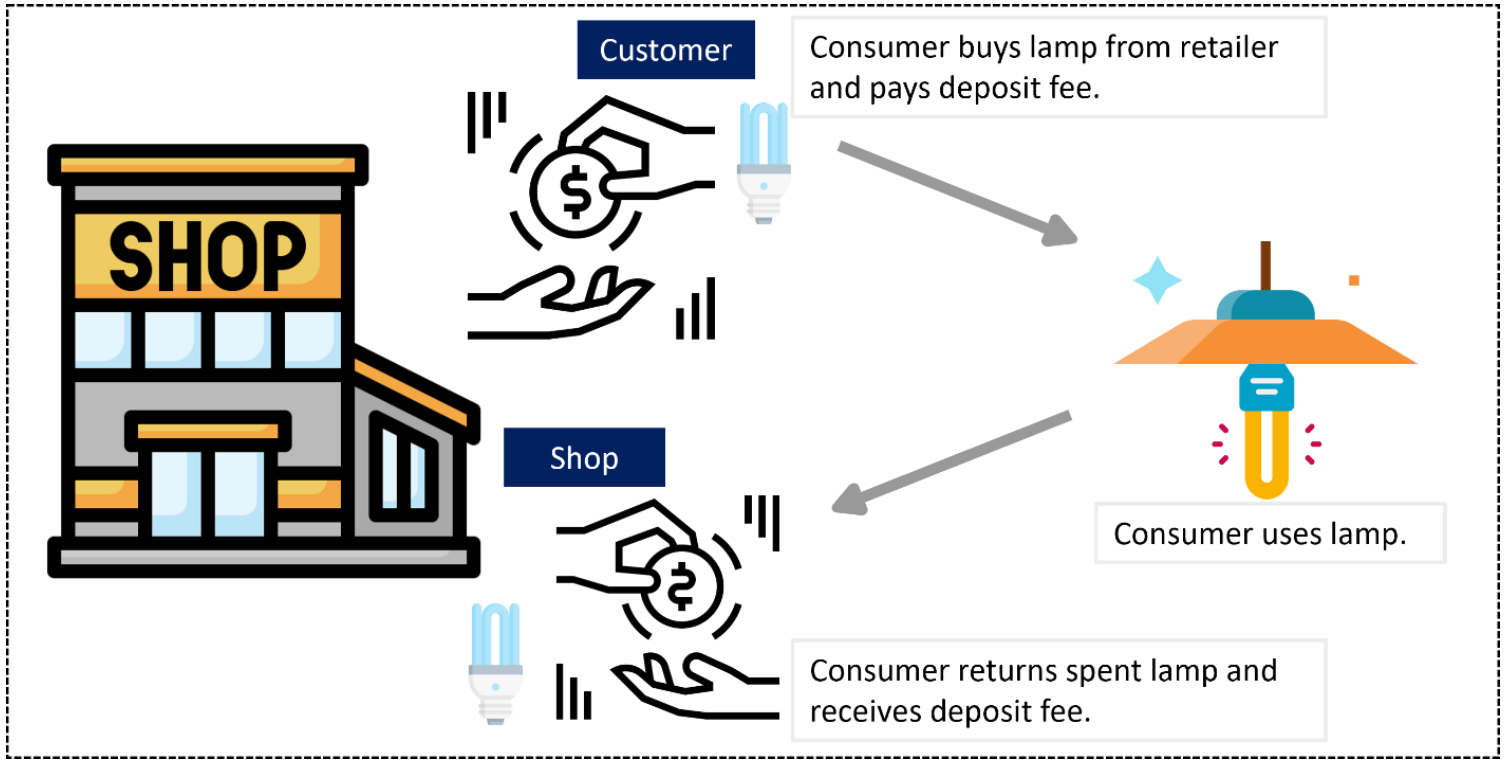
Storage



Interim Storage Facility for Hazardous Waste in USA

Source: EPA

Collection



Collection: Take Back Programs

Transport

Example of metallic mercury container in preparation for road/sea transport (ADR, IMDG)

Source: Remondis 2021

Security Measures for Road and Sea Transportation

Example of secure UN packaging in a 40ft sea container

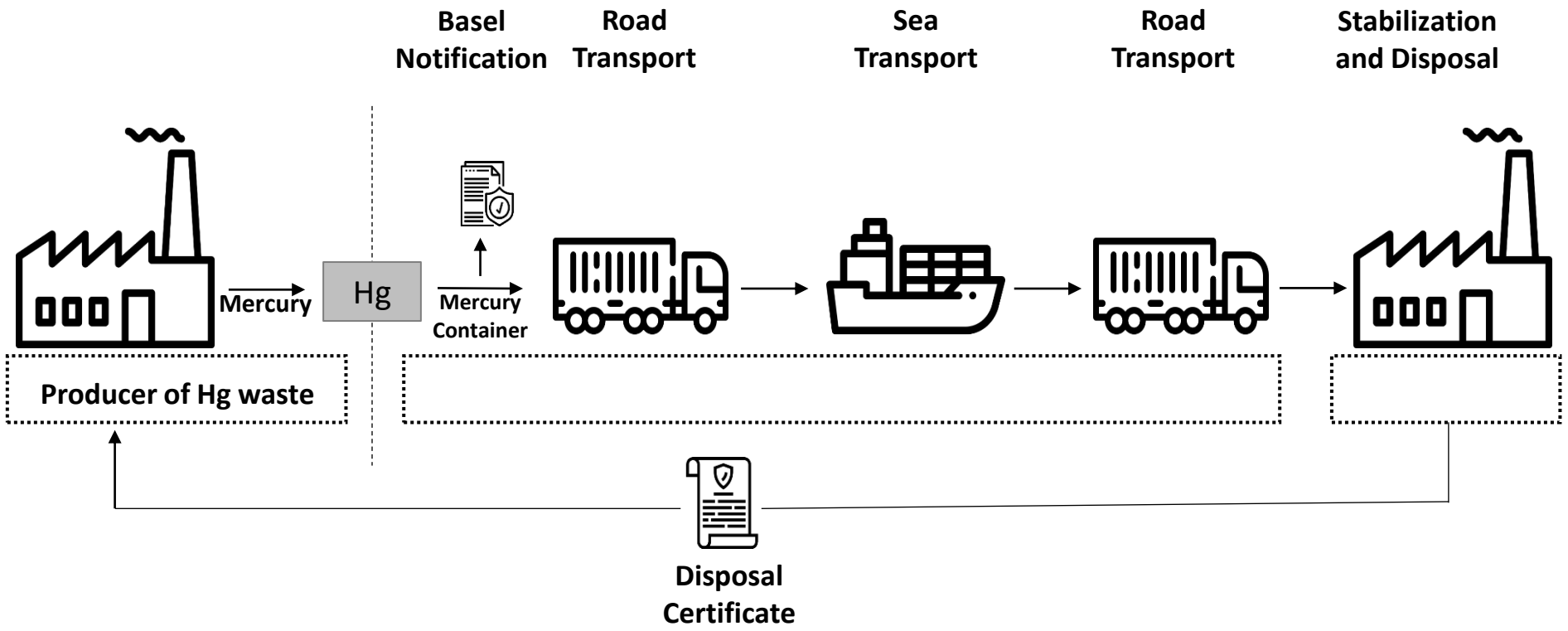
Source: BFS 2021

Interim Storage

Centralised Hazardous Waste Storage Facility in Germany, e-g- TRGS 510

Source: ALBA 2020

Recap of processes up to stabilization and disposal



In case local infrastructure cannot treat the wastes, shipment may be necessary under the Basel Convention. All services must follow strict international regulations on transport, treatment and disposal of mercury waste.

TREATMENT

Recovery (Recycling, reclamation) or treatment options exist and facilities are classified thus for handling wastes, examples, general:

Code	Recovery Operations	Code	Disposal Operations
R4	Recycling/reclamation of metals and metal compounds	D5	Specially-engineered landfill
R5	Recycling/reclamation of other inorganic materials	D9	Physico-chemical treatment
R8	Recovery of components from catalysts	D12	Permanent storage
R12	Exchange of wastes for submission to operations R4, R5, R8 or R13	D13	Blending or mixing prior to submission to D5, D9, D12, D14 or D15
R13	Accumulation of material intended for operations R4, R5, R8 or R12	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

treatment

Physico-Chemical Treatment: Stabilization/Solidification (S/S)

Immobilize the mercury in a solid and low permeable matrix so that the waste complies with the acceptance criteria for disposal in specially engineered landfills or permanent storage in underground facilities

treatment

Two of the most used Stabilization/Solidification (S/S) approaches are:

- Sulphur Stabilization of Mercury
- Sulphur Polymer Stabilization of Mercury and Mercury Containing Wastes

Recovery

Recovery operations lead to resource recovery, recycling, reclamation, direct re-use, or alternative uses

Mercury recovery from solid waste generally comprises of 3 stages:

1. Pre-Treatment

- aims to increase efficiency of subsequent steps

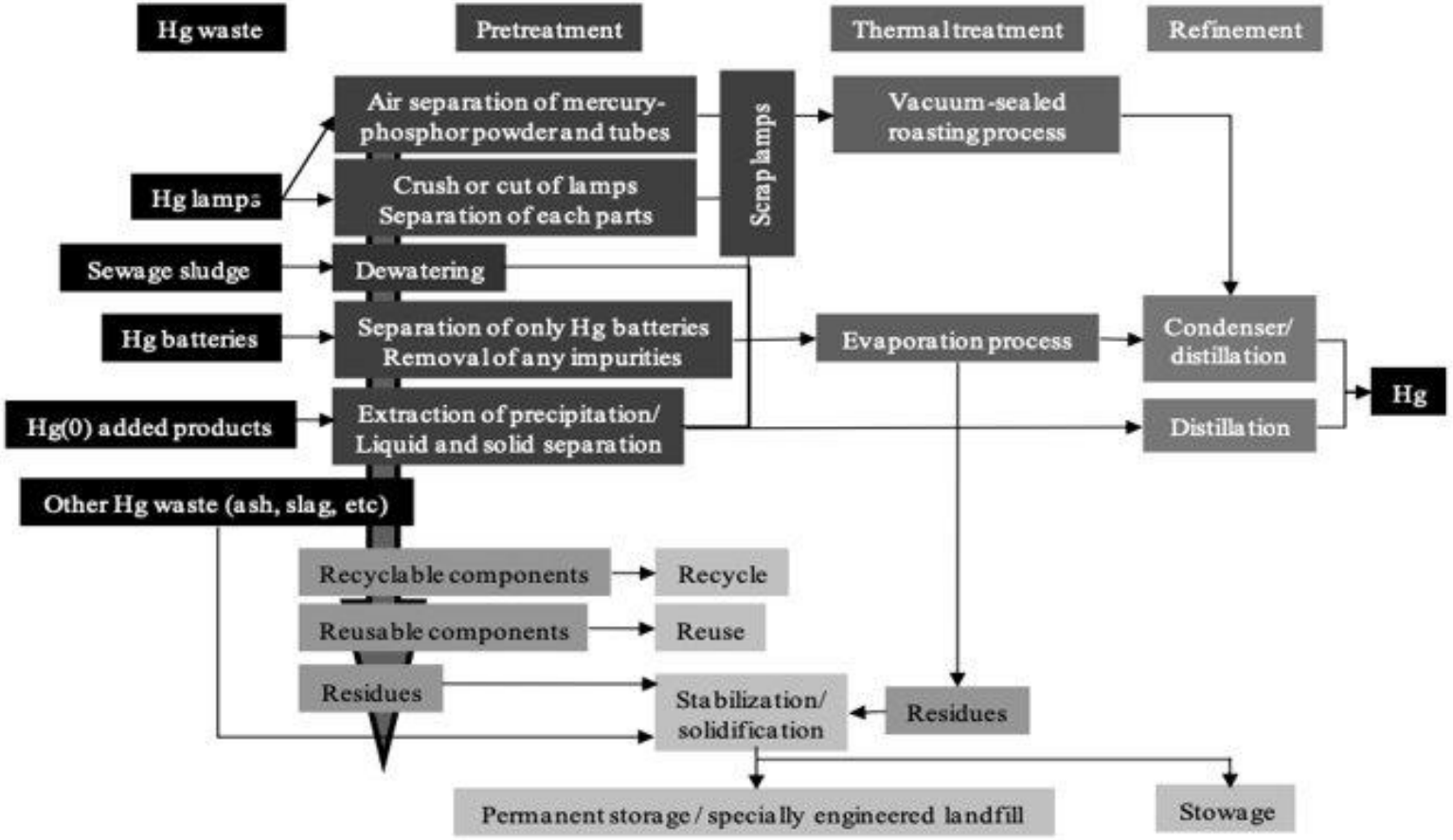
2. Thermal-Treatment

- mercury is separated by heating it above its vaporizations temperature

3. Purification or Refinement

- mercury vapour emitted during waste treatment is washed out

TREATMENT PROCESS



Flow for Recovery of Mercury

Source: UNEP 2020

Thermal stabilization – example Germany

Source: REMONDIS

Disposal

- Disposal operations are those operations which do not lead to the possibility of resource recovery, recycling, reclamation direct re-use or alternative uses
- Waste must first undergo adequate pre-treatment
- Mercury recovered from waste can then be chemically stabilized and or physically solidified using commercially available technologies
- Stabilisation or solidification
- Underground storage in salt mines

Source: UNEP 2020

Underground storage – example Germany

Underground storage for Hg – example Germany

- UTV
- 29 Teutschenthal
- 30 Bernburg
- 31 Wintershall
- 32 Hattorf
- 33 Unterbreizbach
- 34 Zielitz
- 35 Kaverne Staßfurt
- 36 Stetten
- 37 Heilbronn
- 38 Kochendorf
- 39 Sondershausen
- 40 Bleicherode
- 41 Sollstedt

- UTD (DK-IV-Deponien)
- 25 Herfa-Neurode
- 26 Zielitz
- 27 Heilbronn
- 28 Sondershausen

Source: SBB

Thank you for your attention!

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