POLICY PAPER ON THE ENVIRONMENTALLY SOUND MANAGEMENT OF MERCURY AND MERCURY COMPOUNDS IN THE PHILIPPINES

2014

Swedish Society for Nature Conservation

BAN TOXICS!

TABLE OF CONTENTS:

EXECUTIVE SUMMARY

Mercury (Hg) is a harmful neurotoxin with adverse effects on humans, ecosystem and wildlife. Consequently, the Minamata Convention on the Control of Mercury was adopted on 30 October 2013 to establish control on the supply and demand for mercury; address the emissions to air and releases on land and water; and mandate environmentally sound management (ESM) and disposal of mercury-wastes.

The main objective of the Policy Paper is to examine the policy options for environmentally sound management on storage and disposal of mercury and mercury compounds provided by the Minamata Convention and the Basel Convention. The Policy Paper also looks at the two Conventions' implications on Philippine laws, and provides an overview of the technical issues and challenges in adopting different options for ESM.

A fundamental jumping point for the Paper are the sources and applications of mercury and mercury compounds, using the results of UNEP Level-1 toolkit for identification and quantification of Hg releases. This is complemented with the results from two parallel studies conducted by BAN Toxics (BT)— one on household waste production in three key cities in the country, and another on the patterns of mercury trade in different sectors.

Evident in the results of these 2 studies is the significant mercury use contributed from artisanal and small-scale gold mining (ASGM), coal-fired power generation, and the intentional use of Hg in consumer products. For example, statistics from the UN COMTRADE showed that the Philippines imported 301,711 kilograms of elemental Hg from 2000 to 2014, which raises the question on where these Hg end up.

With the use of mercury in different sectors and industries, the issue of ESM of this toxic substance is put on the spotlight. An examination of the Minamata Convention showed specific obligations for Parties, particularly citing Article 10 on environmentally sound interim storage of mercury other than mercury waste, and Article 11 which covered the latter. Technical guidelines developed under the Basel Convention also provided voluntary standards on ESM of wastes but is limited by its non-binding nature. At the national level, RA 6969, or the "*Philippine Toxic Substances, Hazardous and Nuclear Wastes Control Act*" and its ensuing regulations covered a wide range of activities such as importation, manufacture, processing, handling, storage, transportation, sale, distribution, use and disposal of mercury, but needs fundamental overhaul to make it compliant to the Minamata Convention.

This is most glaring at the disposal stage of mercury wastes (Hg-wastes). The Paper evaluated the suitability of various final disposal options to determine their feasibility in the Philippines. There are multiple final disposal options for mercury around the world, and these options can be viewed in two broad categories: above and below ground. Each broad category has illustrative models, which the study examined: (1) above ground storage, represented by the United States Defense National Stockpile Center; and below ground storage, such as in the EU. Furthermore, the use of existing hazardous waste facilities and exportation of Hg waste for ESM were also examined.

The assessment of the final disposal options were founded on the criteria consolidated from UNEP Chemicals, IAEA, US DOE DNSC EIS and the UNDP GEF Global Healthcare waste project. These criteria include considerations on technical requirements, public health and safety, environmental concerns, financial, social and political implications, among others.

The assessment showed that the adoption of below ground storage facility can be challenging, primarily because of the Philippines's vulnerability to natural disasters. Above ground, warehouse-type storage or final disposal options, is favored. However, site identification and facility construction should be at par with the minimum procedures and technical requirements for hazardous waste collection and storage according to both international and local legal regimes.

Mercury poses a multi-faceted challenge to many nations, especially to a developing country like the Philippines. In order to achieve a proper ESM approach in mercury management, the following gaps need to be addressed:

- Prevention or minimization of mercury wastes through addressing its supply to the country, as well as the introduction of mercury-free alternatives;
- Update and improvement on the legal infrastructure for the ESM of mercury, as well as a more rigorous implementation of local laws;
- Undertaking of a more comprehensive evaluation of final disposal options for mercury in the Philippines; and
- Ratification of the Minamata Convention.

ABOUT BAN TOXICS

BAN Toxics (BT) is an independent, non-profit, non-governmental, environmental organization that seeks to:

1. Promote environmental justice in the Philippines and the Asian region, ensuring that developing countries in the region do not bear a disproportionate burden of pollution coming from developed countries.

2. Prevent toxic trade in products, wastes, and technologies, particularly trade from developed to developing countries in the Asian region through the promotion of self-sufficiency in waste management, clean production, toxics-use reduction, and other sustainable and equitable practices or methodologies.

3. Reach out and work in solidarity and partnership with allied groups locally and regionally in Asia, striving to instill a broader consciousness of the interrelatedness of each community, each country, within the region and to uphold our collective fundamental human right to life and to live in a healthy and peaceful environment.

4. Promote a new earth economics that accounts for nature's services, and the disservices from pollution, that internalizes all costs including those transferred to the global commons, disenfranchised communities, the environment and the future.

5. Develop local and regional initiatives through research, investigation, and policy dialogue with government and grassroots organizations in order to actively share information and expertise through workshops, conferences, newsletters, reports, films, web features, and through other similar or as yet undeveloped media.

BAN Toxics works closely with local, national and international environmental NGOs, intergovernmental organizations, and academic institutions using both local and international campaigning, capacity-sharing and bridge-building between activists in Asia, and throughout the world.

BAN Toxics is a duly registered non-profit, non-governmental organization with the Philippine Securities and Exchange Commission.
We are based in Quezon City, Philippines.

ABOUT THE POLICY PAPER

The Policy Paper on the Environmentally Sound Management of Mercury and Mercury Compounds in the Philippines (Policy Paper) was co-authored by Richard Gutierrez, *JD. Ll.M.*, founder and Executive Director of BAN Toxics, and Myline Macabuhay, Global Chemicals Programme Assistant Coordinator at BAN Toxics.

The Policy Paper is part of the output for the US Department of State funded project SLMAQM-11-GR-027, entitled “Development of National and Regional Approaches to Environmentally Sound Management of Mercury in Southeast Asia”.

REASON FOR THE POLICY PAPER

The purpose of the document is to provide Philippine policymakers and local stakeholders with an understanding of the nature of environmentally sound management as it applies to mercury and mercury compounds to prepare them and their country for the requirements the Minamata Convention on Mercury (Convention) may usher in. With the adoption of the Convention in October 2013, the Policy Paper is timely as an additional tool for the Philippine government as it reviews the impacts of ratification to the Convention.

The Policy Paper also seeks to provide policymakers with updated legal and technical data of the prevailing issues surrounding environmentally sound management of storage and disposal of mercury and mercury compounds.

FINANCIAL SUPPORT/ ACKNOWLEDGEMENTS

BAN Toxics acknowledges the financial support of the US Department of State and the Swedish Society for Nature Conservation (SSNC) for the development and distribution of this Paper.

The co-authors wish to acknowledge and express our sincere appreciation to the following individuals who provided essential feedback and comments to improve the accuracy and quality of the Paper:

- Mr. Michael Bender of the Mercury Policy Project;
- Mr. Peter Maxson of Concorde East/West Sprl
- Ms. Elena Lymberidi-Settimo of the European Environment Bureau;
- Mr. Alexander Baart of K+S Entsorgung GmbH;
- Mr. Dennis Lynch of the US Defense National Stockpile Center;
- Mr. Thomas Baart of GRS;
- Ms. Manny Calonzo of Ecowaste;
- Ms. Faye Ferrer of Healthcare Without Harm-Southeast Asia;
- Ms. Beng Pausing, Mr. Geri Geronimo Sañez, Ms. Angie Bravante and Ms. Leah Becina of the Department of Environment and Natural Resources.

The authors would also like to extend their gratitude to Jezreel Belleza, Tanya Conlu, Charlie Golez, Joseph Manalo, Raven Gutierrez, Angelica Carballo-Pago and Jun Salaveria.

DISCLAIMER

The sole responsibility for the content of this Report lies with the co-authors. The organizations which provided financial support are not responsible for any use that may be made of information contained therein.

LIST OF ACRONYMS/ TERMS

AO	Administrative Order
ASGM	Artisanal and Small-scale Gold Mining
Basel Convention	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal
BT	BAN Toxics
CCO	Chemical Control Order
CIU	Categorical Industrial Users
COP	Conference of Parties
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DILG	Department of Interior and Local Government
DOH	Department of Health
DOTC	Department of Transportation and Communication
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EO 79	Institutionalizing and Implementing Reforms in the Philippine Mining Sector providing Policies and Guidelines to ensure Environmental Protection and Responsible Mining in the Utilization of Mineral Resources

ESM	Environmentally sound management
EU	European Union
GEF	Global Environment Facility
HHW	Household Hazardous Wastes
IAEA	International Atomic Energy Agency
IRR	Implementing Rules and Regulations
LAC	Latin America and Caribbean
Minamata Convention	Minamata Convention on the Control of Mercury
NGOs	Non-government Organizations
NSP	National Strategic Plan
PIC	Prior Informed Consent
RA 6969	Toxic Substances, Hazardous and Nuclear Wastes Control Act
RA 7076	People's Small-scale Mining Act
SPC	Sulfur Polymer Cement
SPSS	Sulfur Polymer Stabilization/ Solidification
TCLP	Toxicity Characteristics Leaching Procedure
UN COMTRADE	United Nations International Trade Statistics Database
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNSD	United Nations Statistics Division
US DOE DNSC	United States Department of Energy- Defense National Stockpile Center
WTO	World Trade Organization

CHAPTER I: INTRODUCTION

Mercury (Hg) is a harmful neurotoxin with adverse effects on humans, ecosystem and wildlife.[1] While initially seen as an acute, localized hazard, Hg pollution is now established to pose chronic toxicity exposure diffused to the greater population at a global scale. It is one of the hazardous substances listed by the US EPA for "virtual elimination".[2]

Due to the risks posed by Hg pollution, the Minamata Convention on the Control of Mercury (Convention) was adopted on 30 October 2013 and has since changed the global mercury policy landscape. It was primarily developed to protect human health and the environment from the adverse effects of mercury. The Convention, in part, establishes control to, among others, decrease the supply of mercury; limit, and in specific cases, eliminate demand of Hg; address emissions to air and releases in land and water; and, mandate environmentally sound storage and disposal.

Of the myriad issues covered under the Minamata Convention, this study looks into the environmentally sound storage and disposal of Hg and Hg compounds. Improper management of Hg and mercury compounds (Hg

1 United States Geological Survey, 2000.
2 Agency for Toxic Substances and Disease Registry, 1999.

compounds), both as a commodity and waste, from its handling, transport, storage and final disposal, can result in emissions and releases that can eventually harm human health and the environment.

As an issue, both storage and disposal not only impacts industrial users and generators, but household users and generators as well. This study looks into the various considerations that policymakers and civil society stakeholders need to examine to arrive at a rational and comprehensive solution for the environmentally sound storage and disposal of Hg and Hg compounds.

1.1 OBJECTIVES OF THE STUDY

The objectives of the study are the following:

1. Provide Philippine policy makers with information and insight on the environmentally sound storage and disposal of Hg as required by the Minamata Convention and its impact on relevant Philippine laws;
2. Provide an overview of the outstanding technical issues that the Philippine government will need to consider as it reviews options of environmentally sound storage and disposal of mercury and mercury compounds;
3. Enhance the understanding at the regional/international level on the challenges faced by developing countries in the disposal of Hg-waste; and
4. Raise awareness in communities on the consequences of improper Hg-waste disposal and the need for the environmentally sound management of Hg.

1.2 SCOPE AND DELIMITATION

The study looks at the Minamata and Basel Conventions and applicable Philippine laws and regulations, e.g. Republic Act No. 6969,. as the basis for its review.

The study focuses on Hg and Hg compounds and wastes as defined under the Minamata Convention. It does not focus on Hg releases generated from coal-fired power plants, incinerators, and other emission point sources, but touches on the subject from an ESM discussion.

Moreover, since there are no previous reports available on Hg generated in the country and subsequent assessment of excess Hg in the Philippines, the inventory results of the Level-1 Hg Release UNEP Toolkit was used in this study. This, however, is limited and does not give an accurate estimation on the excess Hg to be stored in Philippines.

Lastly, the study does not focus on intermediary steps related to mercury-wastes (Hg-wastes), such as the means or methods for collecting and transporting Hg and Hg-wastes to an interim storage facility, the subsequent technical and cost implications of these steps, and intermediate disposal operations.

1.3 RESEARCH METHODS

The methodology for the study mainly involved the collection of relevant literature on Hg source inventory, storage, and disposal options. The table below summarizes the stages for the assessment process and the data sources for the following topics:

TABLE 1. RESEARCH METHODOLOGY

	Topic	Data Source
1	Quantity of excess Hg for storage	- Philippine DENR inventory using the UNEP toolkit - Cebu, Davao and Marikina Cities' household hazardous waste (HHW) inventory and assessment - COMTRADE data on Philippine Hg import (trade)
2	Legal structure for hazardous waste (Hg) management	- Republic Act No. 6969 and DENR AO No. 29 Series of 1992 - DENR AO No. 38 Series of 1997 - DOH AO No. 21 Series of 2008 - DepEd MC No. 160 Series of 2010 - Minamata Convention on Hg
3	Criteria for Hg storage facilities	- UNEP Chemicals Hg Storage Facility guidelines
4	Technologies and Infrastructures for Hg management	- US DOE-DNSC EIS for above ground Hg storage facility - BAN Toxics' terminal storage options for Hg-wastes in the Philippines - Assessment options for managing excess Hg supply and costing components in Indonesia

The last stage involved screening the available options using the UNEP Chemicals' criteria for the most feasible storage facility and review of available technologies and infrastructure for the environmentally sound management of Hg.

"Mercury" as used in the Policy Paper

The word "mercury" has a specific legal meaning under the Minamata Convention. For brevity, the Policy Paper will be using the term "mercury" to encompass "mercury and mercury compounds" as defined under the Convention. The Convention has separate definitions of "mercury and mercury compounds" and the specific definition of the terms will be dealt with in the appropriate section of this Policy Paper.

CHAPTER II: MERCURY AND ENVIRONMENTALLY SOUND MANAGEMENT

This section provides a brief overview of mercury and its characteristics, speciation, and routes of exposure to humans. The section also discusses in brief the linkage of mercury in society, where it is found and how it is used, in order to provide the reader a quick understanding of the impact of mercury use in society. Lastly, the section traces the supply of mercury and establishes the critical link between mercury supply and demand, and the need for controls in order to mitigate impacts on the waste or end-of-life stage of mercury or products that contain mercury.

2.1 BASIC PROPERTIES OF MERCURY

About Mercury

Mercury is a constituent element of the earth, a heavy metal. In pure form it is known as “elemental” or “metallic” mercury. Mercury is rarely found in nature as a pure liquid metal, but rather with compounds.

Mercury occurs naturally in the environment and exists in a large number of forms.

a. **Elemental mercury** is a heavy, silvery-white metal that is liquid at room temperature and atmospheric pressure. However, mercury vaporizes readily at usual room temperatures. Most of the mercury encountered in the earth’s atmosphere is elemental mercury vapor.
b. **Inorganic mercury compounds**, e.g. mercuric sulfide (HgS). These compounds are called mercury salts. Most inorganic mercury compounds are white powders or crystals, except for mercuric sulfide, which is red and turns black after exposure to light.
c. **Organic mercury** is formed when elemental mercury combines with carbon. There is a potentially large number of organic mercury in the environment; the most common of which is methyl mercury.

2.2 IMPACTS TO HEALTH AND THE ENVIRONMENT

A cause for concern

Mercury is a toxin and is harmful to humans and wildlife. Significant adverse impacts on human health and the environment have been documented around the world. Some populations are especially susceptible to mercury exposure, most notably the fetus, the newborn and young children due to their developing nervous systems.

Mercury is present throughout the environment. As an element, mercury cannot be created nor destroyed by any chemical means. Mercury levels in the environment have increased considerably since the on-set of the industrial age. Mercury is now present in various environmental media and food.

Mercury is persistent and cycles globally. Once mercury is released into the environment, it persists and cycles through various channels (air, water and soil).

Deposited mercury can change form– into methylmercury through microbial action. Methylmercury has the capacity to accumulate in organisms (bio-accumulate) and concentrate up into the food chain (bio-magnify), most especially in the aquatic ecosystem.

Routes of exposure

The primary route of exposure of mercury to humans is through their diet. However, people can also be exposed to mercury by breathing in air or drinking water contaminated with mercury compounds.

Mercury is a well-known neurotoxin. The most important health hazard from a developmental point of view is that to the unborn child in utero. Studies conducted in the Faeroe Islands, Denmark demonstrated that the offspring of women exposed to doses below the official threshold of Hg whilst pregnant, resulted in reduced intelligence and difficulties in various learning processes compared to the offspring of women not exposed to mercury.[3] Similarly, studies conducted in gold mining areas in the Philippines have shown that prenatal exposure to mercury was associated with reduced scores in neurodevelopmental testing at age.

2.3 ENVIRONMENTALLY SOUND MANAGEMENT OF HAZARDOUS WASTES (ESM)

At its 10th meeting, the Conference of Parties of the Basel Convention recognized that global harm to human health and the environment is caused by inadequate waste management procedures.[4] The meeting stressed the critical importance of prevention and minimization of hazardous wastes and other wastes, and noted the need for a more systematic and comprehensive effort to improve guidance on the environmentally sound management of wastes.

ESM is defined under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (Basel Convention) as, "*taking all practicable steps to ensure that hazardous wastes or other wastes are managed in a manner that will protect human health and the environment against the adverse effects which may result from such waste*."[5]

The Basel definition is broad and lends itself to various interpretations. A narrow view of ESM is from an end-of-pipe perspective that looks at managing wastes after they are produced. This notion has, however, been put aside as a more comprehensive understanding of ESM has taken precedence.

3 Axelrad, A, et al, 2007.

4 Section B of decision BC-10/3 on the Indonesian-Swiss country-led initiative to improve the effectiveness of the Basel Convention.

5 Art. 2.8, Basel Convention.

ESM includes the entire waste management hierarchy, including waste prevention, minimization, reuse, recycling, recovery and final disposal.[6] Due to the differing country capacities, it has been difficult to standardize ESM. In this regard, a framework document on ESM (ESM Framework) has been developed, and it encourages countries to promote:

a. Prevention and minimization;
b. Sustainable use of resources in both production and consumption;
c. Recognition of waste as a resource (where appropriate);
d. An integrated life-cycle approach; and
e. Innovation in the production and delivery of services.[7]

In order to ensure that wastes are managed in an environmentally sound manner, the ESM Framework elaborates that it is necessary for countries to:

a. Have a clear picture as to which wastes are arising and the quantities that need to be managed;
b. Understand how these need to be managed to ensure ESM (which will vary according to the waste stream);
c. Have sufficient capacity to manage all waste streams in an environmentally sound manner;
d. Ensure that those with a role in the generation and management of wastes (including governments, generators, carriers, dealers, brokers and those managing facilities) understand what they need to do to ensure wastes are managed in an environmentally sound manner;
e. Have a system that incentivizes compliance;
f. Monitor the effectiveness of the system; and
g. Ensure that the transboundary movement of wastes is in compliance with the Basel Convention.

---

[6] Framework for the ESM of waste.

[7] Framework, p. 9

The Policy Paper looks at 3 critical elements of the ESM Framework as it pertains to mercury and mercury compounds: (1) sources of mercury and mercury emissions in the Philippines; (2) means of managing the mercury waste streams; and (3) assessment of policy and technical options available to the country.

CHAPTER III: SOURCES OF HG AND ESTIMATED QUANTITY IN THE PHILIPPINES[8]

Understanding the source and distribution of Hg is important in assessing the ESM policy options for Hg storage and its cost implications. The sources of Hg contributing to its release in the biosphere can be grouped into four categories:

1. Natural sources, or releases due to natural mobilization of naturally-occurring Hg from the Earth's crust (i.e., volcanic activity, weathering of rocks);
2.)Current anthropogenic releases from the mobilization of Hg impurities in raw materials such as fossil fuels. The release of Hg through the combustion of coal in power production is deemed as the single largest global source of atmospheric Hg emissions;

[8] BAN Toxics, 2009.

3. Current anthropogenic releases resulting from Hg used intentionally in products and processes due to releases during manufacturing, disposal or incineration of spent products. Hg in thermometers, batteries and other products that have become wastes and discarded into the waste stream are examples of these sources; and,
4. Remobilization of historic anthropogenic Hg releases previously deposited in soils, sediments, water bodies, landfills and waste/ tailings piles.

Of the four categories, the releases due to natural mobilization of Hg and remobilization of anthropogenic Hg previously deposited in soils, sediments and water bodies are not well understood and largely beyond human control. Thus, are not covered in this Policy Paper.

In order to standardize the methodology and database of the Hg inventory or sources, UNEP has developed a toolkit for identification and quantification of Hg releases ("Mercury Toolkit"). The study is based on the Level-1 Toolkit for Identification and Quantification of Hg Releases provided by UNEP, which uses a spreadsheet with default input factors/ distribution factors, and provides a general overview of the Hg inventory. The results of parallel projects conducted by BAN Toxics (BT) on household waste (HHW) generation in three Philippine cities and Hg trade in the country were also used in this study.

3.1 SUMMARY OF HG SOURCES AND EMISSIONS IN THE PHILIPPINES

Evident in the results from the UNEP toolkit inventory are the significant contributions of the use of Hg in artisanal and small-scale gold mining operations, the release of Hg as a by-product in the combustion of coal for power generation, and the application of Hg in a wide array of industries such as cement, lime, pulp and paper production, measuring devices, electric and electronic equipment, among others.

TABLE 2. RESULTS OF THE UNEP HG TOOLKIT.

Main Source Category	Total Hg Output (kg Hg/year)						
	Air	Water	Land	Impurity in products	General waste	Treatment disposal	TOTAL
Extraction and use of fuels/ energy sources	31,886	0	0	0	53.90		**31,940**
Primary (virgin) metal production	39,507	13,171	13,197	2,610	0	2,610	**71,095**
Production of other minerals and materials with Hg impurities	241	0	0	241	0	0	**482**
Intentional use of Hg in industrial processes	105	11	200	53	0	158	**527**
Consumer products with intentional use of Hg	943	20	1,120	0	1,082	0	**3,165**
Other intentional product/ process use	7,064	1,331	1,326	266	17,179	532	**27,698**
Production of recycled metals (secondary) metal production	0	0	0	0	0	0	**0**
Waste incineration	0	0	0	0	0	0	**0**
Waste deposition/ landfilling and waste water treatment	48	1,161	595	0	0	0	**1,804**
Crematoria and cemeteries	38	0	344	0	0	0	**382**
TOTAL	**78,628**	**15,694**	**16,782**	**3,170**	**18,314**	**3,300**	**137,093**

Artisanal and Small-scale Gold Mining[9]

Artisanal and small-scale gold mining (ASGM) refers to mining activities that use rudimentary techniques in extracting minerals, most commonly gold, by miners working in small sized operations.

Small-scale gold mining has been practiced in the Philippines since the 3rd Century. During this period, people from Cordillera, Camarines Norte and Masbate mined the precious metal to be used as personal adornments, hunting and farm implements and as a barter commodity which they traded with Chinese merchants.[10]

Artisanal and small-scale gold mining plays an important economic role in the Philippines, especially in the rural areas. It provides significant source of livelihood to about 350,000 miners and their families, and indirectly supports the livelihood of around two million people. The small-scale mining sector is known to have contributed 40 to 50 percent of the country's total gold production from 1990 to 1999.

For the last five years, the sector has produced an average of 30 tons equivalent to about 80 percent of the country's annual gold supply, which placed the Philippines as one of the top twenty gold-producing countries in the world. Despite its economic contribution to the country, it is saddled with major environmental problems— among them is the use of mercury.

According to the DENR inventory, this sector contributes around 71 tons of mercury per annum into the environment. This figure may be considered conservative as other studies have shown that more than 71 tons of mercury have been used. In 2007, an investigation conducted

9 This section is lifted from BAN Toxics'report, entitled, "*The Price of Gold: Mercury Use in Artisanal and Small-scale Gold Mining in the Philippines*", published in 2010.

10 Rovillos, et. al., 2003.

by the Geological Survey of Denmark and Greenland and the Maximo T. Kalaw Institute for Sustainable Development approximates five (5) tons of annual mercury emission from small-scale mining communities in Zamboanga del Norte and Camarines Norte. According to the assessment by the Department of Health (DOH) submitted to UNEP in 2001, small-scale gold mining in Northern Mindanao alone emits 140 tons of mercury annually. Studies also show that in the early 90s, the small-scale gold mining sector accounted for 25 tons of mercury release annually while another study reveals that between 1986 to 1988, around 140 tons of mercury was released into the environment from 53 mining communities.

Mercury Source for ASGM

Hg mining in the Philippines ceased in 1976. All of the country's Hg supply is from imported sources. Hg is routinely traded multiple times before final consumption. Statistics reveal that annual global trade of Hg and its compounds are most likely in the range of USD 131 million in value.[11]

The 2011 global Hg trade map released by the Geneva-based ZOÏ Environmental Network identified the Philippines as one of the main Hg trading centers in Asia, together with Indonesia, Thailand, China, Myanmar, Vietnam, North and South Korea. Most of the known Hg supply or imports come from the US, Spain, and Germany. Current data however points to a re-alignment in trading hubs brought upon by the Minamata Convention, with Singapore and Hong Kong becoming major Hg trading hubs in the region and for the world.

11 This section is lifted from BAN Toxics'report, entitled, *"Mercury Trade in the Philippines"*, published in 2012.

Based on COMTRADE statistics, the country imported over **301,711 kilograms** of Hg commodities from 2000 to 2012.[12]

TABLE 3. UN COMTRADE DATA ON HG (CODE 280540) IMPORTATION IN THE PHILIPPINES.

Year	Trade Value (USD)	Quantity (kgs)
2012	118,362.00	5,743
2011	394,497.00	6,750
2010	259,060.00	33,497
2009	1,086,255.00	96,276
2008	50,099.00	7,656
2007	636,005.00	31,792
2006	390,502.00	33,098
2005	416,098.00	21,446
2004	58,491.00	9,485
2003	26,955.00	5,719
2002	1,331.00	123
2001	48,492.00	20,072
2000	82,134.00	30,054
	3,568,281.00	**301,711**

12 Trade values for commodity code 280540. No data were found for 2013 and 2014. For trade data on other mercury commodity, see http://comtrade.un.org/db/ce/ceSearch.aspx

The growing demand for Hg, mostly from ASGM and products, resulted in regular importation of Hg into the Philippines. Some countries do not fully report their Hg exports to the UN Statistics Division (UNSD) thereby limiting the data available. The COMTRADE data, however, may still be considered as a minimum representation of the global imports of Hg.

The rampant use of Hg in the ASGM sector in the Philippines has resulted in high Hg emissions to the environment. Hg monitoring in several provinces in the Philippines have shown that detrimental levels of Hg are present in ASGM communities.[13]

Left unmanaged the continued use of Hg in products and in ASGM presents two major emission sources that can greatly impact public health and environment in the Philippines.

TABLE 4. HG LEVELS IN AMBIENT AIR IN SEVERAL ASGM AREAS.

ASGM Area	Date	Hg in Ambient Air		
		MIN	AVE	MAX
Gaang, Balbalan, Kalinga	07/06/2013	91.9	2,033.1	26,487.8
Jose Panganiban, Camarines Nore	12/04/2012	77.9	2,851.1	27,464.9
Syndicate, Aroroy, Masbate	03/03/2013	<20	1,462.4	6,812
Mt. Diwata, Monkayo, Compostella Valley	05/18/2013	6,178.1	16,272.3	>30,000

3.3 HG IN POWER GENERATION (COAL FIRED POWER PLANTS)

Coal, natural gas, and other fossil fuels contain mercury as a natural impurity and a significant amount of mercury is released into the atmosphere and environment from coal-burning power plants.[14] Burning

13 BAN Toxics, 2014.

14 Zero Mercury Working Group, Briefing Paper on Emissions, available at: www.zmwg.org

fossil fuels is the major anthropogenic source of mercury air emissions worldwide, and this is no different in the Philippines.

In 2012, the Philippine Department of Energy reported that power generation in the Philippines largely comes from coal, at nearly 38.76 percent. With 13 operational coal-fired power plants, the government plans to bring another 45 online.

Coal used for the coal-fired power plants in the Philippines are either imported or sourced locally (in Semirara).

3.4 HG IN CONSUMER PRODUCTS

The use of Hg in consumer products further established that individual households contribute to the burgeoning Hg problem as well. This is reflected in the results of the inventory conducted in 2012 by BT in partnership with A2D Project-Research Group for Alternatives to Development in the cities of Cebu, Davao and Marikina. Improper storage and/or disposal of household wastes (i.e., electronics and electrical appliances, personal and healthcare devices, home improvement products) can contribute upwards 4.9 to 137 kg of Hg per year.[153,16]

TABLE 5. TOTAL HG OUTPUT FROM HHW IN 3 PHILIPPINE CITIES.

	Total Number of Households	Total Hg Output (kg Hg/year)
Cebu City		137
Davao City	179,774	50
Marikina City	105,351	4.9*

**from electronics and electrical appliances only*

[15] A2D Research Group for Alternatives to Development, 2012a.

[16] A2D Research Group for Alternatives to Development, 2012b.

The study estimated the total annual amount of Hg generated and released to the environment by the products inventoried. This was done by using the amount of total waste generated per household per year and expressing it in terms of mg Hg per kg of waste (parts per million, ppm). For Cebu City, the site with the largest sampling size (1,710 respondents), the total Hg generated as waste was computed at 0.33 kg annually, or 1.07 ppm of the total HHW waste. Given that waste generation in the Philippines averages over 500,000 metric tons per year, this can be extrapolated to around 533 kg of waste Hg generated from household products alone.

CHAPTER IV: LEGAL CONSIDERATIONS FOR HG STORAGE AND DISPOSAL

This section reviews the legal regimes that govern the environmentally sound storage and disposal of Hg that can impact Philippine policy. There are three major prevailing legal regimes: the Minamata Convention on Mercury (Convention) and the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal (Basel) at the international level; and Republic Act 6969 (RA 6969) at the national level.

4.1 MINAMATA CONVENTION ON HG

The Convention is a multilateral environmental agreement that specifically addresses human activities which contribute to widespread Hg pollution. It is a major international development in the global control of chemicals and wastes, and is the latest effort of the international community on the issue.

The Convention takes its name after the city that hosted its adoption, as well as the site that experienced severe, decades-long incidence of Hg poisoning.

On 10 October 2013, the Philippine government signed the Convention. Although, the country has not yet ratified the Convention, the act of signing it obligates the country to act in good faith not to contravene the Convention as it takes steps to ratify it.[17]

The Convention, once enforced, will require party nations to[18]:

1. Reduce, and where feasible, eliminate the use and release of Hg from ASGM;
2. Control Hg air emissions from coal-fired power plants, coal-fired industrial boilers, certain non-ferrous metals production operations, waste incineration and cement production;
3. Phase-out or take measures to reduce Hg use in certain products such as batteries, switches, lights, cosmetics, pesticides and measuring devices, and create initiatives to reduce the use of Hg in dental amalgam;
4. In addition, the Convention addresses the supply and trade of Hg, safer storage and disposal, and strategies to address contaminated sites; and
5. The Convention includes provisions for technical assistance, information exchange, public awareness and research and monitoring. It also requires Parties to report on measures taken to implement certain provisions.

The Convention has specific obligations on storage and disposal of mercury. Article 10 of the Convention deals with the environmentally sound interim storage of mercury other than mercury waste, and Article 11 covers Hg-wastes. The following discussion elaborates on the treatment of these two issues under the Convention.

---

17 Article 18.a, Vienna Convention on the Law of Treaties, available at: https://treaties.un.org/doc/Publication/UNTS/Volume%201155/volume-1155-I-18232-English.pdf. Philippines ratified 15 November 1972

18 United States Environmental Protection Agency, 2013.

4.1.1 ENVIRONMENTALLY SOUND INTERIM STORAGE

Article 10 of the Convention applies to the environmentally sound interim storage of mercury and mercury compounds. The article makes two critical distinctions on its scope:

a. It applies only to non-waste mercury and mercury compounds; and
b. It is limited to "interim" or temporary storage since this is storage associated with an allowed use[19] under the Convention. Article 10 does not cover long-term or permanent storage.

Mercury and mercury compounds covered under Article 10 are:

a. References to "mercury" include mixtures of mercury with other substances, including alloys of mercury, with a mercury concentration of at least 95 per cent by weight; and
b. "Mercury compounds" means mercury (I) chloride (known also as calomel), mercury (II) oxide, mercury (II) sulphate, mercury (II) nitrate, cinnabar and mercury sulphide. [20]

The definition does not generally cover products that contain mercury, unless the product conforms to the Article 10 definition of mercury and mercury compounds. An example of a mercury product that falls under Article 10 is elemental mercury used in ASGM.

The Convention has two distinct obligations for countries on interim storage:

1. Take measures to ensure that interim storage is undertaken in an environmentally sound manner. (Article 10.2)

---

[19] Article 2.k of the Minamata Convention states that, "Use allowed" means any use by a Party of mercury or mercury compouds consistent with this Convention, including, but not limited to, uses consistent with Articles 3 (Supply and Trade), 4 (Products), 5 (Processes), 6 (Exemptions Available to a Party Upon Request) and 7 (Artisanal and Small-scale Gold Mining).

[20] Article 10 follows the definitions of mercury and mercury compounds under Arts. 3.1. a and b respectively.

2. Cooperate with each other and with intergovernmental organizations and other entities, such as NGOs, academe, etc. to enhance capacity building for environmentally sound interim storage. (Article 10.4)

Article 10 of the Convention does not define "environmentally sound interim storage". Instead the Convention instructs the Conference of Parties (COP) to develop and adopt guidelines on "environmentally sound interim storage". In this regard, the COP has the prerogative to determine the extent of the issues to be covered. The COP may address issues such as: quantity limits, defining what an appropriate interim period of storage should be, and best practices for handling and transportation.

The COP can also take into account guidelines developed under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention) and other relevant guidelines. (Article 10.2)

Notwithstanding the absence of the COP guidance on interim storage at this point, the existing provisions under Article 10 are sufficiently instructive as to what can and needs to be addressed in the Philippines.

As a practical matter for the Philippines, the interim storage rules and guidance will primarily affect facilities supplying or trading mercury or mercury compounds, notably traders of dental amalgam, dental clinics and hospitals, and mercury suppliers such as pawnshops, especially those near or around ASGM areas.[21]

It is important to note that the mercury and mercury compounds in "interim" storage under Article 10 may become "wastes" at a later point in time. In this instance, Article 11 will apply when the mercury or mercury compounds become wastes. *See succeeding discussion*.

4.1.2 ENVIRONMENTALLY SOUND MANAGEMENT OF MERCURY WASTES

Article 11 of the Convention applies to Hg wastes. Hg wastes can come in a variety of forms, depending upon the source— from sludges and spent catalysts to end-of-life products containing mercury and contaminated residuals, not to mention Hg waste and Hg compounds as well.

Unlike Article 10 that has a narrow definition of mercury, Hg-wastes under Article 11 is quite broad. The Convention defines Hg-wastes to mean substances or objects consisting, containing, or contaminated with mercury or mercury compounds in a quantity above the relevant thresholds that are:

- Disposed of;
- Intended to be disposed of; or
- Required to be disposed of by the provisions of national law or this Convention. (Article 11.2)

Further, under Article 11 the term “mercury compounds” is defined to mean any substance containing Hg and other chemicals separable only through chemical reactions.[22] The definition of Hg and Hg compounds under Article 11 broadens its application over an array of substances and objects beyond the Hg and Hg compounds covered in Article 10.[23] In this instance end-of-life products, contaminated materials, etc. not covered for interim storage are covered under Article 11.

The coverage of Article 11 presents a distinct challenge for countries in meeting the obligations required under the Convention for Hg-wastes. Article 11 is also closely linked with the Basel Convention and is mutually supportive of the Basel Convention and complementary in addressing the mercury waste issue.

---

21 In 2013, Executive Order No. 29 was passed, which prohibits mercury use in ASGM. Although the EO prohibits the use of mercury in ASGM, Administrative Order No. 38-1997, still allows under certain conditions the importation, manufacture, and distribution of mercury in the country. Thus, the applicability of “interim” storage requirements on traders applies, until the aforementioned Order is either amended or modified.

22 Article 2.e

The relevant definitions of waste-related terms under Article 11 are the same definitions under the Basel Convention (Article 11.1). Thus, the term "disposal" under the Minamata Convention has the same definition as the Basel Convention's definition of disposal. The Basel Convention defines disposal "*as any operation specified in Annex IV*". Annex IV of the Basel Convention enumerates various disposal operations (*See Annex 5 for details*). Article 11 of the Convention requires country parties to take appropriate measures so that mercury waste is:

a. Managed in an environmentally sound manner, based on guidelines developed under the Basel Convention and those adopted by the COP.
b. Only recovered, recycled, reclaimed or directly re-used for a use allowed to a Party under the Convention; or for environmentally sound disposal.
c. Not transported across international boundaries except for environmentally sound disposal.[24]

The Convention also mandates parties to take appropriate measures to cooperate with each other and with intergovernmental organizations and other entities to develop and maintain global, regional and national capacity for the management of Hg-wastes in an environmentally sound manner.

a. ESM of Mercury Waste

While both the Basel and Minamata Conventions address Hg-wastes, they can be expected to bring different strengths to the environmentally sound management of Hg-wastes. The Minamata Convention is expected to have a more direct impact on domestic waste policies because of the specific obligations on domestic level implementation of ESM

[23] Although the Article 11 definition covers mercury wastes broadly, there are exceptions. Article 11 does not cover overburden, waste rock and tailing from mining, except from primary mercury mining, unless they contain mercury or mercury compounds above thresholds defined by the Conference of Parties. (Article 11.2)

[24] Article 11.3, Minamata Convention.

(depending upon how the anticipated new annex is drafted, *see discussion below*). On the issue of transboundary movement of Hg-wastes, the Basel Convention is the prevailing global regime,[25] thus, the Minamata Convention will follow the Basel rules on the issue (for a discussion of the Basel Convention, see following section).

A key element to the ESM of mercury waste lies in the Article 11 mandate for the COP to develop additional requirements for ESM on mercury waste. As the COP has not yet been constituted as of this writing, it is difficult to predict what the additional requirements of ESM will be. However, Article 11 provides some guidance in developing additional ESM requirements, particularly for the COP to take into account the Parties' waste management regulations and programmes. In this case most waste management regulations and programmes are guided by the Basel ESM guidelines. Thus, to augur possible requirements for mercury waste, the Basel ESM guidelines will be a good starting point.[26]

The impact of this rather circuitous ESM route is clear, the requirements that will be developed shall be adopted as an additional annex to the Convention. This makes the ESM requirements binding on countries who will be Parties to the Convention.

b. Recovered, recycled, reclaimed or directly re-used for a use allowed under the Convention, or for environmentally sound disposal.

---

25 Not to transport mercury wastes across international boundaries, except for environmentally sound disposal in conformity with Article 11 and the Basel Convention, and except where Basel does not apply. (Article 11.3.c).

26 Another key area in the ESM of mercury waste under the Convention is the development of "relevant threshold" for mercury waste, though this is still undefined. The COP will define the threshold in collaboration with the Basel Convention (Article 11.2), but no time limit has been set for this task.

The Convention seeks to reduce global mercury pollution through complementary measures to minimize mercury supply and demand. Controlling how mercury derived from waste is used is one mechanism to minimize the global mercury supply, by requiring controls to prevent the diversion of this mercury to illegal uses. Thus, Article 11 has specific limits on recovered, recycled, reclaimed, or directly re-used mercury, and for environmentally sound disposal.

Note that as the Convention follows the Basel definition of disposal there are 2 lists of disposal and recycling operations under Basel that can apply. Considering that the ESM on mercury waste has not yet been developed under the Convention, a country may wish to consider the draft technical guidelines in development under Basel to form an idea of what the ESM of mercury waste would be.

Similar to Article 10, Article 11 is somewhat limited at this point, because it awaits further elaboration of the COP on critical items such as ESM on Hg-wastes, relevant thresholds and other issues. In spite of this however, as with Article 10, there is enough structure within Article 11 that helps form the basis for a comprehensive policy on mercury waste ESM. The reference to Basel for both definitions and guidance is instrumental in the formation for domestic policy mercury waste management.

4.2 BASEL CONVENTION [27]

The Basel Convention was initiated in response to the numerous international scandals regarding hazardous waste trafficking in the 1980s. Negotiations on the Convention started in 1987 and concluded on March

27 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Mar. 22, 1989, 1673 U.N.T.S. 57, available at https://treaties.un.org/doc/Treaties/1992/05/19920505%2012-51%20PM/Ch_XXVII_03p.pdf.

22, 1989 with 35 states signing the Convention in Basel, Switzerland.[28] To date, 181 countries have ratified the treaty. The Philippines became a party to the Basel Convention on 21 October 1971.

The Basel Convention seeks to minimize the generation[29] and exportation of hazardous wastes.[30] It also aims to promote national self-sufficiency in hazardous waste management by placing responsibility on toxic waste generators to dispose of the wastes as close to area of generation as possible.[31] In its efforts at minimizing waste exports, the Basel Convention also restricts traffic in toxic wastes by applying the "Prior Informed Consent" or PIC procedure,[32] and prohibiting waste trade with countries not parties to the Basel Convention.[33] Shipments made without the proper notification and consent of the importing Party or when the shipment does not conform in a material way with the shipping documents, are deemed illegal.[34] Illegal traffic under the Basel Convention is a criminal act.[35]

The strength of the Basel Convention is in its binding obligations on waste traffic at the international level through the PIC procedure. At the national level, the Basel Convention's main tool is the issuance of ESM guidelines on specific wastes. These will be discussed later in this section.

a. Hazardous Waste under Basel

The Basel Convention only applies to toxic and other wastes.[36] Waste is defined by the Convention as "any substances or objects which are

---

28 For a full list of signatories, see Parties to the Basel Convention, BASEL CONVENTION, http://www.basel.int/Countries/StatusofRatifications/Parties/tabid/1290/ Default.aspx (last visited Feb. 17, 2014)

29 Art. 4.2.a, Basel Convention.

30 Art. 4.2.d., Basel Convention.

31 Arts. 4.2.b and 4.10, Basel Convention.

32 See Art. 6, Basel Convention (establishing prior informed consent requirement).

33 Art. 4.5, Basel Convention.

34 Art. 9.1, Basel Convention.

35 Art. 4.3, Basel Convention.

36 Article 1, Basel Convention.

disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law."[37] The Basel Convention definition of wastes is unique because it defines it without basing it on economic value or use of the substance and places emphasis on the fact of disposal or intent to dispose of the substance.

"Hazardous wastes" are defined under the Basel Convention as certain wastes and waste streams which are:

i. Listed in any of the categories in Annex I, unless they do not possess any of the hazardous characteristics defined in Annex III to the Convention;
ii. Not covered under the above-mentioned description, but are defined as or considered to be hazardous wastes under the domestic legislation of the party of export, import or transit.[38]

The wastes regulated by the Convention are further specified under the lists of wastes contained in Annexes VIII (waste) and IX (non-waste). Thus, under Basel, a waste is considered hazardous if it is listed in Annex I and VIII, and must possess some hazardous characteristics elaborated under Annex III.

Wastes having constituents of mercury or mercury compounds are defined as hazardous wastes under the Basel Convention and are covered in category Y29 of Annex I and categories A1010, A1030 and A1180 of Annex VIII. Since elemental mercury and mercury-containing or contaminated wastes are categorized as hazardous wastes under the Basel Convention, the improper management of Hg-wastes can lead to emissions or releases of mercury which is a concern under both treaties.

---

[37] Article 2.1, Basel Convention.

[38] Article 1.1, Basel Convention.

b. Disposal and Storage under the Basel Convention

Disposal is defined as any operation found in Annex IV of the Basel Convention. The list of disposal operations is broad and includes recycling, reclamation, and other processes.

Storage is also considered a disposal operation under Section A of Annex IV of the Basel Convention, with two distinct forms that are mentioned:

i. D12 – Permanent storage (e.g. emplacement of containers in a mine); and
ii. D15 – storage pending any of the operations in Section A.

Considering the above disposal operations, storage under Article 11 can be easily confused with storage under Article 10. A simple way to distinguish the two, in the absence of specific guidelines or requirements, is to: first, determine whether the covered mercury or mercury compounds is product or waste; and second, to assess its destination, whether for disposal or an allowed use. Mercury products will most likely be destined to an allowed use destination than disposal. In such a case, the storage requirements for these types of mercury fall under Article 10 of the Minamata Convention and not under Article 11 or the Basel Convention.

c. Transboundary Movement

Any transboundary movement of Hg-wastes will be covered under the jurisdiction of the Basel Convention.[39] For the Philippines, Republic Act 6969 sets forth the Basel Convention rules and is discussed in the following section.

d. Basel Technical Guidelines

Technical guidelines are developed under the Basel Convention for the ESM of the wastes falling under its jurisdiction. The Basel technical

[39] Article 11.3.c. Exports to a country not party to Basel or Minamata Convention, requires the Minamata or Basel Party to take into account relevant rules, standards and guidelines before allowing such export.

guidelines are not binding on parties, and only recommendatory in nature. This is a limitation of the Basel Convention, which the Minamata Convention complements under Article 11.

Notwithstanding this limitation technical guidelines, however, provide the foundation upon which countries can develop a standard that is not less, or at a minimum, meets what is environmentally sound as required by the Basel Convention.

The Basel Convention technical guidelines for the environmentally sound management of wastes consisting of elemental mercury and wastes containing or contaminated with mercury was adopted by the Basel Convention COP by its decision BC-10/7 and is now currently being updated.[40] This document discusses the best available techniques and best environmental practices for Hg management, specifically on: [41]

- Hg-waste prevention and minimization at source;
- Identification and inventory;
- Minimum guidelines on handling, collection, packaging, labeling, interim storage and transportation of Hg-waste;
- Treatment of Hg-waste and recovery of Hg;
- Remediation of contaminated sites;
- Health and safety;
- Emergency response; and,
- Public awareness and participation.

4.3 PHILIPPINE LAWS AND THEIR IMPLEMENTATION[42]

The 1987 Constitution of the Philippines outlines the state's policies on public health and environment that forms the basis for environmental regulations in the country. The Constitution calls for the government to

40 A final draft will is expected to be presented at the Conference of the Parties by May 2015.
41 United Nations Environment Program, 2011.
42 BAN Toxics, 2009.

protect and advance the right to health of and the right of the people to a balanced and healthful ecology. This fundamental policy gave rise to various environmental enactments on the issue of toxic wastes.

RA 6969, otherwise known as the "*Philippine Toxic Substances, Hazardous and Nuclear Wastes Control Act*" and its ensuing regulations, is the cornerstone of the current Hg legislation in the Philippines. It was designed to respond to the heightened problems associated with the dumping of toxic chemicals and hazardous wastes during the 1980s. To address these concerns, the law covered a wide range of activities such as importation, manufacture, processing, handling, storage, transportation, sale, distribution, use and disposal.

In 1992, the Department of Environment and Natural Resources (DENR), tasked to enforce RA 6969, released AO No. 29 Series of 1992, known as the Implementing Rules and Regulations (IRR) of RA 6969. The IRR expands on the provisions of the law and clarified certain processes and responsibilities on chemicals, hazardous and nuclear wastes. The IRR clarified the scope of the law by providing a list of wastes classified as hazardous under RA 6969 and subject to its control. Hg and Hg compounds (D407) were identified in the list, clearly placing these substances under the ambit of RA 6969.

The IRR also elaborated on several policy points on hazardous wastes, four of which are of particular relevance to the issue of ESM of Hg-waste:

1. In the management hierarchy of hazardous wastes, priority should be on the minimization of its generation, followed by its recycling, treatment to render it harmless, and landfilling of hazardous wastes;
2. Waste generators are responsible for the proper management and disposal of their hazardous wastes;
3. Waste generators shall bear the cost for the proper treatment, storage and disposal of their hazardous waste; and,
4. Ownership of the hazardous waste remains with the generator until the hazardous waste is certified to have been treated, recycled, reprocessed or disposed of by the designated waste treater.

Note however, that the IRR exempted wastes from domestic premises and households from its coverage. In 1997, the DENR further issued rules on the control of Hg, particularly AO No. 38 Series of 1997, or the Chemical Control Order (CCO) for Hg and Hg compounds. The CCO created additional requirements for entities dealing with Hg or Hg containing compounds, such as importers, manufacturers, distributors, transporters and treaters. Moreover, under the CCO, the use of Hg and Hg compounds shall be strictly limited to the following end-users:

- Chlor-alkali plants
- Mining and metallurgical industries
- Electrical apparatus (lamps, arc rectifiers, battery cells and others)
- Industrial and control instruments
- Pharmaceutical
- Paint manufacturing
- Pulp and paper manufacturing
- Dental amalgam
- Industrial catalyst
- Pesticides (fungicide) production or formulation

These entities must comply with the CCO's guidelines on the:

- Acquisition of required permits from the Environmental Management Bureau (EMB) of the DENR such as license to use and purchase Hg, importation clearance, license for treating, transporting or disposing Hg or Hg compounds, and a Hg management plan;
- Submission of quarterly reports of activities and transactions to the EMB and submission of records retained by the premises to inspection by any authorized government officer;
- Proper handling of Hg and Hg compounds, including storage, labeling, packaging, pre-transport, and transport (shipping) based on the standards adopted by the Department of Transportation and Communication (DOTC); and,
- Development of training and contingency programs for all workers handling Hg-bearing or Hg-contaminated wastes to avoid exposure, and

requirements for the proper management of the chemicals and wastes in an emergency, among others.

The CCO also made it explicit that no Hg-bearing wastes will be discharged without prior DENR approval. Lastly, the CCO linked the liability of the importer and distributor of Hg and Hg compounds with the end-users in cases of injury, damage to public health and the environment.

In August 11, 2008, DOH issued AO 21 Series of 2008, or the "*Gradual Phase-out of Hg in all Philippine Healthcare Facilities and Institutions*," making the country a leader in the Southeast Asian region on the issue of Hg. The AO mandated all hospitals to:

- Discontinue the distribution of Hg thermometers to patients through distribution of hospital admission/ discharge kits;
- Follow guidelines for the gradual phase-out of Hg within two years;
- Conduct an inventory of all Hg-containing devices and corresponding Hg minimization program, especially for new healthcare facilities applying for a license to operate; and,
- Create a Hg minimization program for all healthcare facilities other than hospitals.

This AO was subsequently reiterated through MC No. 160 Series of 2010 by DepEd, which imposed school clinics and laboratories to phase-out the use of Hg-containing devices.[43]

Hg releases through the ASGM sector is one of the pressing issues addressed by the National Strategic Plan (NSP) on ASGM finalized on March 2011. The NSP recognizes the vital contribution of the sector to rural economies in providing livelihood to local communities. However,

43 Former Secretary Jesse Robredo of DILG also released MC No. 140 in the same year, required local government-run healthcare facilities to follow the DOH directive and task provincial health officers (PHO) to be vigilant in its implementation.

the sector's continued use of Hg and other toxic chemicals, as well as other social, institutional, financial and regulatory issues was also highlighted.

One of the objectives of the NSP is the reduction of Hg use in the sector to 90 percent by 2021, by developing and implementing coherent national policies and regulations that promote the sustainability of ASGM and its allied sectors. Initially, laws and regulations addressing Hg use in ASGM have been inadequate, with RA 7076 (the *People's Small-scale Mining Act*) having no explicit prohibition on the use of the toxic substance. Furthermore, the CCO on Hg permitted, among many others, the use of Hg in mining and metallurgical industries. The gap, however, was addressed by Executive Order 79 (EO 79) (*Institutionalizing and Implementing Reforms in the Philippine Mining Sector providing Policies and Guidelines to ensure Environmental Protection and Responsible Mining in the Utilization of Mineral Resources*). Section 11(E) of the EO specifically prohibits the use of Hg in ASGM.

The proactive stance taken by the respective departments (DENR, DOH, DepEd and DILG), as well as the national government assure that the amount of Hg cycling in the Philippines is diminished and ultimately eliminated. However, with these phase-outs comes the responsibility of appropriate storage and disposal for the ensuing Hg and Hg-containing wastes.

A glaring incident that illustrates the urgency of a final disposal facility for Hg was the Fabella hospital Hg spill on 8 August 2013.1 Fabella Memorial Hospital is a government-owned maternity hospital known as a "baby factory" due to the immense number of women from lower-income brackets who go there to give birth.

Fabella was one of the health facilities that discontinued the use of Hg-containing medical devices after the DOH phase-out in 2008. It was not clear, however, why a maternity hospital would have in storage a large amount of Hg dental amalgam. Several patients in the pediatric ward were transferred as a precautionary measure due to the unacceptable levels of Hg shown in the initial assessment in and around the storage room. The stop-gap measure taken by the hospitals is a stinging example of the current problem faced by local generators in trying to do the right thing when government action on final disposal is lagging behind. The interim storage is unsustainable in the long-run due to security and safety concerns.

The implementation of EO 79 in ASGM communities also poses a challenge for storage and its ensuing security issues for local governments. For instance, the province of Romblon has taken steps to eliminate Hg use in the province, when Governor Eduardo Firmalo ordered a moratorium in mining. A kilogram of Hg costs around PHP 7,500 in Davao City, and PHP 30,000 in Kalinga. Aside from the potential environmental hazards to the residents, confiscation of Hg and its eventual storage in a local area could attract criminal entities. Without proper guidelines on storage and their subsequent implementation at the local level, LGUs are left helpless in mitigating consequences with Hg storage.

Other laws that directly or indirectly regulate Hg use and emissions in the Philippines include:

- Presidential Decree No. 984 (Pollution Control Law of 1976)
- Presidential Decree No. 1586 (Environmental Impact Assessment System Law of 1978)
- Republic Act No. 8749 (Clean Air Act of 1998)
- Republic Act No. 9003 (Ecological Solid Waste Management Act of 2001)
- Republic Act No. 9275 (Clean Water Act of 2004)

CHAPTER V: POLICY CONSIDERATIONS FOR HG STORAGE AND DISPOSAL [45, 46, 47]

The objective of storing and disposing Hg under the Minamata Convention is to ensure that the sequestered Hg is not reintroduced into the environment. However, this has a set of unique challenges due to the special properties of Hg as a chemical.

This section will discuss the critical policy issues on the ESM of mercury and mercury compounds: prevention and minimization, interim storage, and end-of-life management.

---

45 Hidayat, 2012.
46 United Nations Environment Program, n.d.
47 United States Department of Energy, 2010.

5.1 PREVENTION AND MINIMIZATION

As discussed in Section 3.2, the Philippines no longer mine Hg. Hg present in the country entered through international trade. As a practical first step in addressing Hg-wastes, the Philippine government should look at addressing the influx of Hg and Hg compounds into the country. It should look at the following areas: use, products, and processes.

After understanding where Hg is used, which products have them, and possible processes that use it, the government can focus on looking at Hg-free alternatives.

The next area the government will need to consider is the Hg trade. In this instance, ratifying the Minamata Convention makes practical sense as the Convention creates trade controls on Hg.[48] In addition to trade controls, there are various other advantages the Convention provides to the Philippines on issues of trade, products, and processes, such as product phase out requirements, minimizing and dumping of unwanted mercury. It also protects the country from a WTO dispute against unfair trade practices through the creation of trade controls on mercury.[49]

Unless the government deals with Hg source and supply, by either preventing or controlling the influx of mercury into the country, the Philippines will face a difficult task in managing Hg-wastes and compounds. (*See Section 5.3).*

5.2 NON-WASTE MERCURY STORAGE CONSIDERATIONS

As discussed, Article 10 of the Minamata Convention covers the environmentally sound interim storage of non-waste Hg and Hg compounds and is limited to temporary or interim storage associated with an allowed use under the Convention. While the COP is yet to finalize this guidance, the UNDP

---

48 Art. 3, Minamata Convention.

49 *See*, Minamata Convention on Mercury, Ratification and Implementation Manual, David Lennett and Richard Gutierrez, 2014, available at www.bantoxics.org.

GEF Global Healthcare Waste Project can be used as a reference as it deals with the temporary storage of mercury (waste) on-site and/or intermediate storage in a centralized facility for a period not exceeding five years.[50]

The UNDP GEF's general guidelines are also based on the technical guidelines provided by the Basel Convention, and include basic requirements for siting and preparation, storage design requirements, labeling and signage. These requirements were included in the discussion on the technical requirements for storage in section 6.3.

Alternatively, the US EPA refers to the US DNSC's scheme of storing its elemental Hg reserves in an aboveground storage facility (discussed in section 5.3.2) as a means of managing "commodity-grade" mercury supplies.[51]

5.3 MERCURY WASTE END OF LIFE MANAGEMENT

Like any substance or waste, there are special facilities which have advanced recycling technologies designed for Hg-wastes, particularly elemental Hg. However, there is a potential for Hg to be released during the recycling process, because of its volatility even in room temperature. Recycled Hg could further escape once sold on the international commodities market and used in various applications, products and processes. In order to address growing concerns over Hg emissions from wastes, countries have initiated and developed environmentally-sound disposal facilities for Hg-wastes.

5.3.1 CRITERIA FOR ASSESSING MERCURY DISPOSAL FACILITIES

In determining which disposal facility options to pursue, UNEP Chemicals have enumerated certain factors to consider, which include the scope and size of the storage facility and the technical capacities and geologic conditions in building above or below ground.

---

50 United Nations Development Program, n.d.

51 The US EPA's roadmap for managing commodity-grade mercury supplies is part of archived documents that can be found at http://www.epa.gov/mercury/archive/roadmap/pdfs/III_Commodity-GradeHg.pdf

GEOGRAPHIC	TECHNICAL
• Regional [large] central facility/ facilities • National [small] facilities • Export to foreign countries	• Above ground, special engineered warehouses • Below ground storage in geological formations (mines, special rock formations, etc.)

Furthermore, several issues (enumerated below), must be recognized:

TABLE 6. CRITERIA FOR ASSESSING HG DISPOSAL FACILITIES COMPILED FROM VARIOUS SOURCE GUIDELINES.

Criteria	Checklist
Technological Considerations	☐ Definition of Hg to be stored (i.e. chemical species, concentration, volume/mass reduction ☐ Site-specific requirements: ○ Geology; ○ Hydrology ○ Frequency of occurrence of natural disasters; ○ Location and accessibility; ○ Decommissioning and long term surveillance ☐ Storage-specific requirements ○ Chemical-physical criteria for the waste itself (whether inert, immobilized or encapsulated) ○ Infrastructure capacity including building materials ○ Leaching prevention (to control evaporation, erosion, corrosion) ○ Monitoring systems (to control all Hg sequestered) ○ Long term documentation ☐ Transportation mode to the facility (including interim storage) ☐ Use of pretreatment of stabilization techniques to excess Hg to reduce volume/mass before storage
Public Health, Safety and Environmental Concerns	☐ Environmental impacts of facility construction ☐ Occurrence of associated risks to human health
Financial Implications	☐ Capital/investment costs ☐ Operations and maintenance costs ☐ Guidelines for financial arrangements (i.e. fee for service)
Social and Political Acceptability	☐ National: presence of legal framework, political stability and stakeholder participation ☐ International: presence of bilateral agreements for Hg owners on how to use and access storage facility, and possible structures for shared responsibility ☐ Availability of long term provisions for sustainability
Availability of Human Resources/ Manpower	☐ Availability of guidelines for salary grades of hazardous waste workers ☐ Training capacities on operations, maintenance, emergency and preparedness
Legal/ Regulatory Framework	☐ Presence of legislation such as those concerning import or export restrictions; ☐ Licensing procedures ☐ Waste acceptance rules ☐ Documentation and inventory procedures

1. **Scope of storage and disposal**. The type of surplus Hg or Hg-wastes subject to storage needs to be first identified. Since each country faces various sources of Hg of varying severity, determining the scope of what needs to be stored defines and narrows the scope.

   Under this category, the type of Hg to be stored is considered (whether it is elemental or ionic), as well as the volume and concentration. Chemical-physical characteristics of Hg should be accounted for in storage and may lead to the employment of pre-treatment/ stabilization techniques (whether inert, stabilized or encapsulated). In the end, the amount and the type of Hg-waste to be stored dictates the facility's specifications and subsequent financial implications and legal framework.

2. **Facility infrastructure**. There are two main issues to consider under this category: site and facility infrastructure. The location of the facility is crucial in determining the type of facility to build, whether above ground or below ground. The site's geology, hydrology, occurrence of natural disasters, accessibility, transport to the facility via road or rail, among others, need to be factored in.

   Some countries have looked into the issue on whether a centralized or multiple storage facilities are needed. Countries with Hg mine sites or Hg-contaminated sites focused on evaluating the comparative advantage between selecting existing contaminated sites (such as abandoned Hg mines) or a Hg-free site. Site sitting factors include:

Physical Setting and Location Factors	☐ Site size ☐ Compatibility with land use plans ☐ Seismic risk or predicted peak acceleration for an earthquake event expected to occur once in 2,500 years ☐ Nearest surface water feature ☐ Provisions for 100-year floodplain ☐ Presence of residential populations within 16-km (10-mile) radius ☐ Presence of vulnerable populations within 16-km (10-mile) radius (environmental justice)

3. **Legal framework**. This category tackles the presence of a comprehensive legal infrastructure able to support the operation of a disposal facility. Issues involving attribution of ownership of the waste and responsibility, licensing procedures, waste acceptance and documentation need to be clearly defined and delineated under law. Transition or transfer of responsibility, if any, is also a matter for consideration, particularly at what point do Hg generators remove themselves from any liability for the Hg to be stored.

   Some corollary points related to this category are the determination of the body or entity that will create, implement, monitor and evaluate standards and compliance.

4. **Public health and environmental concerns**. Twin concerns on the existing capacity to accurately map out possible environmental impacts and the evaluation of risks posed to human health both need to be fully understood. This includes:

Public Health and Environmental Consequences	☐ Land use and visual resources ☐ Geology and soils ☐ Air and water qualities ☐ Occupational and public health safety (risks to involved workers, noninvolved workers, and members of the public at the site) ☐ Transportation incidence o Accessibility from main road o Annual truck accident fatalities o Accessibility from rail system o Annual rail accident fatalities o Ecological impacts (i.e. risk to sediment dwelling biota and soil invertebrates in case of accidents with fires and dry deposition) o Presence of vulnerable populations at/or near probable transport accident site (environmental justice)

5. **Social and political acceptability**. There are salient and pressing issues that accompany facilities concerning the storage of hazardous wastes, such as public acceptance, site situation near environmentally-sensitive

areas or indigenous peoples' lands, access to courts for legal redress by facility workers and affected communities, role of non-government organizations (NGOs) and other stakeholders, impact on minorities and gender, and fundamental freedoms such as those of the press and speech, among many others. Countries that will embark on establishing disposal facilities need to embrace these issues together with the technological requirements.

6. **Financial implications**. Capitalization of the facility and the long term monitoring of the facility are two important financial aspects. The latter is as equally important as the first, for it concerns the responsibility for financially sustaining the operation of the disposal facility.

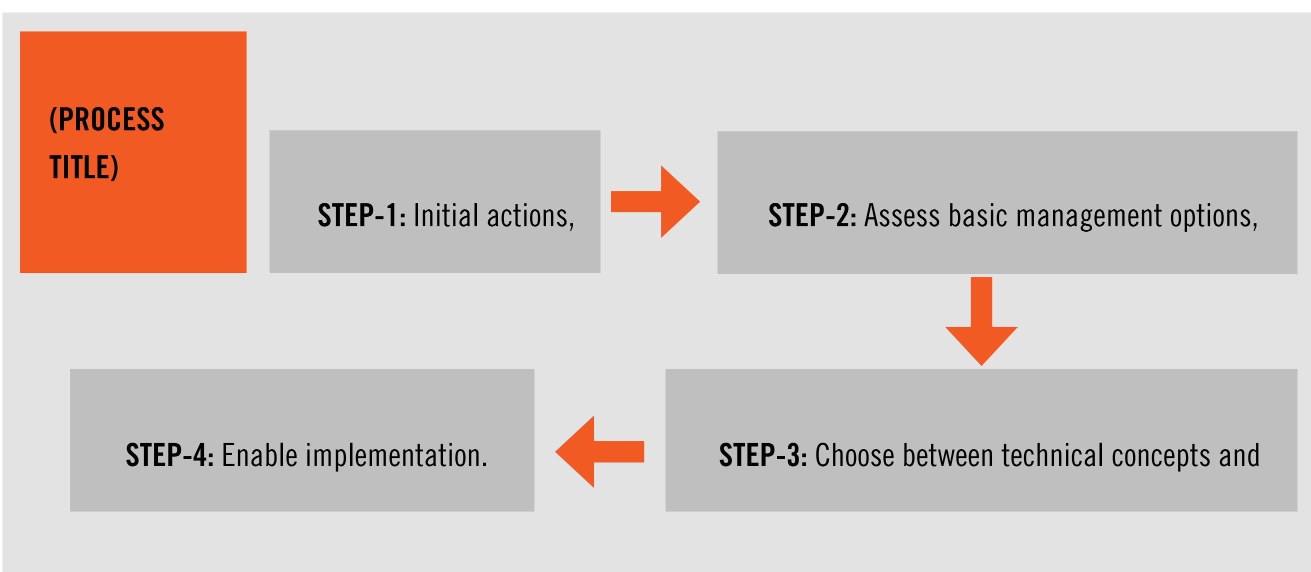
   At the core of this category is the source of funds for the facility, whether it will be a shared enterprise, borne by the facility operator, or subsidized by government. Feasibility for international aid or investments can also be explored. Thus, it is important to identify the long-term sustainability options needed by the facility.

Hagemann (2011), in Hidayat (2012), proposed that the environmentally-sound storage and disposal of excess Hg be conducted by adopting the principles originally developed by the International Atomic Energy Agency (IAEA) for nuclear waste management. These principles are:

- Protection of human health. Elemental Hg and Hg-waste shall be managed in such a way as to secure an acceptable level of protection for human health.
- Protection of the environment. Elemental Hg and Hg-waste shall be managed in such a way as to provide an acceptable level of protection of the environment.
- Protection beyond national borders. Elemental Hg and Hg-waste shall be managed in such a way as to assure that possible effects on human health and the environment beyond national borders will be taken into account.

- Protection of future generations. Elemental Hg and Hg-waste shall be managed in such a way that predicted impacts on the health of future generations will not be greater than relevant levels of impact that are acceptable today.
- Burdens on future generations. Elemental Hg and Hg-waste shall be managed in such a way that they will not impose undue burdens on future generations.
- National legal framework. Elemental Hg and Hg-waste shall be managed within an appropriate national legal framework, including clear allocation of responsibilities and provision for independent regulatory functions.
- Control of Hg-waste generation. Generation of Hg-waste shall be kept to the minimum practicable.
- Hg-waste generation and management interdependencies. Interdependencies among all steps in Hg-waste generation and management shall be appropriately taken into account.
- Safety of facilities. The safety of facilities for elemental Hg and Hg-waste management shall be appropriately assured during their lifetime.

The process of decision-making for the safe management of excess Hg would require a careful examination of the compliance of available technologies to guidelines set in a national legal framework that are at par with international standards.



Each step of action above consists of several decision elements that could be taken into account when designing a national decision process. When new information obtained that could lead to the different conclusion, re-assessment of the process and/or revision of the earlier decision may be is required.

5.3.2 OPTIONS FOR DISPOSAL VIA PERMANENT STORAGE OF MERCURY WASTE IN THE PHILIPPINES

The following section describes the progressing development of disposal of Hg, via permanent storage operations, and looks at the regional approaches that can be used for reference in developing Hg ESM in the Philippines.

a. Above ground storage- United States of America (US)

   The US has the longest and most consolidated experience in storing elemental Hg. Their federal government is currently running two Hg storage facilities under the responsibility of Defense National Stockpile Center (DNSC) and Department of Energy (DOE), which operates the National Defense Stockpile Program to store and sell metallurgical ores and materials.

   DNSC has approximately stored 4,436 tons of government-owned commodity grade elemental Hg for over 50 years. With the suspension of sales of elemental Hg started in 1994 and the increased use of Hg substitutes, the DNSC was prompted to come up with a strategy for long term Hg management.

   In 2001, the DNSC initiated a Hg Management Environmental Impact Statement (MM EIS) process that evaluated three alternatives for Hg management:

   - Maintaining all the sites (no-action/status quo);
   - Consolidating the Hg for storage at one location for the period of 40 years (long term storage); and
   - Selling the elemental Hg on the market (needs 30 years to sell the whole Hg).

The MM EIS process covered the evaluation of the potential environmental, human health and socioeconomic impacts of these alternatives (*see Section 5.2.1*). The result of the EIS process, announced three years after, decided the consolidation of Hg in one location— the Hawthorne Army Depot in Nevada. This decision was based on the following:[52]

- Safe long term management. The EIS looked into the viability of the facility for 40-years and concluded that the risk of neglect or future damage is negligible;
- Environmental/health risks are "negligible" to "low". Risk of an accident occurring is considered a low probability. For example, accidents such as fire during a rainstorm is seen to happen once in 10,000 to 1 million years;
- Economies of scale requires minimization of costs instead of spreading cost over several facilities;
- Consistent with policies and objectives of the DNSC, removing excess Hg inventory is consistent with the national security mission.

Underground storage and pre-treatment options (stabilization of elemental Hg) were also considered in the MM EIS, but these have not been further evaluated because of the following reasons:[53]

- Limited availability of existing underground mines, inspection considerations, additional material handling, and regulatory issues;
- Additional environmental impacts and costs for stabilization of elemental Hg, with less significant benefits; and
- Possible future use of metallic Hg in industrial processes.

The enactment of the Hg Export Ban Act of 2008 by the US congress prohibited the sale, distribution and transfer of elemental Hg by federal agencies to any other federal agency, any state or local government agency, or any private individual or entity, including banning for export from the

52 BAN Toxics, 2009.

53 Hidayat, 2012.

United States effective 1 January 2013. The Act also directs the DOE to accept and store excess Hg generated from commercial Hg recyclers, by-product of gold mines, and dismantling of chlor-alkali plants.

The storage facility needs to comply with the requirements stated in Section 5(d) of the Act, Management Standards for a Facility, including the requirements of the Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act (RECRA). The DNSC stockpiled Hg was placed in a 200,000 ft^2 warehouse equipped with the following:

- Static ventilation
- Heat, smoke and fire detection system
- Intrusion detection
- Active fire suppression systems
- Buildings constructed of materials resistant to fire such as concrete and steel
- All doors fitted with 3-inch containment dikes
- Installation of Terra Nap flooring and lamps

For long term storage of Hg in above ground facility, it is important to build the warehouse in an area not susceptible to natural disasters, or on ground strong enough to withstand natural disasters. In addition, the facility needs to be located far away from residential areas as a safeguard against accidental Hg spillage or Hg spillage by natural disasters.

b. Below ground storage- European Union (EU)[54]

In 22 October 2008, the Council and European Parliament adopted Regulation (EC) No 1102, which banned the exportation of Hg and required its subsequent safe storage. The regulation aimed to prevent the chlor-alkali industries' surplus Hg from re-entering the global market.

With the adoption of this regulation, large amounts of metallic Hg initially considered as raw material, became waste. The export ban started on 15 March 2011 and included:

- Metallic Hg
- Cinnabar ore
- Hg (I) chloride
- Hg (II) oxide
- Mixtures of metallic Hg with other substances including alloys of Hg, with a concentration of at least 95 percent (wt) Hg.

The quantity of surplus Hg was estimated to be around 10,000 tons of metallic Hg. Feasible storage options identified by BiPRO GmbH, the company assigned by the European Commission, include those enumerated below:

- Permanent storage of metallic Hg in salt mines;
- Pre-treatment of metallic Hg with a subsequent permanent storage in salt mines;
- Pre-treatment of metallic Hg with a subsequent permanent storage in deep underground hard rock formations; and,

[54] Hidayat, 2012.

- Pre-treatment of metallic Hg with a subsequent permanent storage in above ground facilities.

Acceptance criteria and minimum requirements for the safe disposal of metallic Hg were also recognized:

- Metallic Hg must have a purity greater than 99.9 percent contained in a carbon steel container;
- Stabilized Hg must have a leaching rate below 2 mg/kg of dry mass; and,
- Facilities related to permanent storage in salt rock must have a minimum depth of 300 meters.

Given these requirements, the EU ranked the storage options based on economic and environmental assessment.

TABLE 7. ECONOMIC AND ENVIRONMENTAL ASSESSMENT OF HG STORAGE OPTIONS IN THE EU

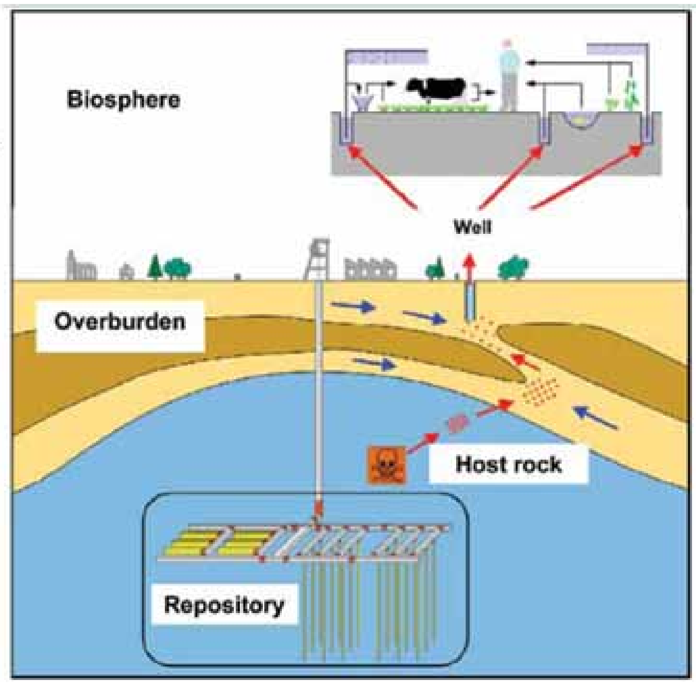
Storage Options	Assessment*	
	Economic	Environmental
• Pre-treatment (sulfur stabilization) of metallic Hg, with subsequent permanent storage in salt mines	2	1
• Pre-treatment (sulfur stabilization) of metallic Hg, with subsequent permanent storage in hard rock underground formation	2	2
• Permanent storage of metallic Hg in salt mines	1	--
**1= highest level*		

Note that the EU regulation considered above ground storage as a temporary option. Two countries, Germany and Sweden, have examined underground disposal systems described below:[55]

[55] BAN Toxics, 2009.

Salt mines- Germany

The concept of this method places Hg wastes in the cavities of excavated, disused salt mines. As identified by the EU recommendations, salt mines offer the safest, as well as the most environmentally responsible solution for the disposal of hazardous wastes like Hg. The surrounding rock salt mass provides a seal against liquids and gasses because the layers surrounding the rock salt mass and the covering layers reliably seal the rock salt layer against any intruding moisture. The geological feature has been stable for 200 million years, which guarantee an intact salt layer.



The storage areas of an underground waste disposal plant are positioned lower than any groundwater reservoirs, and typically have no humidity. In addition to natural barriers, artificial barriers are used (i.e., dry brick walls, rock salt fillings). Wastes, which are stored underground in this way, are not subjected to the sometimes significant dissolution and transport processes, such as are often the case in above ground storage. Underground storage also allows more fitting uses of the above ground space, which is especially useful for countries with small landmasses.

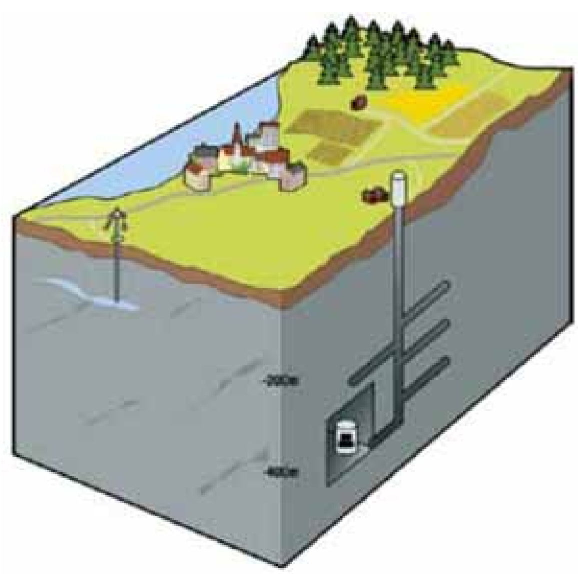
K+S Entsorgung GmbH, the German company running the salt mine facility, inspects all wastes intended for storage individually. Within this scope of approval procedures are the following guidelines examined:

- Type of waste and chemical composition
- Physical characteristics
- Chemical characteristics
- Toxicological characteristics

Since this is an underground facility, the most important criterion for work safety is monitoring the ventilation and aeration system, particularly in reference to hazardous particles in the air. This is done using gas detection instruments, by internal measurements at the separate work stations, and also by external auditing agencies.

Deep rock injection- Sweden

The Swedish Environmental Protection Agency was tasked to formulate proposals for the storage of Hg-containing wastes. A consultation process with waste owners on this issue concluded that storage deep down in bed rock is the best solution to deal with Hg wastes.



Source: Björn Södermark, Swedish Environmental Protection Agency

Research undertaken on this storage option showed that storage underground in deep bedrock relies on the capability of nature itself to provide protection of the waste. The concept is very similar to the German salt mines, however, the Swedish model included the possibility of placing their repository in a new site.

Swedish regulations put the responsibility of building and maintaining the storage facility to the polluter (waste owner) and the role of the government is to guide the process in the right direction and set up the framework of activities. Additionally, financing for the facility will be derived from the owners with partial help from the government.

c. Use of Existing Hazardous Wastes Facilities-Latin America and Carribean[56]
An assessment report by UNEP Chemicals in July 2009 showed that the quantity of excess Hg to be stored for the Latin America and Caribbean (LAC) region over the period 2015–2050 could amount to more than 8,000 tons. The base case scenario assessed in this report also indicates that the Hg supply in LAC may exceed demand even before 2015, which could imply a need for storage of the excess Hg.

Furthermore, in 2010, Laboratorio Tecnológicodel Uruguay (LATU) and UNEP Chemicals, through a study report on the feasibility of long-term storage for excess Hg in LAC, proposed three options for the long-term storage of Hg:

- Above-ground storage in specially engineered warehouses;
- Below-ground storage in geological formation (e.g., mines, special rock formations); and
- Export to a foreign country/facility, as a short term solution (when there is an in-significant amount of the excess Hg).

In 2010, Argentina and Uruguay implemented the “Hg Two Countries Project” to determine the feasibility of using of existing hazardous waste facilities as temporary storage facilities for Hg (commodity or waste). A survey of such facilities and of relevant country legislation showed the following results:

- Uruguay has two identified storage/disposal sites for elemental Hg and Hg-containing wastes. An abandoned chlor-alkali plant is selected

[53] Hidayat, 2012.

as temporary above ground storage, while a Categorical Industrial Users (CIU) landfill has been put as a candidate for below ground Hg-waste disposal site.

- Argentina has five identified hazardous waste landfills under Law 24.051. These are authorized to receive Hg Y29 Control category, which are subject to prior stabilization using D5 hydrosulfide Hg, sulfides or poly sulfides. One facility in Buenos Aires is authorized to treat Hg-containing lamps. Two companies are doing the qualification as exporters for battery wastes containing Hg.

Country initiatives are undertaken instead of regional strategies because excess Hg projections require the immediate development of storage/disposal capacity.

d. Storage options for Asia Pacific region[57, 58]

Using the similar report conducted by UNEP Chemicals on excess Hg supply, two scenarios of Hg supply-demand were revealed in Asia. The first scenario indicates an approximate of supply-demand equilibrium in 2017, with a need to store 5,500 tons of Hg. The second indicates that excess Asian Hg will be produced around 2027, with a need to store 7,500 tons.

Contributing to these scenarios is the interplay of demands from products and services in industries which use Hg:

INCREASE HG DEMAND	DECREASE HG DEMAND
• Production of vinyl chloride monomer (VCM) • Manufacture of fluorescent lamps	• Decommissioning of chlor-alkali plants • Ban on the use of Hg in ASGM • Natural gas production • Recycling of Hg-containing waste

57 Maxson, 2009a.
58 Hidayat, 2012.

A three-step strategy is proposed by S. Hagemann (2011) to effectively remove Hg from the market and reduce its potential risk by permanent isolation from the biosphere. This strategy covers:

1. Effective collection, intended to remove elemental Hg and Hg compounds that are no longer needed for accepted uses from the market;
2. Early stabilization using commercially-available technology to convert elemental Hg into a non-, or at least much less, soluble chemical form; and
3. Safe disposal, required to achieve a final disposal for stabilized Hg in environmentally-sound manner.

However, Hagemann also emphasized the need for the following aspects of Hg management to be strengthened:

- Legal framework for the obligation and requirements for collection, temporary storage, treatment, disposal;
- Improved collection systems and transport quality for elemental Hg and Hg-waste;
- Availability of temporary storage facilities at end-users or waste collection facilities.
- Availability of a stabilization plant (possibly combined recovery plant to extract Hg from Hg-containing waste); and,
- Availability of facilities for the disposal of stabilized Hg, Hgwastes and possibly other hazardous wastes. For the efficiency of the transportation of the stabilized Hg and waste, the stabilization plant must be close in distance to the disposal facility.

The following storage options for Hg were thus recommended for the Asia Pacific region:

- US concept of storing elemental Hg in aboveground warehouses for up to 40 years or more;
- Storage of Hg (waste or non-waste) in aboveground warehouses; and,
- Final disposal (permanent storage) of Hg-waste in underground mines.

Aside from terminal storage there are prevailing practices on the management of waste Hg and upcoming technologies which can be considered.

Indonesia

In 1999, the Republic of Indonesia adopted Government Regulation (GR) No.18, which covers Hazardous Waste Management and classifies Hg and Hg-containing wastes as hazardous wastes. Thus, prevailing regulations concerning hazardous waste management will apply to the following activities related to Hg management:

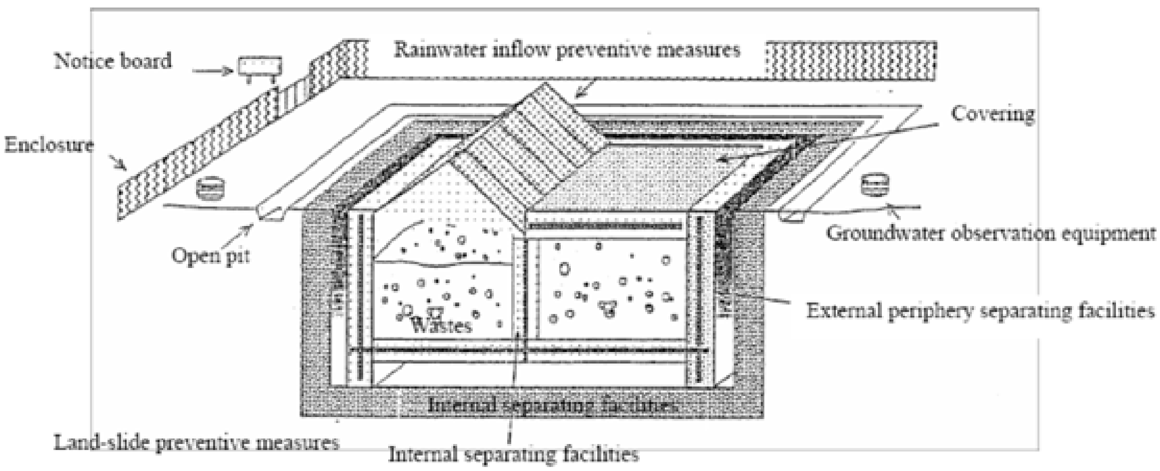
- Temporary storage by the waste generator;
- Transportation;
- Collection and storage and transfer station;
- Treatment; and,
- Disposal.

A documentation of environmentally sound management of Hg wastes in Indonesia shows the following practices and regulations:

- BAPEDAL's Decree No. Kep-05/BAPEDAL/09/1995 on proper waste handling (packaging, labeling and temporary storage). Waste owners are allowed to temporarily store their wastes for 90 days (if the waste production is >50 kg/day) or 180 days (if the waste production is ≤50 kg/day). After this period, the waste shall be managed by the generator itself or handed over to other parties for further management.
- Monitoring of transportation of trucks containing containerized wastes using a GPS fleet tracking system
- End-acceptance laboratory analysis, where the waste is tested in a laboratory for its conformity to the pre-acceptance results, including assessment for its suitability for the treatment decision.
- BAPEDAL's Decree No. Kep-03/BAPEDAL/09/1995 on the technical requirements for hazardous waste treatment. This regulation specifies that the stabilized waste shall meet the requirements of: Toxicity Characteristic Leaching Procedure (TCLP), bearing strength, and paint

filter tests. Specific to Hg, the regulatory TCLP limit is 0.2 mg/L, prior to the disposal into the hazardous waste landfill. Stabilization/encapsulation treatment involves the wastes' reaction with elemental sulfur (S) or sulfur salts to form Hg sulfide (HgS).
- The stabilized Hg is disposed in hazardous waste landfills.

Philippines



Several TSD facilities in the Philippines collect Hg-wastes and dispose it in specially-engineered landfills. The study does not have access to the technical data of the landfills in which the Hg wastes are disposed into. In this regard, the study refers to the Basel Convention technical guidelines.

According to the Technical Guidelines, a specially engineered landfill should be used when disposing Hg-containing waste to the landfill site. Landfill sites should be completely shut off from the outside natural world. The entire landfill is enclosed in watertight and reinforced concrete, and covered with the sort of equipment which prevents rainwater inflow such as a roof and a rainwater drainage system.

For further information on Hg management, see Basel Convention technical guidelines for the environmentally-sound management of wastes consisting of, containing or contaminated with Hg.

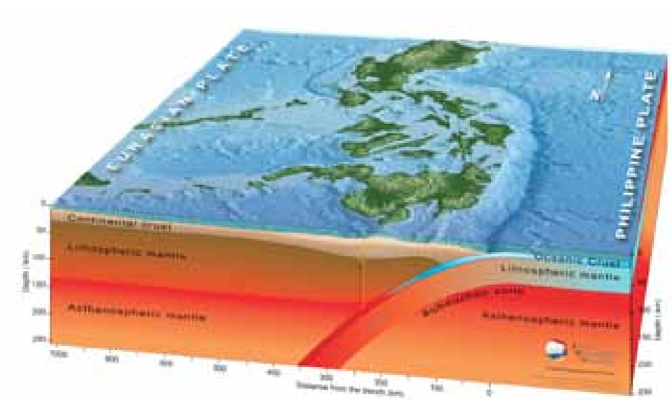
CHAPTER VI: CONSIDERATIONS OF ISSUES FOR FINAL DISPOSAL IN THE PHILIPPINES

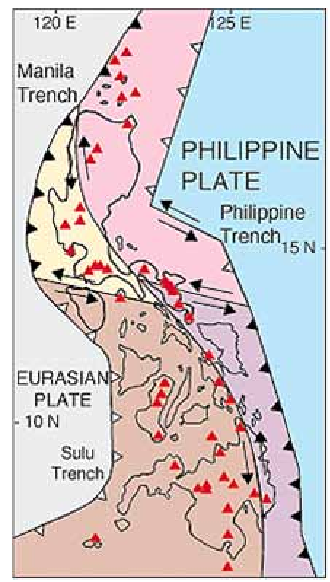
Using the criteria set by UNEP Chemicals (*discussed in Chapter II*) and guided by the principles developed by IAEA for hazardous waste management, the permanent storage options were assessed based on their suitability to the Philippine settings.

6.1 CHALLENGES TO BELOW GROUND STORAGE

The Philippines lies in the southern portion of the Pacific Ring of fire, an area where a large number of natural disasters such as volcanic eruptions, earthquakes, flooding and tropical storms or hurricanes occur. The "Ring of Fire" is a direct result of the plate tectonics, where denser oceanic plates are subducted by lighter continental plates.

An example of this phenomenon is the formation of the Philippine trench, which demarcates the convergent boundary of a subduction zone involving the Philippine plate. The presence of a chain of volcanoes near this area (around 300 km) is a manifestation of the tectonic movements that occur in this geographical location.[59] Furthermore, the subduction of the Eurasian Plate (South China Sea basin and the transitional oceanic-continental crust of the Palawan block) along the 560 mile (900 km) length of the Manila and Sulu trenches produced a discontinuous line of active volcanoes from Taal in the south to Iraya in the north.





Aside from the Eurasian and Philippine plates, the country is composed of several micro-plates squeezed between two convergent plate margins. The diagram below shows the subduction zones in the different regions (black triangles), transform or major strike-slip faults (arrows), and active volcanoes in the last 10,000 years (red triangles). Plates and micro-plates are shown in different colors.[60]

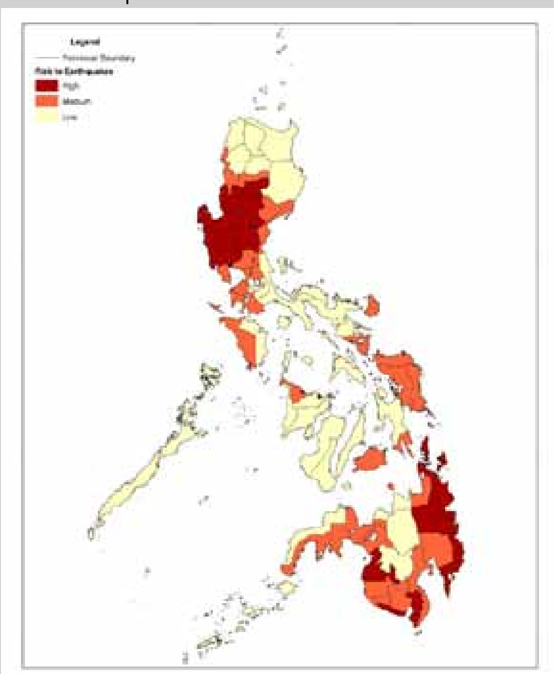
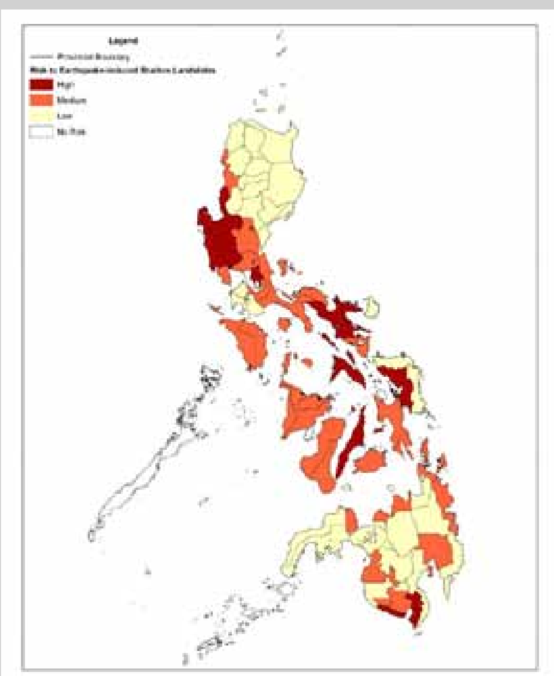
With these geographical concerns, mapping the Philippines' vulnerability to environmental disasters will show that a majority of the provinces are prone to earthquakes, earthquake-induced landslides, volcanic eruptions and tsunamis. The study on these vulnerability maps was undertaken by the Manila Observatory and DENR.[61]

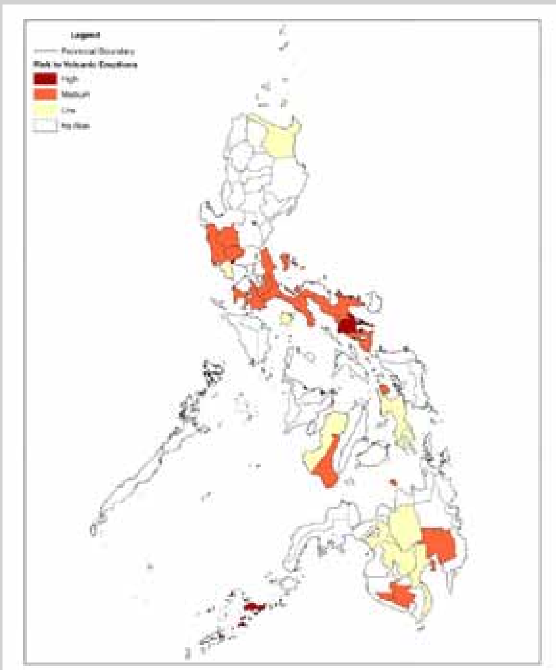
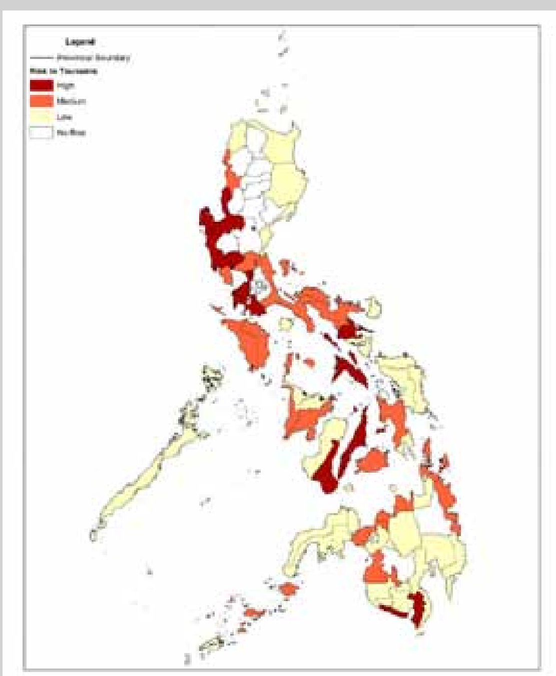
59 Philippine trench, n.d.

60 Tectonics and volcanoes of the Philippines, n.d.

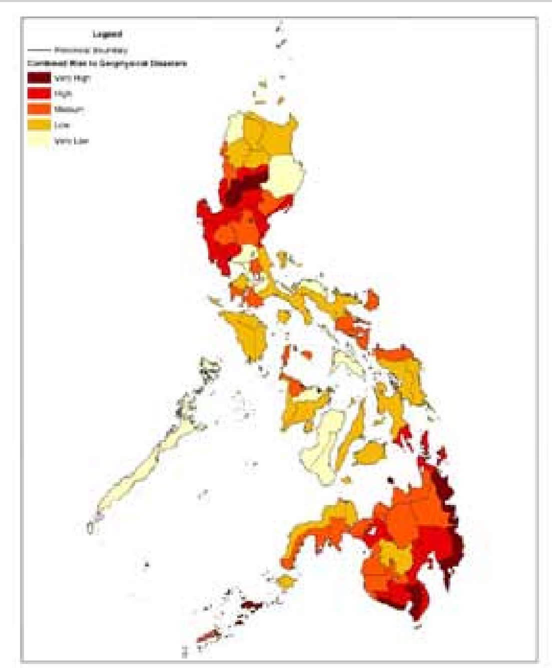
61 Manila Observatory Center for Environmental Geomatics, 2005.

TABLE 8. DENR-MANILA OBSERVATORY VULNERABILITY MAP FOR THE PHILIPPINES

Vulnerability Map	Affected Provinces
Risk to earthquakes 	Since 1968, PHIVOLCS recorded twelve destructive earthquakes in the Philippines. This record includes the infamous 16 July 1990 Luzon earthquake which caused innumerable injuries and at least 1,100 deaths. Seismicity (geographic and historical distribution of earthquake events) is all over the country except in the Palawan region.
Risk to Earthquake-induced Landslides 	Most of the provinces, except Palawan, are susceptible to landslide hazards.

Vulnerability Map	Affected Provinces
Risk to Volcanic Eruptions 	In 1991, Mt. Pinatubo eruption was well known to be the most violent eruption in the 20th century. Philippine Volcanoes are classified as Active, Inactive and Potentially active. Twenty-two (22) historically active volcanoes are distributed all over the archipelago. Since volcanoes are not present in some provinces, these particular areas have no risk to volcanic eruptions.
Risk to Tsunamis 	In 14 November1994, a 7.1 magnitude earthquake in Mindoro triggered a tsunami that left at least 41 persons dead, mostly children and old people. Most of the coastal areas have experienced a tsunami or have a tsunami hazard potential.

Combined Risk to Geophysical Disasters



Due to these geological concerns, design and construction of underground disposal will need highly engineering standard and technology in order to tackle these natural hazards, that eventually implies to the capital cost. Although Palawan is relatively safer than the other provinces, the unique biodiversity of its flora and fauna is one of the considerations against building a facility in their area.

Underground storage of elemental Hg is primarily intended to isolate Hg from the biosphere in geological formations that are expected to remain stable for a long time. German storage facilities utilized salt rock formations because it is practically impermeable and along with overlying and underlying impermeable clay strata, provides a geological barrier.[62] However, the availability of underground hard and salt rock formations for the long-term storage of mercury in Philippines still needs further evaluation.

6.2 CHALLENGES TO ABOVE GROUND STORAGE

The above ground storage for elemental Hg is based on the experience of the US DOE-DNSC in storing stockpiled liquid Hg in a specially-engineered warehouse. The most important component of this option is the containment of elemental Hg.

Compared to underground storage options, constructing and operating an above ground storage facility is more feasible in the Philippine context. This option allows easier maintenance of the Hg stockpile, and allows access for eventual recycling.

However, several issues must be taken into account for the aboveground storage of Hg in elemental form:

- Availability and cost of technology for sequestering Hg in Hg-containing products;
- Hg in its elemental form pose susceptibility to release in the biosphere in the case of unexpected incidents;
- Unauthorized access to the stored Hg or theft may lead into subsequence illegal re-use or black market; and
- Recurring cost for re-flasking and re-drumming.

Identifying the appropriate storage option, in the end, is also dictated by the urgency of the need to store Hg. Given that projections for excess Hg will occur in 2015 or 2017, the aboveground storage option is the most favorable option for middle term solution, at least until 2050 or longer. After this period, stabilization of elemental Hg could be implemented for further permanent storage in the country or in a centralized permanent storage in the Southeast Asian or the Asian region.

Establishing proper criteria for site sitting and storage requirements are very important to tackle the above drawbacks. The UNEP Chemicals' list of considerations for a storage facility for Hg can serve as a guide in construction and maintenance.

6.3 REQUIREMENTS FOR THE PERMANENT STORAGE MANAGEMENT OF HG[63, 64, 65]

The following aspects of Hg management must be taken into consideration once a storage facility is constructed.

TABLE 9. REQUIREMENTS FOR HG PERMANENT STORAGE MANAGEMENT CONSOLIDATED FROM VARIOUS SOURCE GUIDELINES

Components	Considerations
Pre-acceptance criteria	Defined as the requirements for the Hg to be accepted to the facility. The acceptance criteria for Hg are: - Elemental form, with purity> 99.9 percent - Maximum metallic contaminates <20 mg/kg each - No residual radioactivity - No impurities capable of corroding carbon or stainless steel Packaging/containment should be: - 76 lb-flasks placed in 200 liter UN-drums (6 flasks per drum) - 4 drums per standard pallet - Properly labeled
Personal Protective Equipment (PPE)	Storage personnel shall be equipped with the appropriate PPE including: - Body suit/ coveralls - Safety hat - Safety shoes - Half-face respirator, with Hg cartridge - Gloves (of nitrile material) - Safety goggles or glasses with side shields
Environmental Monitoring	For the Hg storage activity, impacts to the air, soil and water would be the main concerns. The following are the typical environmental monitoring, which shall be conducted by the storage operator. - Indoor air monitoring using passive and active air samplings, and compared to time-weighted average (TWA) standards of exposure for occupational health - Ambient air monitoring in areas representing upstream and downstream of the prevailing wind direction - Water monitoring for groundwater (total Hg analysis)and plumbing/drains (residue contaminants) - Soil monitoring to determine possible deposition and accumulation of Hg
Medical Check up Program	Involves: - Pre-employment check-up as employee baseline health conditions - Annual or regular blood, urine and hair tests depending on exposure assessments of each employee's job description

63 Hidayat, 2012.

64 United States Department of Energy, 2010.

64 United Nations Development Program, n.d.

Components	Considerations
Security	To prevent inadvertent or deliberate unauthorized entry on the Hg storage area, site specific requirements unique to a specific facility should be evaluated in consultation with security experts: - An artificial barrier such as barbed wire or concrete fence, which is installed surrounding the perimeter of the facility - Warning signs not to enter the facility are installed on the fences facing outside - 24-hour Security guards - Surveillance devices such as CCTV - Special personnel ID - Controlled entrance road to the facility
Record-keeping	The facility shall maintain at least the following records: - Quantity of Hg received - Type of packaging - Transporter's name and address - Vehicle type and license number - Driver and/or person who is sending the Hg - Date of receipt - Packaging conditions
Personnel Training	All Personnel working at the Hg storage must receive adequate training, which is required to operate the storage. The training may include general hazardous material management, as well as specific to the Hg management. The training consists of 2 categories: - Basic safety, and - Operations
Emergency Response Plan (ERP)	The ERP should address employee evacuation, internal and external reporting mechanisms, public notification and evacuation, and remedial response. The ERP covers the response procedure in the event of sabotage or terrorism, fire, and other disastrous events that could cause significant Hg releases beyond the building perimeter.
Closure Plan	Closure Plan consists of written procedures on how the storage facility will be closed down in an environmentally-sound manner. The plan also includes fund allocation reserved for: - Building demolition - Site assessment - Decontamination

6.4 ENCAPSULATION TECHNOLOGIES[67]

Storing Hg in its liquid elemental form poses high risk for exposure even when monitoring protocols are put into place. As such, the Basel technical guidelines provided encapsulation technologies that stabilize and solidify Hg can be undertaken to serve as an additional later for mitigating impacts of accidental spills. The US EPA defines stabilization and solidification as:

- Stabilization refers to techniques that chemically reduce the hazard potential of a waste by converting the contaminants into less soluble or less toxic forms. The physical nature and handling characteristics of the waste are not necessarily changed by stabilization;
- Solidification refers to techniques that encapsulate the waste, forming a solid material and does not necessarily involve a chemical interaction between contaminants and the solidifying additives. The product of solidification, often known as the waste form, maybe a monolithic block, a clay-like material, a granular particulate, or some other physical form commonly considered "solid".

Two of the most widely used techniques involved grout/Portland cement stabilization and Sulphur Polymer Stabilization/ Solidication (SPSS). The former utilizes cementitious materials such as cement, ground granulated blast furnace slag, fly ash, lime, silica fume, clay and additives to immobilize contaminants or otherwise enhance the waste form properties. On the other hand, SPSS involves the reaction of elemental or Hg-containing waste with sulfur polymer cement (SPC), a thermoplastic material composed of 95 percent of of elemental sulfur, to form a stable Hg sulfide compound. The mixture is then melted, mixed and cooled to form a monolithic solid waste form.

[67] United Nations Environment Program, 2011.

6.5 COST ESTIMATE[68]

The following assessment was done to determine the cost of establishing a national storage in Indonesia, prepared by S. Hidayat (2012) for Balifokus-Indonesia. Given the similar geographic situation of the former with the Philippines, the assessment can give a viable picture of how much Hg storage will also cost the country. The cost estimate was done with the following assumptions:

- The proposed storage is located in Java island;
- Hg to be stored in its elemental form;
- Hg received by the facility is already contained in prescribed flasks; and,
- The storage facility is designed for the capacity of 1,000 tons of elemental Hg, having 1,373 m^2 building area and 5,000 m^2 land area.

The cost associated to the establishment of National Storage can be categorized into two components summarized in the table below:

TABLE 10. COST COMPONENTS FOR THE INDONESIA NATIONAL STORAGE FACILITY.

Capital or Investment	Recurring/ Operational
• Pre-construction: feasibility study, EIA, detailed engineering design and permitting/public consultation. • Construction: civil, mechanical, electrical and fire suppressant system • Closure: building demolition/facility dismantling, hazardous/non-hazardous waste disposal, and site assessment and site-rehabilitation	• Personnel • Maintenance and Utilities • Consumables & PPE • Environmental Monitoring

68 Hidayat, 2012.

Tables 11 and 12 show the costs associated with each component:

TABLE 11. CAPITAL/ INVESTMENT COSTS FOR THE INDONESIA NATIONAL STORAGE FACILITY.

Investment Component	Cost (USD)
Pre-construction	
Feasibility study and site sitting	120,000
Environmental Impact Assessment (EIA)	140,000
Detailed engineering design	15,000
Permit and public consultation	150,000
SUB TOTAL	**425,000**
Facility construction	
Land acquisition	1,000,000
Civil structure	436,550
Electrical work	56,285
Mechanical work	13,728
Fire service	146,890
Equipment	100,000
Weighbridge	50,000
Drums and pallets	464,286
Closure/ De-commissioning	200,000
SUB TOTAL	**2,467,739**
TOTAL	**2,892,739**

TABLE 12. OPERATIONAL COSTS FOR THE INDONESIA NATIONAL STORAGE FACILITY.

Operational Component	**Cost (USD, per annum)**
Manpower	
Operator/ Labor	104,400
Safety/ Compliance officer	18,000
Security	75,600
Manager/supervisor	72,000
Routine Maintenance	12,000
Utilities (water and electricity)	30,000
Consumables and PPE	10,000
Environmental Monitoring	
Air	12,000
Water	6,000
Soil	6,000
Contingency	24,000
TOTAL	**370,000**

6.6 HG WASTE FOR EXPORT

Hazardous wastes and other wastes should, as far as is compatible with their ESM, be disposed in the country where they were generated. However, transboundary movement of such wastes can be permitted under the following conditions:[68]

- If conducted under conditions that do not endanger human health and the environment;
- If exports are managed in an environmentally-sound manner in the country of import or elsewhere;
- If the country of export does not have the technical capacity and the necessary facilities to dispose of the waste in question in an environmentally-sound and efficient manner;
- If the wastes in question are required as raw material for recycling or recovery industries in the country of import; or,
- If the transboundary movements in question are in accordance with other criteria decided by the Parties.

Any transboundary movement of hazardous wastes require (1) prior written notification from the exporting country, (2) prior written consent from the importing country, and (3) consent from transit countries, if appropriate. Thus, the approved consignment must be accompanied by a movement document from the point where the transboundary movement commences to the point of disposal. However, Parties shall prohibit the export of hazardous substances and other wastes if the country of import prohibits the import of such wastes. For instance, the Amendment to the Basel Ban, once enforced, will immediately prohibit all transboundary movement of hazardous wastes from OECD (developed) to non-OECD (developing) states.

Hazardous wastes shipments, if allowed, must conform to international rules and standards on packaging, labeling and transport. When no prior

---

68 United Nations Environment Program, 2011.

consent is given, the country of export shall ensure that the wastes in question are taken back to the country of export. In the case of illegal traffic, the country of export shall ensure that the wastes are taken back to the country of export for their disposal or disposed of in accordance with the provisions of the Basel Convention.

Transboundary movements of hazardous wastes and other wastes are permitted between a Party and a non-Party to the Basel Convention only if a bilateral, multilateral or regional arrangement exists as required under Article 11 of the Basel Convention. Under the Minamata Convention, similar transboundary movement is allowed for ESM disposal.[69]

With the growing concern over final disposal of Hg-wastes, jurisdictions will likely ramp up regulations and restrictions in the acceptance of Hg-wastes. This can present an additional barrier for countries without final disposal options within their territories.

[69] Article 3.6, Minamata Convention.

CHAPTER VII: CONCLUSION AND RECOMMENDATIONS

Hg poses a complex challenge to many nations, more so to a developing country such as the Philippines. As discussed in previous sections, Hg from human sources are varied, from its release through coal combustion to the very products that society has grown to rely on that eventually become wastes. Developing nations are forced to grapple with the environmental and health problems caused by Hg, a toxin that cannot be destroyed, whose toxicity has no half-life, and whose use and application is unnecessary for the most part because of the prevalence of safer Hg-free alternatives.

The global ideal of reducing and eliminating human emissions of mercury has an integral element to it – the control of the supply, use and trade of mercury and the eventual sequestration of the releases of this toxin and storing it permanently. The international community has set a high goal and to achieve this requires a multi-faceted and full life-cycle approach. In order to help achieve this, the Philippine government for its part needs to abandon certain biases on regulation and seriously consider the challenge of the final disposal of Hg-wastes, its implications and demands, as a facet of a comprehensive approach and not an end in and of itself.

The following recommendations are gleaned from the issues raised in this Policy Paper:

1. PREVENTION AND MINIMIZATION OF MERCURY WASTES, STARTS WITH ADDRESSING MERCURY SUPPLY INTO THE COUNTRY.

The Philippine government must ensure that Filipinos are not burdened by foreign Hg coming into the Philippines, resulting in the Philippines becoming a dumping ground for imported unwanted Hg and Hg. The task is three-fold: control the amount of Hg coming in, phase-out sources, and prohibit elemental Hg and Hg contained in other sources (e.g., those contained in products that are not necessary or which have Hg-free alternatives).

The government cannot simply focus on end-of-pipe solutions and must close the tap supplying Hg into the country. This policy would ease end-of-pipe solutions such as permanent storage, as it indirectly sets up limits to the amount of Hg that needs to be dealt with at the disposal stage.

2. UPDATE AND IMPROVE LEGAL INFRASTRUCTURE ON HG; CREATION OF A COMPREHENSIVE NATIONAL POLICY ON HG WITH A PROVISION FOR INTERIM AND PERMANENT STORAGE

It is evident in the legal analysis of Philippine laws that there is a need to update the laws, not just to meet possible Minamata Convention requirements, but to also make it responsive to the unique case of Hg. Moreover, a comprehensive national policy on Hg is needed in order to thread together the disparate areas of environment, public health, and trade that the Hg issue straddles. A national policy also serves as a guide post for the development of a legal infrastructure to support the policy and for government enforcement.

For instance, in the waste management hierarchy under the IRR of RA 6969, recycling and reuse of waste are identified as priorities while the unique demands of Hg for permanent storage does not fit squarely with the established priorities. For regular wastes this may be apt, but in the case of Hg, recycling or re-using only increases the probability of its eventual release once it is placed again in commerce.

There are also gaps in addressing Hg at source. Under the CCO, certain industries are favored to import Hg into the country (e.g. dental amalgam). The recent DENR inventory shows that major Hg emissions in the Philippines come from gold-mining operations. Knowing that the major source emission comes from the small-scale mining industry, outreach efforts to reduce demand through Hg-free alternatives should be considered along with an eventual restriction on imports by these sources.

The demands of such comprehensive national policy would necessitate the inclusion of the following elements:

1. Permanent storage as part of waste management policy. The government needs to reopen its policy on waste management with respect to permanent storage of Hg. Presently, the IRR and CCO do not recognize permanent storage as an option in the environmentally-sound management of Hg-wastes. Specifically, the government needs to look at prevention and minimization, interim storage, types of treatment or stabilization of Hg, and investigate permanent storage/disposal methods. Recovery or recycling Hg-waste operations should be guided by the policy-makers such that the process does not undermine policies set to protect human health or cause harm to the environment.
2. Need for comprehensive measures to address the intentional anthropogenic sources of Hg in the Philippines. CCO was enacted in 1997, a full decade before the present understanding of Hg has been fully compiled. Therefore, it is understandable that the legal tools employed under the CCO are insufficient and lacks the breadth needed to complement the envisioned national policy on Hg. A new law or regulation must contain measures that would help operationalize the policy on Hg, such as, providing fiscal incentives for companies that convert to Hg free technologies or manufactures or distributes Hg-free alternatives.

3. Existing laws need to acknowledge the role of permanent storage/final disposal and create a space for it in the hierarchy of waste management with reference to mercury.

4. Modify existing exemptions on end-users of Hg. Allowing major users of Hg such as chlor-alkali plants, dental and metallurgical and mining industries runs counter to the very need for controlling releases. This also creates a perverse incentive for these users to continue using Hg. This exemption clearly needs to be phased out as voluntary measures, including financial incentives, are employed to convert these operations to Hg free technologies.
5. Expanding the responsibility of generators/ distributors of wastes. The CCO rightfully contains provisions that hold importers, distributors, and end-users liable for injury or damages caused by the improper disposal of Hg-containing wastes. Instead of relying on monetary indemnification, any proposed law on Hg, must include the responsibility of the importer, distributor, manufacturer to take-back their products containing Hg and hold them responsible for the storage of such wastes. This is known as extended-producer responsibility (EPR). EPR has two distinct features. First, it creates a disincentive for manufacturers or distributors to sell Hg-containing equipment, and thus cultivate the use of alternatives. Second, it rightfully includes the manufacturers or distributors in addressing the resultant problems caused by their products.
6. Clarifying roles and jurisdictions of the departments involved in the national policy on Hg. A national policy that extends into the areas of trade, environment, and health requires proper coordination among different agencies. The CCO is presently ill-equipped to delineate the roles and jurisdictions of the respective agencies. Therefore, coordination amongst the agencies should be enhanced. It is crucial that this be done particularly in addressing products and waste issues to avoid any conflict between departments, especially, if one department wields more influence than the other.

7. Multi-stakeholder process. An integral part to the success of the various efforts on permanent storage is the inclusion of all affected parties in the discussion of a path towards permanent storage. Part of this effort should include identifying and encouraging stakeholders to come to the table to discuss the issues.

8. Provide current and relevant information on Hg. The government must ensure access to such information and proper risk communication. The government needs to re-affirm the importance of the public's access to relevant and current information on Hg and its obligation to develop and furnish that information to the public. This should be a collaborative effort between the health and environmental agencies. It is also crucial for government to provide advisories on Hg levels in fish, especially to populations sensitive to Hg.

3. Key component of ESM's prevention and minimization is the introduction of alternatives or facilitation of mercury-free substitution.

Controlling Hg supply is difficult to achieve without the necessary control on demand. There are multiple examples throughout the world where the use of Hg has been phased out of products and processes. As ASGM is the largest emitter and user of mercury, the Philippines must find ways to introduce and coax miners away from mercury. On the product side, outside of the use of fluorescent light bulbs, almost all products can be made without the use of Hg. This includes Hg used in the healthcare sector, in measuring devices, thermostats and thermometers.

There is a lack of awareness amongst the population concerning the dangers of Hg and the existence of Hg-free alternatives. The Philippine government increased it efforts towards promoting awareness-raising on Hg, but must include promotion of alternatives or substitutes as well.

4. Improve implementation of existing laws.

a. Strictly implement the Ecological Solid Waste Management Act, RA 9003, to ensure maximum mandatory separation of waste at source and the ban on dumping of toxic wastes is observed. Under RA 9003 as well local government should create mechanism for the immediate collection of Hg-wastes and other special wastes to ensure that once these wastes are segregated that they are handled in an environmentally-sound manner.

b. The national government should support LGUs to develop regional interim Hg waste storage facilities, with a view towards permanent storage that can manage in an environmentally-sound manner interim collection of Hg-wastes.
c. Strongly implement Republic Act 8749, the Clean Air Act of 1998, to stem the incineration or open-burning of Hg-wastes.

5. Immediately evaluate permanent storage for the Philippines

The options presented in this study serves as a preliminary step. A comparison of all the alternative options should be considered, including the social, economic and environmental implications of such project. In choosing a permanent storage option, aside from the criteria mentioned in the UNEP Chemicals guidelines, the following should be taken into account:

1. Creation of a multi-stakeholder process to review options and recommend one that is appropriate to the Philippine setting. At the end of the day, the government needs to determine which permanent storage option is suitable for the country. In order to do this, a multi-stakeholder body needs to be created to review existing options based on the specific criteria. The need to involve the various sectors in this process acknowledges the wide impact Hg has. These interests need to be properly represented and heard to validate the option that will be chosen.
2. Social dimension of the problem. The issue of Hg pollution and releases is not merely a technological issue. There is a social dimension to the Hg pollution that needs to be addressed, and in choosing a permanent storage facility these dimensions have to be dealt with:
   a. Lax implementation of laws. The CCO's initiative on record keeping and monitoring provided an excellent opportunity to track Hg-

containing wastes as far back as 1997. Unfortunately, implementation of the law has been lax, and only some information has been gathered in the ten years since the CCO was passed. The same mistake must not recur on any new comprehensive initiative on Hg.

b. Poverty and corruption. The illegal sale of Hg in the Philippines and its heavy use in the ASGM sector are critical issues that underpin the need for permanent storage options.
c. With the confluence of factors, such as high poverty rate in the country that could drive more people into the mining sector, availability of Hg through illegal channels, and the ensuing surplus Hg through government plans to phase-out Hg from use and existing stocks, could very well end up in the ASGM sector if oversight is not immediately applied to phase-out efforts.

6. Ratify the Minamata Convention

The Minamata Convention proves to be advantageous to the country. In addition to helping address trade and dumping concerns, the Minamata Convention will also provide financial and technical assistance or resources to countries that are Parties to it.[70] Thus, for a developing country, the advantages of being a part of the Convention, outweighs any perceived disadvantages.

[70] Article 13, Minamata Convention.

ANNEX I: REFERENCES

A2D Research Group for Alternatives to Development. (2012a). Household hazardous waste and items baseline inventory in Davao and Marikina City, Philippines.

A2D Research Group for Alternatives to Development. (2012b). Household hazardous waste and items baseline inventory in Cebu City, Philippines.

Abundance in Earth's crust of the elements (n.d.). Retrieved September 21, 2014 from, http://periodictable.com/Properties/A/CrustAbundance.al.log.html

Agency for Toxic Substances and Disease Registry. (1999). *Toxicological Profile for Mercury*. Retrieved February 17, 2014 from, http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=115&tid=24

Axelrad, D, Bellinger, D, Ryan, L and Woodruff T. (2007). Dose-response relationship of prenatal mercury exposure and IQ: an integrative analysis of epidemiologic data. *Environ Health Perspect* 115(4), p. 609-615.

BAN Toxics. (2009). Terminal storage options for mercury wastes in the Philippines. Retrieved September 21, 2014 from http://www.scribd.com/doc/14552641/Terminal-Storage-Options-for-Mercury-Wastes-in-the-Philippines

BAN Toxics. (2010). The price of gold: mercury use and current issue surrounding artisanal and small-scale gold mining in the Philippines. Retrieved February 25, 2015 from http://bantoxics.org/download/The_Price_of_Gold.pdf

BAN Toxics. (2012a). Lason sa liwanag. Retrieved September 21, 2014 from, http://www.bantoxics.org

BAN Toxics. (2012b). Mercury trade in the Philippines. Retrieved September 21, 2014 from http://www.bantoxics.org

BAN Toxics, (2014). Mercury monitoring in the Philippines (Draft).

Bentor, Y. (n.d.). Periodic Table: Mercury. Retrieved September 16, 2014 from, http://www.chemicalelements.com/elements/hg.html

Bienkowski, B. (2013). In the public eye: mascara exempt from mercury treaty. Retrieved September 21, 2014 from, http://www.scientificamerican.com/article/in-the-public-eye-mascara-exempt-from-mercury-treaty/

Bose-O'Reilly, S., McCarty, K., Steckling, N. & Lettemeir, B. (2010). Mercury exposure and children's health. *Current Problems in Pediatric and Adolescent Health Care*, 40-8, 186-215. doi: 10.1016/j.cppeds.2010.07.002

Cinnabar. (n.d.) Retrieved September 21, 2014 from, http://www.mindat.org/min-1052.html

Environment Canada. (n.d.) Mercury in the food chain. Retried September 21, 2014 from, https://www.ec.gc.ca/mercure-mercury/default.asp?lang=En&n=D721AC1F-1

Hagemann, S., Opermann, U. & Brasser, T. (2014). Behaviour of mercury and mercury compounds at the underground disposal in salt formations and their potential mobilization by saline solutions. Retrieved September 23, 2014 from, https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_07_2014_behaviour_of_mercury_and_mercury_compounds_at_the_underground_disposal_in_salt_formations.pdf

Hidayat, S. (2012). Assessment options for managing excess mercury supply and costing components of mercury storage in Indonesia.

Manila Observatory Center for Environmental Geomatics. (2005). Mapping Philippine Vulnerability to Environmental Disasters. Retrieved September 23, 2014 from, http://vm.observatory.ph/summary.html

Maxson, P. (2000). Mercury flows and safe storage of surplus mercury. Retrieved from http://ec.europa.eu/environment/chemicals/mercury/pdf/hg flows safe storage.pdf

Maxson, Peter. (2009). *Assessment of Excess Mercury in Asia, 2010-2050*. Concorde. Brussels. Retrieved September 16, 2014 from, http://www.unep.org/hazardoussubstances/Portals/9/Mercury/Documents/supplystorage/EECA%20Excess%20Mercury_Final%20Draft_Apr2010.pdf

Philippine trench. (n.d). Retrieved September 23, 2014 from, http://www.insights-philippines.de/philippinetrench.htm

Stone, M., Cohen, M. & Debban, B. (2006). Mercury vapor levels in exhaust air from dental vacuum systems. *Academy of Dental Materials*, 23, 527-532. doi:10.1016/j.dental.2006.03.011

Tectonics and volcanoes of the Philippines. (n.d). Retrieved September 23, 2014 from, http://volcano.oregonstate.edu/vwdocs/volc_images/southeast_asia/philippines/tectonics.html

The Basel Convention on Ban Amendment. (2011). Retrieved September 23, 2014 from http://www.basel.int/Implementation/LegalMatters/BanAmendment/tabid/1484/Default.aspx

United Nations Development Program. (n.d). Guidance on the clean up, temporary storage and transport of mercury waste from healthcare facilities.

United Nations Environment Program. (n.d.). *Minamata Convention on Mercury*. Retrieved September 16, 2014 from, http://www.mercuryconvention.org/Convention/tabid/3426/Default.aspx

United Nations Environment Program. (n.d) Mercury terminal storage facility [powerpoint slides]. Retrieved September 23, 2014 from http://www.chem.unep.ch/mercury/storage/LAC_Docs/Mercury%20Terminal%20Storage%20Facility.ppt

United Nations Environment Program. (2009). Governing Council, Decision 25/5 Mandates. Retrieved September 23, 2014 from, http://www.unep.org/chemicalsandwaste/Mercury/GlobalMercuryPartnership/MandatesDecision255/tabid/4565/language/en-US/Default.aspx

United Nations Environment Program. (2011). Technical guidelines for the environmentally sound management of wastes consisting of elemental mercury and wastes containing or contaminated with mercury. Retrieved September 23, 2014 from, http://www.basel.int/Portals/4/Basel%20Convention/docs/techmatters/mercury/guidelines/UNEP-CHW-10-6-Add_2_rev_1.pdf

United Nations Environment Program. (2013). Minamata Convention on Mercury: Text and Annexes. Retrieved September 16, 2014 from, http://www.mercuryconvention.org/Portals/11/documents/Booklets/Minamata%20Convention%20on%20Mercury_booklet_English.pdf

United States Department of Energy. (2010). Long term management and storage of elemental mercury: environmental impact statement Retrieved September 23, 2014 from, http://energy.gov/sites/prod/files/2013/09/f3/EIS-0423-S1-FEIS-2013.pdf

United States Environmental Protection Agency. (2013). Minamata Convention on Mercury. Retrieved September 23, 2014 from, http://www2.epa.gov/international-cooperation/minamata-convention-mercury

United States Environmental Protection Agency. (2014). Environmental effects: fate and transport and ecological effects of mercury. Retrieved September 23, 2014 from, http://www.epa.gov/mercury/eco.htm

United States Geological Survey. (2000). *Mercury in the Environment*. Retrieved September 16, 2014 from, http://www.usgs.gov/themes/factsheet/146-00/index.html

United States Geological Survey. (2012). Mineral Commodities Summary. Retrieved September 21, 2014 from, http://minerals.usgs.gov/minerals/pubs/commodity/mercury/mcs-2012-mercu.pdf

Young, R. (1998). Formal toxicity summary for mercury. Retrieved September 21, 2014 from, http://rais.ornl.gov/tox/profiles/mercury_f_V1.html

ANNEX II: UN COMTRADE DATA ON IN THE PHILIPPINES

YEAR	TRADE PARTNER	TRADE VALUE (USD)	QUANTITY (KGS)
2012	USA	118,362	5,743
2011	China, Hong Kong SAR	394,497	6,750
2010	Australia	1,975	45
	Germany	4,164	3,850
	Japan	40,490	3,830
	Switzerland	43,589	3,977
	Spain	50,576	11,100
	USA	52,155	4,845
	Netherlands	66,311	5,850
2009	Spain	560,922	27,975
	Germany	418,935	58,704
	USA	106,398	9,597
2008	USA	50,099	7,656
2007	Russian Federation	378,730	18,216
	Spain	187,848	9,250
	Netherlands	69,427	4,326
2006	Spain	185,038	12,950
	USA	84,385	3,719
	Japan	76,888	14,250
	Singapore	43,928	2,174
	Australia	263	5

MERCURY IMPORTATION

YEAR	TRADE PARTNER	TRADE VALUE (USD)	QUANTITY (KGS)
2005	Spain China, Hong Kong SAR Singapore USA	177,848 130,500 80,000 27,750	7,215 5,632 3,700 4,899
2004	Russian Federation Spain	55,500 2,991	9,250 235
2003	Spain USA United Kingdom	378,730 187,848 255	18,216 9,250 1
2002	Spain USA	1,069 262	115 8
2001	Singapore Spain USA	47,351 914 227	19,950 111 11
2000	Spain China USA Germany United Kingdom	70,875 8,496 1,151 1,032 580	19,950 10,271 12 78 163

ANNEX III: MERCURY LEVELS IN AMBIENT AIR IN SELECTED ASGM COMMUNITIES

TABLE 1. MERCURY MONITORING IN GAANG, BALBALAN, KALINGA						
Spot Locations	**Hg in Ambient Air (ng/m³; December 15, 2012)**			**Hg in Ambient Air (ng/m³; July 6, 2013)**		
	MIN	**AVE**	**MAX**	**MIN**	**AVE**	**MAX**
Camp XX	64.9	836.1	6,095.7	17.6	35	84.9
Camp 40	64.9	836.1	6,095.7	17.6	35	84.9
Store XX	83.4	306.6	1,225.6	10.8	66.3	144.2
Camp 99	259.8	766.4	3,627.7	34.2	63.3	94.4
Camp 62	102.6	276.4	563.6	91.9	2,033.1	26,487.8
Camp 83	229.8	5,250.6	>50,000	62.5	132.3	341.7

TABLE 2. MERCURY MONITORING IN JOSE PANGANIBAN, CAMARINES NORTE

Spot Locations	Hg in Ambient Air (ng/m³; December 4, 2012)			Hg in Ambient Air (ng/m³; March 23, 2013)		
	MIN	AVE	MAX	MIN	AVE	MAX
Pawnshop XX	26.4	277.5	2,086.6	<20	486.9	3,797.2
Town Market	<20	420.4	1,930.2	<20	449.7	2,904.3
Municipal Health Office	20.2	52.7	152.9	<20	231.1	2,574.3
Mining Facility at Brgy. Sta. Rosa Sur	77.9	2,851.1	27,464.9	113.4	364.6	1,251.6

TABLE 3. MERCURY MONITORING IN AROROY, MASBATE

Spot Locations	Hg in Ambient Air (ng/m³; December 4, 2012)			Hg in Ambient Air (ng/m³; March 23, 2013)		
	MIN	AVE	MAX	MIN	AVE	MAX
Health Center at Brgy. Luy-a	<20	111.7	476.4	30.1	527.2	1,078.8
Mining Facility at Brgy. Panique	<20	4,521.4	>30,000	<20	557.1	2,591.8
Sitio Gold Bag, Brgy. Syndicate	<20	560.4	7,475.6	<20	1,462.4	6,812
Town Market	<20	289.3	2,533	<20	356.9	3,687.3

TABLE 4. MERCURY MONITORING IN MT. DIWATA, MONKAYO, COMPOSTELLA VALLEY

Spot Locations	Hg in Ambient Air (ng/m³; December 4, 2012)			Hg in Ambient Air (ng/m³; March 23, 2013)		
	MIN	AVE	MAX	MIN	AVE	MAX
Smelting Area	383.2	5,493.6	28,717.3	1,820.1	3,916.3	9,916.4
Residential Area	73.3	384.7	1,381.4	6,178.1	16,272.3	>30,000
Gold Buyer	7,594	17,496.5	>30,000	264.2	1,118.5	4,676.8
Mining Facility	<20	20.9	42.4	997.2	2,497.7	6,082.5

ANNEX IV: MINAMATA CONVENTION TEXT

ARTICLE 10
ENVIRONMENTALLY SOUND INTERIM STORAGE OF MERCURY, OTHER THAN WASTE MERCURY

1. This Article shall apply to the interim storage of mercury and mercury compounds as defined in Article 3 that do not fall within the meaning of the definition of mercury wastes set out in Article 11.
2. Each Party shall take measures to ensure that the interim storage of such mercury and mercury compounds intended for a use allowed to a Party under this Convention is undertaken in an environmentally sound manner, taking into account any guidelines, and in accordance with any requirements, adopted pursuant to paragraph 3.
3. The Conference of the Parties shall adopt guidelines on the environmentally sound interim storage of such mercury and mercury compounds, taking into account any relevant guidelines developed under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal and other relevant guidance. The Conference of the Parties may adopt requirements for interim storage in

an additional annex to this Convention in accordance with Article 27.

4. Parties shall cooperate, as appropriate, with each other and with relevant intergovernmental organizations and other entities, to enhance capacity-building for the environmentally sound interim storage of such mercury and mercury compounds.

ARTICLE 11
MERCURY WASTES

1. The relevant definitions of the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal shall apply to wastes covered under this Convention for Parties to the Basel Convention. Parties to this Convention that are not Parties to the Basel Convention shall use those definitions as guidance as applied to wastes covered under this Convention.
2. For the purposes of this Convention, mercury wastes means substances or objects:
   a. Consisting of mercury or mercury compounds;
   b. Containing mercury or mercury compounds; or
   c. Contaminated with mercury or mercury compounds,

   in a quantity above the relevant thresholds defined by the Conference of the Parties, 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 the provisions of national law or this Convention. This definition excludes overburden, waste rock and tailings from mining, except from primary mercury mining, unless they contain mercury or mercury compounds above thresholds defined by the Conference of the Parties.
3. Each Party 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 that the Conference of the Parties shall adopt in an additional annex in accordance with Article 27. In

developing requirements, the Conference of the Parties shall take into account Parties' waste management regulations and programmes;

b. 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 paragraph 3 (a);
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. In circumstances 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.

4. The Conference of the Parties shall seek to cooperate closely with the relevant bodies of the Basel Convention in the review and update, as appropriate, of the guidelines referred to in paragraph 3 (a).
5. Parties are encouraged to cooperate with each other and with relevant intergovernmental organizations and other entities, as appropriate, to develop and maintain global, regional and national capacity for the management of mercury wastes in an environmentally sound manner.

ANNEX V: BASEL CONVENTION TEXT

DISPOSAL OPERATIONS

A. OPERATIONS WHICH DO NOT LEAD TO THE POSSIBILITY OF RESOURCE RECOVERY, RECYCLING, RECLAMATION, DIRECT RE-USE OR ALTERNATIVE USES

Section A encompasses all such disposal operations which occur in practice.

D1	Deposit into or onto land (e.g., landfill)
D2	Land treatment, (e.g., biodegradation of liquid or sludgy discards in soils)
D3	Deep injection, (e.g., injection of pump-able discards into wells, salt domes of naturally occurring repositories)
D4	Surface impoundment, (e.g., placement of liquid or sludge discards into pits, ponds or lagoons)
D5	Specially engineered landfill, (e.g., placement into lined discrete cells which are capped and isolated from one another and the environment)

D6	Release into a water body except seas/oceans
D7	Release into seas/oceans including sea-bed insertion
D8	Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in Section A
D9	Physico chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations in Section A, (e.g., evaporation, drying, calcination, neutralization, precipitation)
D10	Incineration on land
D11	Incineration at sea
D12	Permanent storage (e.g., emplacement of containers in a mine)
D13	Blending or mixing prior to submissions to any of the operations in Section A
D14	Repackaging prior to submission to any of the operations in Section A
D15	Storage pending any of the operations in Section A

B. OPERATIONS WHICH MAY LEAD TO RESOURCES RECOVERY, RECYCLING RECLAMATION, DIRECT RE-USE OR ALTERNATIVE USES

Section B encompasses all such operations with respect to materials legally defined as or considered to be hazardous wastes and which otherwise would have been destined for operations included in Section A

R1	Use as a fuel (other than in direct incineration) or other means to generate energy
R2	Solvent reclamation/ regeneration
R3	Recycling/ reclamation of organic substances which are not used as solvents
R4	Recycling/ reclamation of metals and metal compounds

R5	Recycling/ reclamation of other inorganic materials
R6	Regeneration of acids or bases
R7	Recovery of components used for pollution abatement
R8	Recovery of components from catalysts
R9	Used oil re-fining or other reuses of previously used oil
R10	Land treatment resulting in benefit to agriculture or ecological improvement
R11	Uses of residual materials obtained from any operations numbered R1- R10
R12	Exchange of wastes for submission to any of the operations numbered R1-R11
R13	Accumulation of materials intended for any operation in Section B

www.bantoxics.org