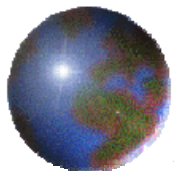


# Draft BAT/BEP Guidance on Reduction of Mercury Releases from Waste Management

UNEP Global Mercury Partnership Waste  
Management Partnership Area Meeting

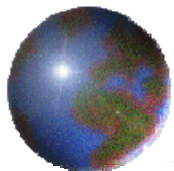
Tokyo, Japan

9-10 March 2010



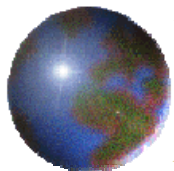
# Organization of Presentation

- Background
- Objective
- Scope of the BAT/BEP Guidance
- Way to prepare the BAT/BEP Guidance
- Organization of the BAT/BEP Guidance
- Information Collection Format
- Discussion points
- Comments from Participants
- Summary of Each Chapter



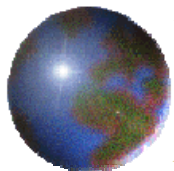
# Background

- UNEP GC Decision 24/3 in 2007 requests the UNEP ED to strengthen the UNEP mercury partnership by specific action including the expansion of the number and scope of partnerships to include new, growing or related sectors such as ... **waste combustion**.
- Waste Management Area was launched in early 2008 with Japan being the lead.



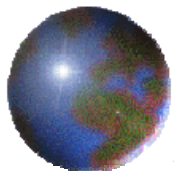
# Background

- ✿ One of the projects in the Waste Management Partnership Area
  - To develop a BAT/BEP guidance for implementation of an important part of the Basel Convention Technical Guidelines on Environmentally Sound Management of Mercury Waste
  - The 1<sup>st</sup> draft waste prepared in 2009 focusing on reduction of mercury releases from waste combustion



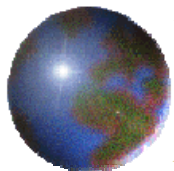
# Background

- ✿ Comments from the 1<sup>st</sup> Waste Management Partnership Area Meeting in March 2009 (1)
  - ▣ Expand the scope to include waste management activities
  - ▣ Emphasize importance of separation of waste products containing mercury before being sent to landfills
  - ▣ Focus on BEP rather than BAT
  - ▣ Several BAT/BEP should be listed because what is the best depends on country situations



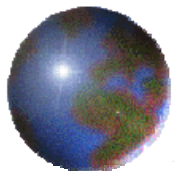
# Background

- ❁ Comments from the 1<sup>st</sup> Waste Management Partnership Area Meeting in March 2009 (2)
  - ❁ Respond to needs of developing countries
  - ❁ Consider the fact that open burning is prevalent in developing countries
  - ❁ Include information not only techniques but also their costs and benefits
  - ❁ Include information about awareness raising activities



# Background

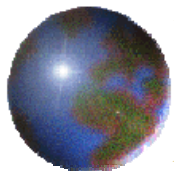
- ✿ **Comments from the 1<sup>st</sup> Partnership Advisory Group Meeting in April 2009**
  - The merits and demerits of each technique needed to be explained and the guidance needed to be wide-ranging.
  - Include the collection and separation of used products, flue gas treatment of waste incinerators, treatment of leachate from landfills and treatment and disposal of solid wastes, ashes and sludge.
  - Bear in mind the need for low-cost solutions that would be appropriate to different countries and conditions.
  - Hope to see the BAT/BEP guidance in early 2011.



# Objectives of the Guidance (1)

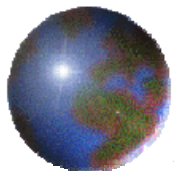
- ✿ To provide information that supports the implementation of BAT/BEP contributing to the reduction of mercury releases from waste management such as:
  - Collection and recycling of waste products containing mercury,
  - Management of waste containing mercury in landfills,
  - Management of mercury from waste combustion,





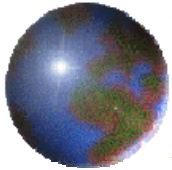
## Objectives of the Guidance (2)

- Management of mercury in residues and hazardous wastes,
- Management of surplus elemental mercury recovered from waste or produced as byproducts,
- Long-term storage facilities for elemental mercury, and
- Remediation of sites contaminated with waste containing mercury.

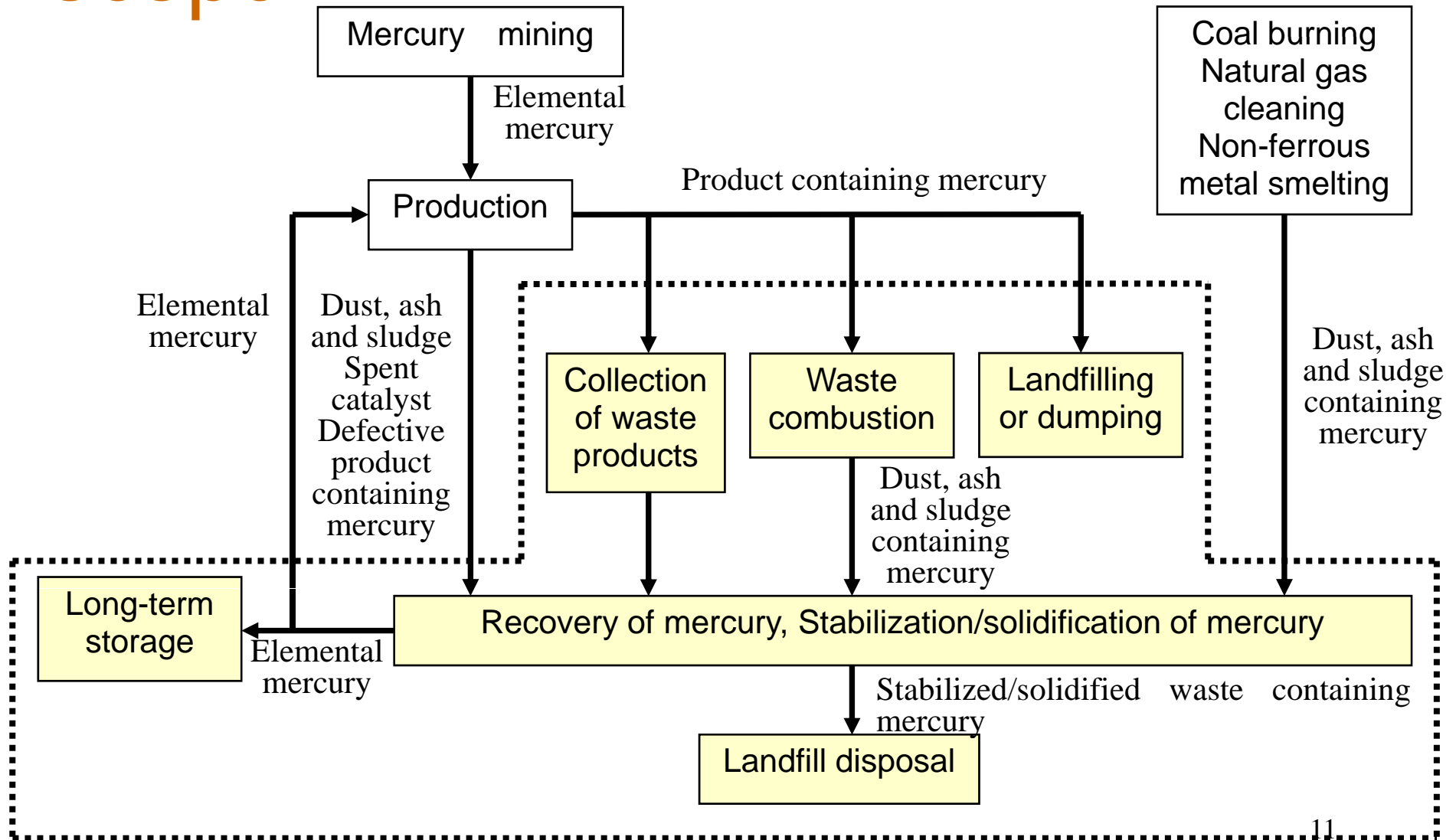


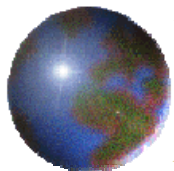
## Objectives of the Guidance (3)

- Basel Convention Technical Guidelines for the Environmentally Sound Management of Mercury Wastes
  - providing basic framework and knowledge and principles
- BAT/BEP Guidance Document
  - providing practical information to readers of the Basel Convention TG when they wish to apply the principles to their waste management policies and practices



# Scope





# BAT and BEP

## ☀ BAT: Best Available Techniques

- Internationally agreed definition in the Stockholm Convention, which can be roughly summarized as:
- Techniques that can most effectively achieving a high level of environmental protection and allow implementation in relevant sector under economically and technically viable conditions

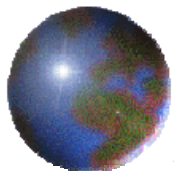
## ☀ BEP: Best Environmental Practices

- The application of the most appropriate combination of environmental control measures and strategies



# Way to Prepare BAT/BEP Guidance Document (1)

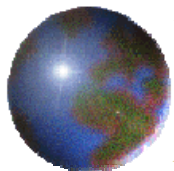
1. Japan prepared a draft outline of the Guidance, and possible BAT/BEP cases in consultation with Japanese experts, and sent them to the participants of the meeting for comments in January.
2. Japan requested Partners and other good practitioners to provide relevant information on their good practices.
3. Taking account of the comments and the info received, Japan prepared a draft text of the Guidance.
4. This meeting review objective, scope, organization, and contents of the draft BAT/BEP guidance.



## Way to Prepare BAT/BEP Guidance Document (2)

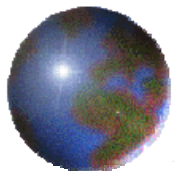
(After this meeting)

5. Japan will revise the draft based on the comments from participants of this meeting.
6. Japan will request Partners and other interested parties to provide comments on the revised draft BAT/BEP Guidance Document (repeat actions 5&6).
7. Waste Management Partnership Area will adopt the draft BAT/BEP guidance document.



## Discussion Points

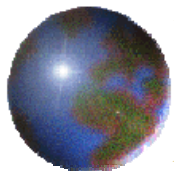
- Have the draft BAT/BEP Guidance appropriately reflected the comments that were made by the meeting participants prior to the meeting in?
- Does the content of the draft BAT/BEP Guidance reflect the needs of the developing countries? If not, what kind of improvements should be made?
- Are there cases that should be included in the BAT/BEP Guidance, other than the cases presented here?



# Organization of BAT/BEP Guidance Document (1)

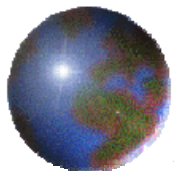
- Chapter 1: Introduction
- Chapter 2: Management of Waste Products Containing Mercury
- Chapter 3: Management of Waste Containing Mercury in Landfills
- Chapter 4: Management of Mercury during Waste Combustion
- Chapter 5: Management of Mercury in Residues/Hazardous Waste





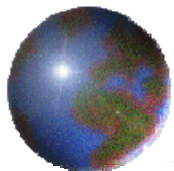
# Organization of BAT/BEP Guidance Document (2)

- Chapter 6: Management of Surplus Elemental Mercury Recovered from Waste or Produced as Byproducts
- Chapter 7: Remediation of Sites Contaminated with Waste Containing Mercury
- Reference
- Annex: BAT/BEP Cases



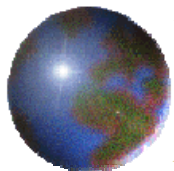
## Information Format for BAT/BEP Cases (1)

- Collection and recycling of waste products containing mercury
  - General information
    - Target product (name, annual sales volume, weight of Hg in the product)
    - Background, Steps to introduce the system, Started year, and Target area
    - Major outcome, Major challenges, and Remaining issues to be solved



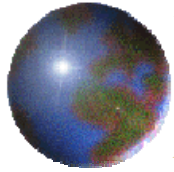
## Information Format for BAT/BEP Cases (2)

- ✚ Collection and recycling of waste products containing mercury
  - ▣ Information about the collection system
    - Outline of collection system
    - Responsibility of stakeholders
    - Necessary costs for the collection and recovery system
    - Transport and storage methods for collected waste products
  - ▣ Information about mercury recovery system
    - Outline of technology
    - Process flow
    - Ways to handle materials other than mercury
    - Description of pollution control measures



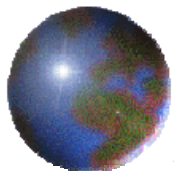
## Information Format for BAT/BEP Cases (3)

- Collection and recycling of waste products containing mercury
  - Awareness raising
    - Target population
    - Activity period/frequency
    - Media used for awareness raising and message delivered
    - Responsibility of stakeholders
    - Cost sharing of stakeholders



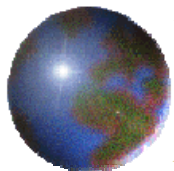
## Information Format for BAT/BEP Cases (4)

- Flue gas, wastewater, residue/waste treatment
  - General information (same as waste products)
  - Information about legal/voluntary system
    - Legal basis or basis for voluntary system
    - Standard on mercury concentration
    - Rationale for standard value
    - Steps to introduce the standard
    - Enforcement scheme



## Information Format for BAT/BEP Cases (5)

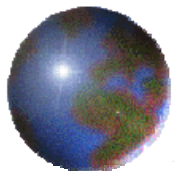
- Flue gas, wastewater, residue/waste treatment
  - Technical information
    - Name and outline of technology to meet standard
    - Process flow
    - Mercury removal efficiency and other environmental benefits
    - Further treatment needs (incl. amount of ashes and sludge generated through the treatment)
    - Initial and running costs (incl. Facility capacity)
  - Awareness raising



# Comments from Participants on Structure of Draft BAT/BEP Guidance

## ✚ Characteristics

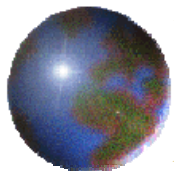
- ✚ Focus on reduction of mercury releases from waste management
- ✚ Partnership areas will not be making narrow determinations of BAT/BEP but rather would be providing information on the range of what we might call “Best Practice Options.” We suggest the use of this term.



## Comments from Participants on Structure of Draft BAT/BEP Guidance

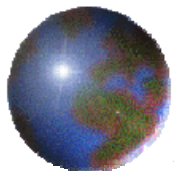
- ☛ Relationship with Draft Basel Convention Technical Guidelines on Environmentally Sound Management of Waste Consisting of, Containing or Contaminated with Mercury (hereinafter referred to as Draft Basel TG)
  - ☛ No duplication
  - ☛ Clearly show in the BAT/BEP guidance corresponding chapters and sections of Basel TG
  - ☛ Refer to 3.4 Application of BAT and BEP of Draft Basel TG
  - ☛ Align with Draft Basel TG to avoid any discrepancies





## Comments from Participants on Structure of Draft BAT/BEP Guidance

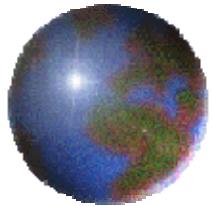
- ✿ Wastes/Practices to be covered
  - Were the ESM of mining wastes from primary mining, wastes from the chlor-alkali production and other Hg-related industrial processes in small quantities considered?
  - Cover most cases in the world, take into account of the different wastes in different countries, and challenges that each country is facing (practical and feasible BAT/BEP Guidance)



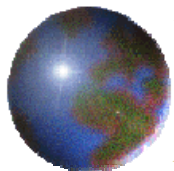
# Comments from Participants on Structure of Draft BAT/BEP Guidance

## ✚ Contents

- The introduction should include some information about the human health impact from mercury.
- There should be another chapter concerning about the Hg reduction technology in products or the use of alternative materials or alternative products.
- Have a clear section on segregation of mercury out of the waste stream

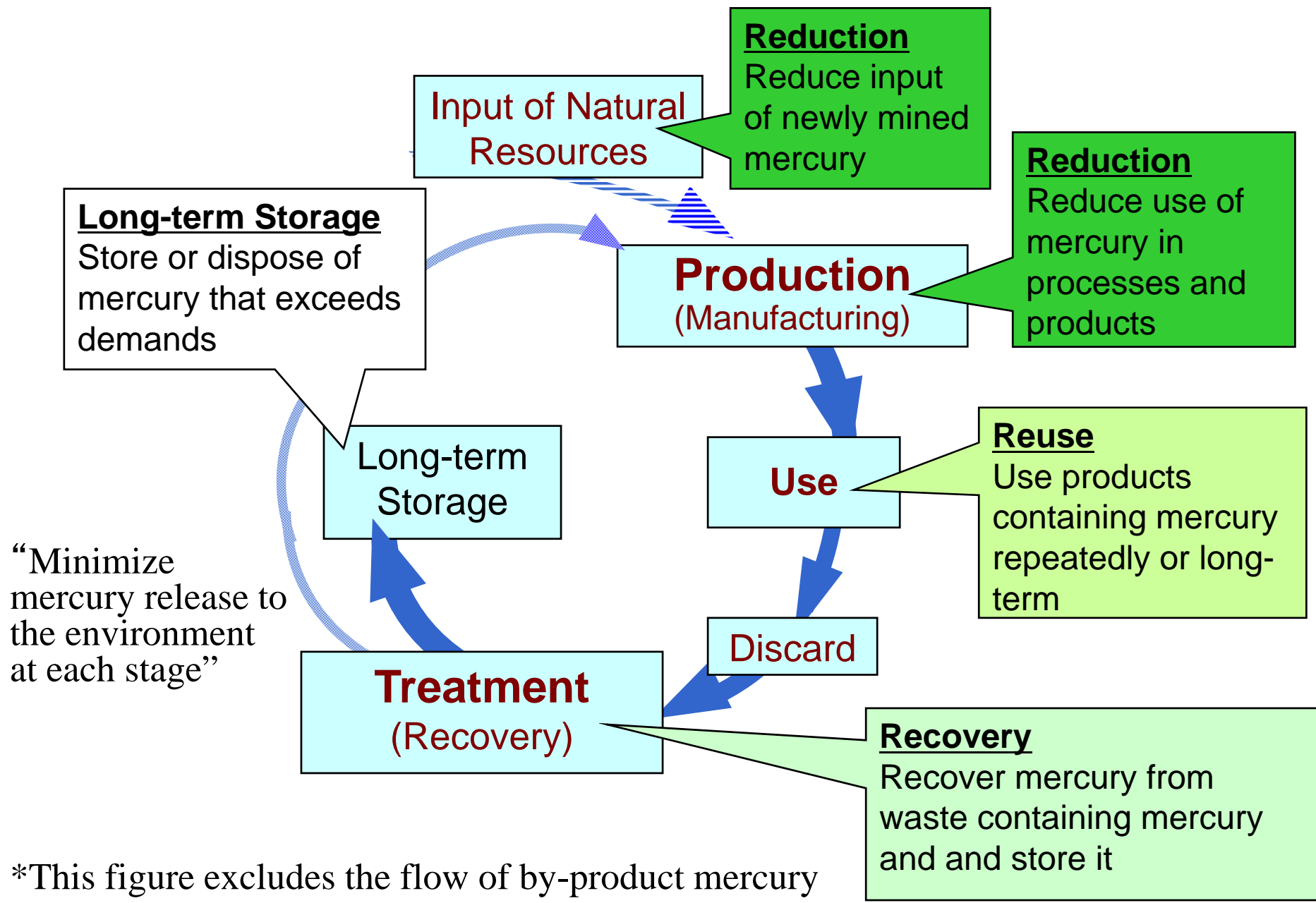


# Chapter 1: Introduction

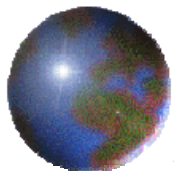


# Contents of Chapter 1

- Background
- Definition of BAT/BEP
- Objective of this guidance
- Scope
- Relationship with the related documents and activities
  - Basel Convention Technical Guidelines
  - UNEP Partnership (products, supply/storage, coal combustion)
- Principles for reduction of mercury releases from waste management

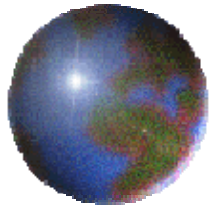


## Basic Concept of Mercury Management

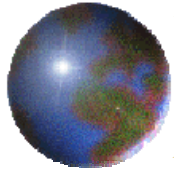


## Contents of Chapter 1

- ❖ Principles for reduction of mercury releases from waste management
  - ❑ Prevention of open burning and dumping
    - Banning on waste dumping in uncontrolled area
    - Cover soil and installation of landfill gas pipe
  - ❑ Awareness raising of stakeholders
    - Difficulties to increase waste products collection rate
    - continuous and targeted awareness raising activities



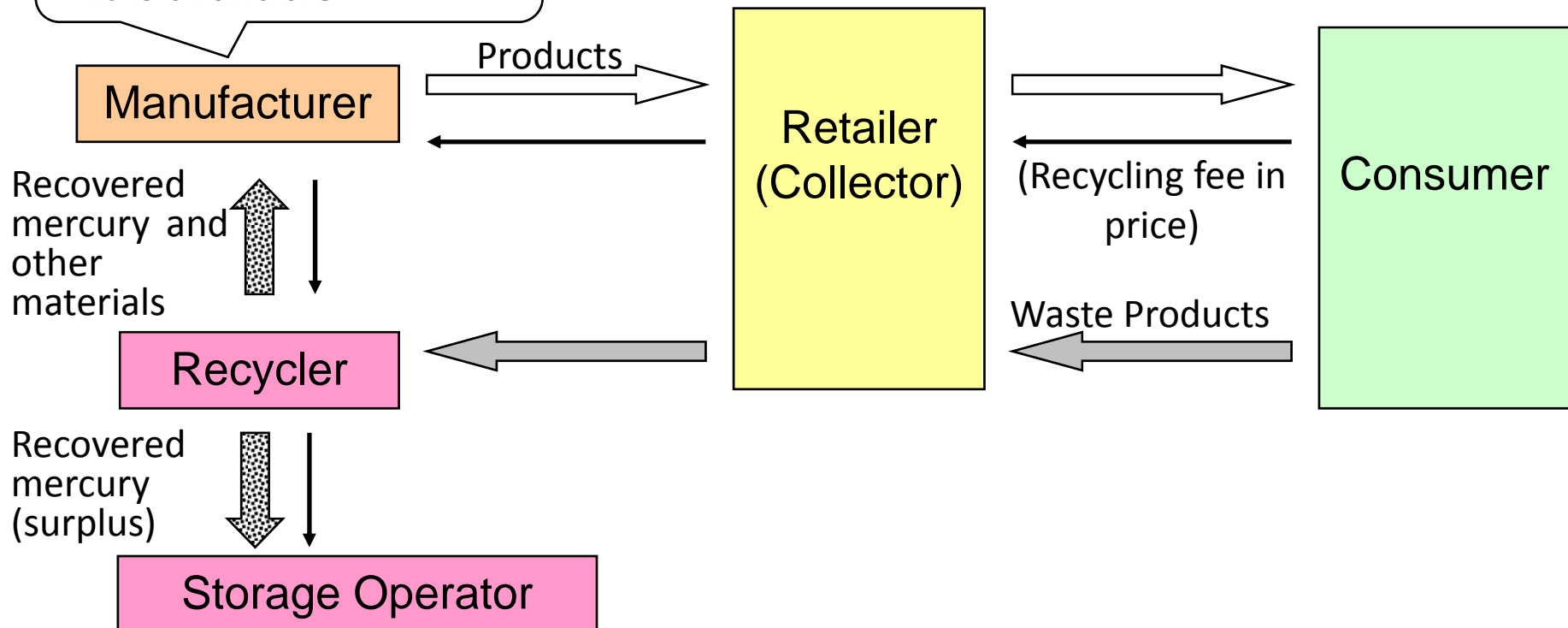
# Chapter 2: Management of Waste Products Containing Mercury



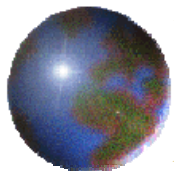
# Principles for Management of Waste Products (1)

## ❊ Closed system for utilization of mercury

**\*Switch to mercury free alternative as soon as it is available**

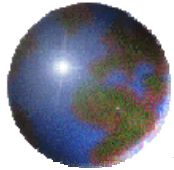






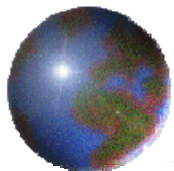
## Principles for Management of Waste Products (2)

- ❁ Steps to establish collection and recycling systems
  - ❁ Identification of types and amount of products containing mercury in the domestic market
  - ❁ Identification of mercury amount included in the products and estimation of environmental and health damage when these products are discarded
  - ❁ Estimation of necessary costs to establish and operate a collection and recycling system
  - ❁ Identification of priority products to be tackled by comparing the abovementioned costs and avoided damages



## Principles for Management of Waste Products (3)

- ❊ Identification of products containing mercury
  - ▣ Table showing types of products containing mercury and amount of mercury contained
- ❊ Establishment of take-back system
  - ▣ Legal or voluntary system?
    - Established industry association or limited number of manufacturers → Legal system could be pursued
    - No industry association → Voluntary system targeting large manufactures first, and then encouraging other manufactures to join

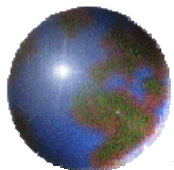


## Principles for Management of Waste Products (4)

### • Establishment of take-back system

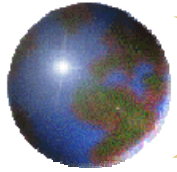
#### ■ For the establishment of a collection system

- Identification of products containing mercury at source  
→ useful tool: labelling
- Collection methods
  - Specific day and time at regular waste collection points
  - Setting collection boxes at public sites
- Key for success
  - Dissemination of information about collection
  - Incentives for bringing waste products to public collection boxes
  - Analysis of different collection rate by region/locale



## Principles for Management of Waste Products (5)

- Establishment of mercury recovery facilities
  - Desirable to recover mercury and other materials at facilities taking measures to prevent mercury releases
  - Permit system should be introduced for mercury recovery facilities as hazardous waste treatment system
- Other options
  - To dismantle the products and store parts containing mercury in a drum and place it under rain-proof areas until mercury recovery facilities are established, or
  - export to other countries which has proper facilities

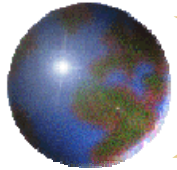


## Principles for Management of Waste Products (6)

### ❖ Cost sharing of stakeholders

#### ❑ Building consensus on sharing costs of

- Collection and recycling of waste products containing mercury (including the construction of mercury recovery facilities)
- Long-term storage of elemental mercury recovered from waste products
- Interim storage of containing mercury parts of waste products (including the construction and operation of dismantling facilities)

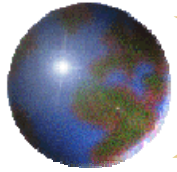


## Principles for Management of Waste Products (7)

### ☉ Cost sharing of stakeholders

#### ■ Cost sharing methods

- EPR (extended producer responsibility)
  - Costs of collection and recycling of waste products and storage of recovered mercury is reflected to the prices of products
- If EPR is not applicable, the public sector needs to play some roles (such as collection of waste products) → gradually reduce involvement of the public sector



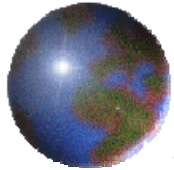
## BEP in the Management of Waste Products (1)

### ⊕ Dental amalgam

- Setting dental amalgam management practice standard in Canada
- Amalgam Wastewater & Recycling Regulations for Dental Facilities in Massachusetts (USA)

### ⊕ Fluorescent lamps

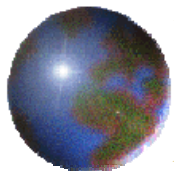
- Take-back system based on EPR in the Republic of Korea
- Annual collection campaign in the Kingdom of Thailand



## BEP in the Management of Waste Products (2)

- ⊕ Electrical and electronic equipment
  - ▣ PC recycling system (including mercury recovery) in Japan
- ⊕ Batteries
  - ▣ Battery collection campaign in Panama
  - ▣ Collection and recycling of batteries based on EPR in Sweden
  - ▣ Collection and recycling of batteries in Japan (elimination of mercury in batteries)

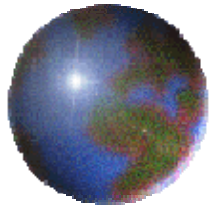




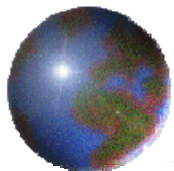
## BEP in the Management of Waste Products (3)

### ✚ Measuring equipment

- ▣ Gradual phase out of mercury in health care facilities in the Republic of the Philippines
- ▣ Collection and recycling of measuring devices in EU (country to be specified)

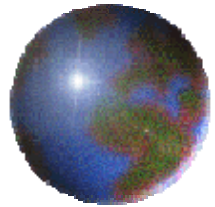


# Chapter 3: Management of Mercury in Landfills

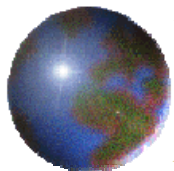


## Principles for Management of Mercury in Landfills

- Behavior of mercury in landfills
  - Effluent as Leachate: minimal
  - Emission as landfill gas: some (mercury concentration in landfill gas was reported to reach the same level as flue gas from waste incinerators and coal-fired power plants)
  - Emission through landfill fire: → major
- Prevention of mercury release
  - Leachate → same as wastewater treatment
  - Landfill gas → prevent waste products from entering household waste stream
  - Emission through landfill fire → prevent landfill fire (cover soil, storage of cover soil for prompt application upon fire)

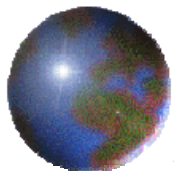


# Chapter 4: Management of Mercury during Waste Combustion



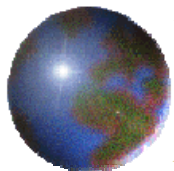
## Principles for Management of Mercury during Waste Combustion (1)

- Behavior of mercury in combustion units
  - Mercury in waste → mainly transferred into flue gas as elemental mercury (few in bottom ash) → some transformed to mercury (II) and transferred to fly ash
  - Mercury (II) is considered to be mercury (II) chloride
- Key to managing mercury from waste combustion
  - Efficient removal of elemental mercury and mercury (II) chloride



## Principles for Management of Mercury during Waste Combustion (2)

- Prevention of waste containing mercury to be entered into combustion units
- Setting emission/effluent standards for waste incineration facilities
- Establishment of a permit system for waste incineration facilities to be constructed and operated in order to ensure meeting emission/effluent standards
- Monitoring performance of incineration facilities



# Principles for Management of Mercury during Waste Combustion (3)

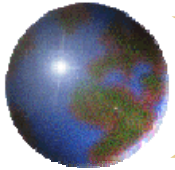
## ☉ Mercury removal technology

### ▣ Flue gas

- Wet system
  - Make water-soluble mercury chloride contact and absorbed to water
  - To remove elemental mercury, need additives to oxidize elemental mercury
- Dry system
  - Make mercury transfer to and stabilize onto solid sorbent

### ▣ Effluent

- Chelating resin
  - Adsorb mercury by forming chelate bonding with mercury ion



# BAT/BEP in Management of Mercury during Waste Combustion

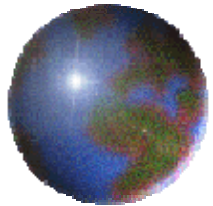
## ⊕ Flue gas treatment

- Co-benefits of controlling major air pollutants in Japan
- Local regulations to control mercury emissions in Kyoto (Japan)
- Case of USA
- Case of a country in EU

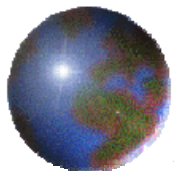
## ⊕ Wastewater treatment

- Application of chelating resin to wastewater from industrial waste landfills in Japan
- Case of a country in EU



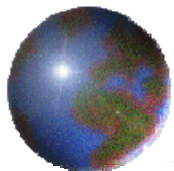


# Chapter 5: Management of Mercury in Residues/Hazardous Waste



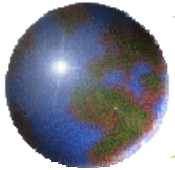
## Principles for Management of Mercury in Residues/Hazardous Waste (1)

- ❖ Types of residues containing mercury
  - ❑ Dusts collected by bag filters and electrostatic precipitators of waste incinerators and other combustion units
  - ❑ Sludge generated through treatment of wastewater from wet scrubbers and industrial processes and sewage



## Principles for Management of Mercury in Residues/Hazardous Waste (2)

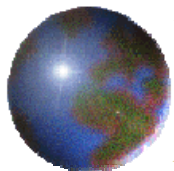
- Setting landfill acceptance criteria and leachate standard
- Establishment of a permit system for treatment facilities/landfills to be constructed and operated in order to ensure meeting the landfill acceptance criteria and the standards
- Monitoring performance of treatment facilities and landfills



## Principles for Management of Mercury in Residues/Hazardous Waste (3)

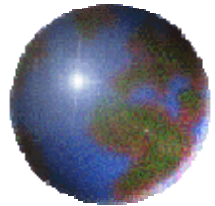
### ✚ Treatment technology

- With high concentration of mercury
  - Retorting or roasting in a thermal processing unit capable of volatilizing mercury and subsequently condensing the volatilized mercury for recovery
- With low concentration of mercury
  - Reducing leachability of mercury by stabilization or solidification

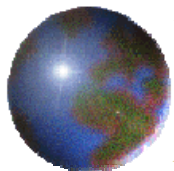


## BAT/BEP in management of mercury in Residues/Hazardous waste

- ✚ Landfill acceptance criteria and technology to meet the criteria
  - ▣ Case of USA (Land disposal restrictions and their treatment requirements)
  - ▣ Case of EU

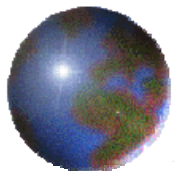


# Chapter 6: Management of Surplus Elemental Mercury Recovered from Waste or Produced as Byproducts



## Management of Surplus Elemental Mercury Recovered from Waste or Produced as Byproducts

- Establishment of legal framework
  - Specify target sources of elemental mercury recovered from waste or produced as byproducts
  - Clarify responsibility of relevant parties (including cost sharing)
- Establishment of storage facilities
  - Prepare technical guidelines to construct and operate the storage facilities
  - Build a national/local consensus for siting the storage facilities



## BEP in Management of Surplus Elemental Mercury Recovered from Waste or Produced as Byproducts

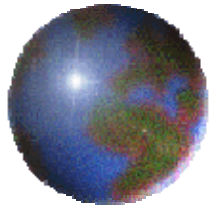
### ✿ Legal framework

- Mercury Export Ban Act of 2008 (USA)
- Regulation (EC) No 1102/2008 of the European Parliament and of the Council of 22 October 2008 on the banning of exports of metallic mercury and certain mercury compounds and mixtures and the safe storage of metallic mercury

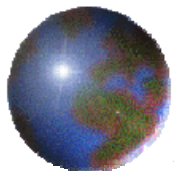
### ✿ Consensus building on siting storage facilities

- Case of USA





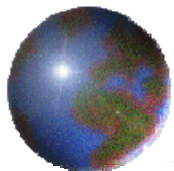
# Chapter 7: Remediation of Sites Contaminated with Waste Containing Mercury



## Principles for Remediation of Sites Contaminated with Waste Containing Mercury (1)

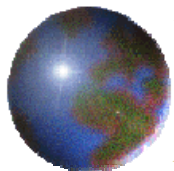
### ✿ Identification of contaminated sites

- Investigate sites with high possibility of being contaminated with mercury, for example:
  - Landfills that accepted waste containing mercury with higher concentration than the acceptance criteria
  - Factories that disposed their wastes containing mercury on the premises without a necessary permit



## Principles for Remediation of Sites Contaminated with Waste Containing Mercury (2)

- Identification of responsible parties for remediation
- Development and implementation of remedial action plan
  - Setting remediation target
  - Selecting remediation technology
  - Securing necessary costs for remediation
- Post-remediation of contaminated sites



## BAT/BEP in Remediation of Sites Contaminated with Waste Containing Mercury

- ❖ Remedial technology
  - ❑ Several technologies are described in the Basel Convention Technical Guideline
  - ❑ Bioremediation using iron-oxidizing bacteria
- ❖ Any remediation case as BEP?