Final Report

NATIONAL ACTION PLAN ON MERCURY AND MERCURY-CONTAINING WASTES MANAGEMENT

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CONTENTS

Section **Page**

1.0 INTRODUCTION 1

1.1 BACKGROUND AND PURPOSE OF THE NATIONAL ACTION PLAN FOR MERCURY AND MERCURY-CONTAINING WASTES MANAGEMENT 2
1.2 SUMMARY OF PREPARATORY ACTIVITIES 3
1.3 SUMMARY OF ISSUES RELATED TO MERCURY AND MERCURY-CONTAINING WASTES 4

2.0 COUNTRY BASELINE 5

2.1 PROFILE OF THE PHILIPPINES 5
2.1.1 Political and Economic Profile 6
2.1.2 Affected Economic Sector Profile 6
2.1.3 Environmental Overview 9
2.2 ASSESSMENT OF MERCURY AND MERCURY-CONTAINING WASTES IN THE PHILIPPINES 12
2.2.1 Inventory of Mercury and Mercury-containing Wastes and Assessment of Mercury Releases into the Environment 13
2.2.2 Assessment of Future Sources of Mercury Wastes 14
2.3 INSTITUTIONAL AND REGULATORY FRAMEWORK 15
2.3.1 Policy and Legislative Framework 15
2.3.2 Existing Regulations Addressing Mercury and Mercury-containing Wastes 15
2.3.3 Management Responsibilities of Mercury and Mercury-containing Wastes 27
2.3.4 Current Enforcement Requirements Relevant to Mercury and Mercury-containing Wastes 29
2.3.5 Summary and Assessment of the Institutional and Regulatory Framework 30
2.4 MONITORING PROGRAMS AND SUPPORTING INFRASTRUCTURE RELEVANT TO RELEASES OF MERCURY RESULTING FROM MERCURY AND MERCURY-CONTAINING WASTES 32
2.4.1 Existing Monitoring Programs 32
2.4.2 Infrastructure for Mercury Monitoring 32
2.4.3 Summary and Assessment on Mercury and Mercury-containing Wastes Monitoring Programs 33
2.5 KNOWLEDGE AND AWARENESS LEVEL 35
2.6 RESEARCH AND DEVELOPMENT ON ESTABLISHING BEST AVAILABLE TECHNIQUES (BAT) AND BEST ENVIRONMENTAL PRACTICES (BEP) 36

3.0 GOALS, STRATEGIES, AND ACTION PLANS 37

3.1 OVERARCHING GOAL AND OBJECTIVES 38
3.2 STRATEGIES AND ACTION PLANS 39

List of Figures

FIGURE 1-1 FRAMEWORK IN THE DEVELOPMENT OF THE NATIONAL ACTION PLAN ON MERCURY AND MERCURY-CONTAINING WASTES MANAGEMENT 3
FIGURE 2-1 PHILIPPINE MAP 5
FIGURE 2-2 SOURCES AND FLOW OF MERCURY AND MERCURY-CONTAINING WASTE IN THE PHILIPPINES 13
FIGURE 2-3 SUMMARY OF LEGAL AND REGULATORY REQUIREMENTS FOR MERCURY AND MERCURY-CONTAINING WASTES 31
FIGURE 2-4 EXISTING MONITORING PROGRAMS FOR MERCURY AND MERCURY-CONTAINING WASTES ALONG ITS LIFE CYCLE 34
FIGURE 3-1. FRAMEWORK FOR THE NATIONAL ACTION PLAN ON MERCURY AND MERCURY-CONTAINING WASTES MANAGEMENT 39

List of Tables

TABLE 2-1. ECONOMIC PROFILES OF SECTORS AFFECTED BY MERCURY AND MERCURY-CONTAINING WASTES 7
TABLE 2-2. WATER QUALITY CRITERIA AND EFFLUENT STANDARDS 23
TABLE 2-3. REVISED WQG AND GES* FOR MERCURY 23
TABLE 2-4. ROLES OF AGENCIES IN THE MANAGEMENT OF MERCURY AND MERCURY-CONTAINING WASTES 28
TABLE 2-5. SUMMARY OF ENFORCEMENT AND MONITORING REQUIREMENTS 29
TABLE 2-6. ENTITIES THAT ANALYZE MERCURY 32
TABLE 2-7. IEC ACTIVITIES OF VARIOUS AGENCIES 35
TABLE 2-8. AVAILABLE ALTERNATIVES TO MERCURY-CONTAINING PRODUCTS 36

List of Annexes

ANNEX 1. SOURCE OF MERCURY AND MERCURY-CONTAINING WASTES, EXISTING MANAGEMENT, AND APPLICABLE LEGAL REQUIREMENTS
ANNEX 2. EXISTING PROGRAMS FOR MONITORING MERCURY AND MERCURY-CONTAINING WASTES

List of Acronyms and Abbreviations

AO	Administrative Order
AOAC	Association of AOAC International
APHA	American Public Health Association Standards
ASGM	Artisanal and small scale gold mining
BAT	Best Available Techniques
BEP	Best Environmental Practices
BFAR	Bureau of Fisheries and Aquatic Resources
BPS	Bureau of Products Standards
BOC	Bureau of Customs
CCO	Chemical Control Order
CHED	Commission on Higher Education
CMS	Chemical Management Section
COD	Chemical Oxygen Demand
COT	Certificates of Treatment
CV-AAS	Cold Vapor Atomic Absorption Spectroscopy
DA	Department of Agriculture
DENR	Department of Environment and Natural Resources
DepEd	Department of Education
DILG	Department of the Interior and Local Government
DOE	Department of Energy
DOF	Department of Finance
DOH	Department of Health
DOLE	Department of Labor and Employment
DOLE BWC	DOLE Bureau of Working Condition
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
ECC	Environmental Compliance Certificate
EELs	Energy Efficient Lighting/Lighting Systems
EMB	Environmental Management Bureau
EMB AQMS	EMB-Air Quality Management Section
EMB CMS	EMB-Chemical Management Section
EMB CO	EMB Central Office
EMB EIAMD	EMB Environmental Impact Assessment Management Division
EMB HWMS	EMB-Hazardous Waste Management Section
EMB ROs	EMB Regional Offices
EMB WQMS	EMB-Water Quality Management Section
EOL	End of Life
ESM	Environmentally Sound Management
ETE/ETV	Environmental Technology Evaluation / Environmental Technology Verification
FDA	Food and Drug Administration
FPA	Fertilizer and Pesticide Authority
GC	Governing Council
GDP	Gross Domestic Product
GES	General Effluent Standards
GNP	Gross national product
GWh	Gigawatt hour
$HgCl_2$	mercuric dichloride
$HgSO_4$	mercury-sulfate
HPLC	High-performance Liquid Chromatography

ICP-MS	Inductively Coupled Plasma–Mass Spectrometry
IEC	Information, Education, and Communication
IRR	Implementing Rules and Regulations
ITDI	Industrial Technology and Development Institute
JAO	Joint Administrative Order
LCP	League of Cities of the Philippines
LED	Light-emitting diode
LGU	Local Government Unit
LMP	League of Municipalities of the Philippines
LPP	League of Provinces of the Philippines
mg/L	milligram per liter
mg/NCM	milligram per normal cubic meter
MGB	Mines and Geosciences Bureau
MGB	Mines and Geosciences Bureau
MOA	Memorandum of Agreement
MVC	Mabuhay Vinyl Corporation
NESSAP	National Emission Standards for Source-Specific Air Pollutants
NGO	Non-Governmental Organizations
NSCB	National Statistical Coordinating Board
NSWMC	National Solid Waste Management Commission
NWRB	National Water Resources Board
OSHS	Occupational Safety and Health Standards
PNSDW	Philippine National Standards for Drinking Water
PULPAPEL	Pulp and Paper Manufacturers Association, Inc.
RA	Republic Act
SMEWW	Standard Methods for the Examination of Water and Wastewater
SMR	Self-Monitoring Report
TCLP	Toxicity Characteristic Leaching Procedure
TSD	Treatment, Storage, and Disposal
UNEP	United Nations Environment Programme
VCM	Vinyl-chloride-monomer
WEEE	waste electronic and electrical equipment
WQG	Water Quality Guidelines

1.0 INTRODUCTION

Mercury is one of the constituent elements of the earth. In pure form, it is known alternatively as “elemental” or “metallic” mercury. At room temperature, some of the metallic mercury evaporates and forms mercury vapors, which are colorless and odorless. The higher the temperature, the more vapors are released.

Mercury is characterized by several unique properties that people have found both novel and useful through the ages. For instance, it is the only metal that is liquid at room temperature and can combine with other metals to form "amalgams" or solutions of metals. It has been a part of the occult arts and human folklore and has been used in medicine as well as science and technology for millennia. Due to its unique characteristics, mercury has multi-uses as indicated below:

- As the metal (among others), used in/as:
  - Extraction of gold and silver
  - Catalyst for chlor-alkali production
  - Manometers for measuring and controlling pressure
  - Thermometers
  - Electrical and electronic switches
  - Fluorescent lamps
  - Dental amalgam fillings

- As chemical compounds (among others), used in/as:
  - Batteries (as a dioxide)
  - Biocides in paper industry, paints, and on seed grain
  - Antiseptics in pharmaceuticals
  - Laboratory analyses reactants
  - Catalysts
  - Pigments and dyes
  - Detergents
  - Explosives

Ironically, inherent to the characteristics of mercury is its high toxicity. Mercury has long been found to cause a variety of documented, significant adverse impacts on human health throughout the world. Similar to other metals, mercury does not degrade but instead accumulates in soil, water, and living organisms. It also can be transported over long distances in the air. Natural processes can convert metallic mercury into the extremely toxic methyl-mercury, which then accumulates in organisms such as fish. In the human body, methyl-mercury can be transferred to the fetus and impedes its brain development, even at low concentrations.

The problem of mercury releases is both a local and international concern. Its contamination issues are seen as a global problem. According to the United Nations Environment Programme (UNEP), which has commissioned a survey of the situation, the concentrations of mercury in the environment and in food (especially fish) are now so high as to cause damage to both humans and the environment. Even regions without any mercury releases, such as the Arctic, are adversely affected due to the fact that the metal can be transported through long distances in the air. Population groups that eat a lot of fish, shellfish, and marine mammals are particularly vulnerable.

Attributed to the increasing releases of mercury into the environment is the management aspect of mercury and mercury-containing wastes. With the foreseen decrease in demand of mercury-containing products and processes, and the increased wastes from decommissioned chlor-alkali plants, long-term storage of mercury waste (in its elemental form) and waste containing/contaminated with mercury must be urgently addressed.

Consistent with the Basel Conference of Parties' decision on the inclusion of mercury wastes as one of its strategic focused areas for the next biennium, a set of draft technical guidelines on the environmentally sound management (ESM) of mercury was developed as a collaborative effort between UNEP Chemicals and the Secretariat to the Basel Convention.

With technical assistance from UNEP Chemicals, the Philippines, through the Department of Environment and Natural Resources (DENR) – Environmental Management Bureau (EMB), has developed this National Action Plan on Mercury and Mercury-containing Wastes.

1.1 BACKGROUND AND PURPOSE OF THE NATIONAL ACTION PLAN FOR MERCURY AND MERCURY-CONTAINING WASTES MANAGEMENT

The Philippines is one of the official signatories and parties to the Basel Convention. The Basel Convention plays an integral part in the call of UNEP Governing Council (GC) for increased efforts to address mercury issues globally. One of the key priorities of UNEP GC is the search for environmentally sound solutions for the storage and management of mercury and mercury-containing wastes, considering the risk that mercury release poses to human health and the environment. Finding effective and ESM of mercury and mercury-containing wastes is therefore of prime importance.

In response to the increasing need for an ESM of mercury and mercury-containing wastes, UNEP Chemicals together with the Secretariat to the Basel Convention developed a set of draft technical guidelines on the ESM of mercury. UNEP Chemicals initiated Country Projects to test the applicability and usefulness of the draft guidelines prior to its finalization. The Philippines was selected as one of the recipients of the project as follow on to the mercury inventory it conducted using the UNEP Toolkit for Identification and Quantification of Mercury Releases.

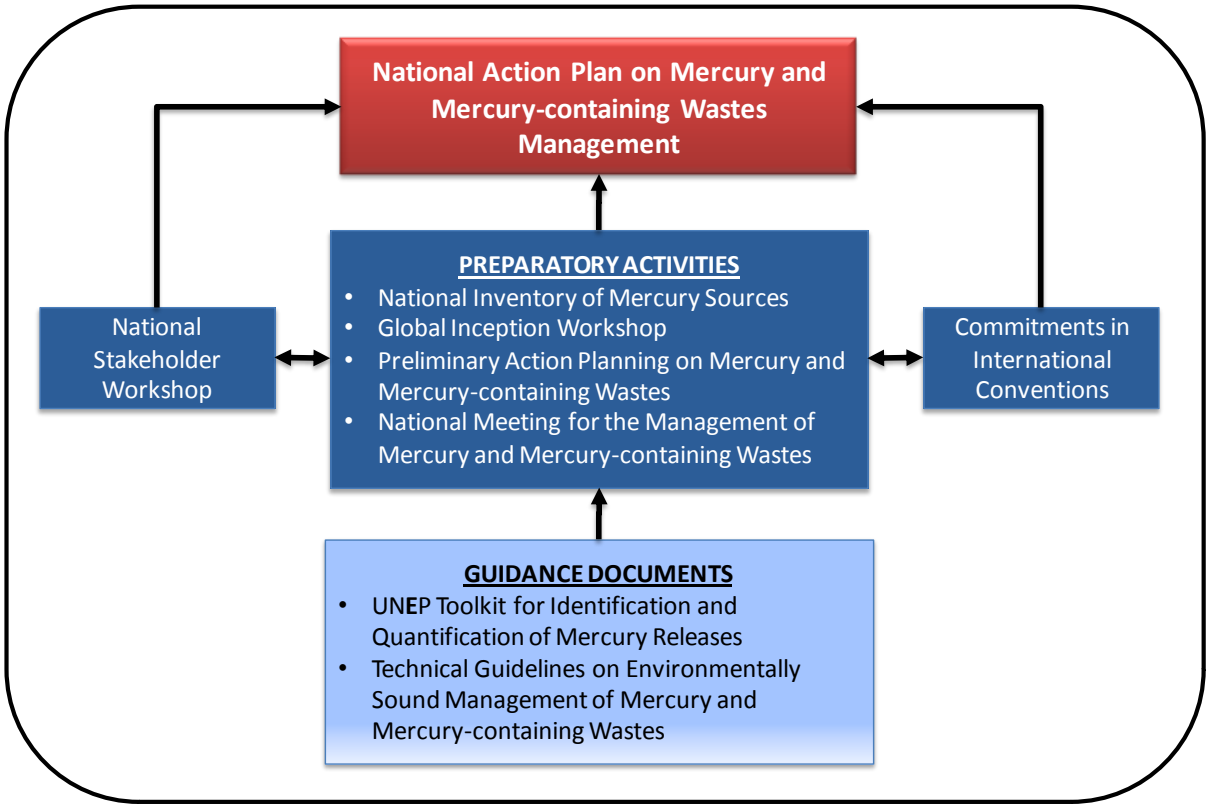
The development of a National Action Plan on Mercury and Mercury-containing Wastes Management is one of the components of the Project on Management of Mercury and Mercury-containing Wastes, implemented by DENR-EMB. It aims to provide a comprehensive roadmap and timeline towards reducing if not eliminating the risks posed by mercury and mercury-containing wastes in the Philippines. This Action Plan covers mercury waste prevention and minimization at source, collection, storage, treatment, and disposal, including protecting workers' safety and public participation.

This Action Plan identifies the existing legislative framework on mercury waste management and analyzes the regulatory improvements needed. It further identifies risk reduction measures and potential funding sources to implement, sustain, and expand ESM of mercury wastes. Moreover, this Action Plan addresses the incorporation of mercury waste minimization into the national poverty reduction strategies.

1.2 SUMMARY OF PREPARATORY ACTIVITIES

The National Action Plan on Mercury and Mercury-containing Wastes Management was developed based on the results of the preliminary activities done for the management of mercury and mercury-containing wastes. Taking into consideration the clear evaluation of existing laws and regulations and the current and future needs of the country, the Action Plan was developed to address the need for an ESM of handling mercury and mercury-containing wastes. Figure 1-1 presents the framework used for the preparation of the National Action Plan.

Figure 1-1 Framework in the Development of the National Action Plan on Mercury and Mercury-containing Wastes Management



In preparation for the development of the Action Plan, DENR-EMB conducted the 2008 National Inventory of Mercury Sources in the Philippines using UNEP's Toolkit for Identification and Qualification of Mercury Releases. In addition, DENR-EMB participated in the Global Inception Workshop in March 2009, and initiated the Preliminary Action Planning on Mercury and Mercury-containing Wastes in November 2009 that became the bases of the National Meeting for the Management of Mercury and Mercury-containing Waste Project held in February 2010. Lastly, as one of the essential components in the development of the Action Plan, a Stakeholder Workshop on the National Action Plan was held in June 2010. These preparatory activities served as venues for soliciting stakeholder inputs as well as the dissemination of information on mercury and mercury-containing waste management.

1.3 SUMMARY OF ISSUES RELATED TO MERCURY AND MERCURY-CONTAINING WASTES

The following summarize the key issues of the Philippines pertaining to the management of mercury and mercury-containing wastes, which the National Action Plan intends to address.

- ***Lack of cohesive legal instruments for the management of mercury and mercury-containing wastes in the Philippines***

Regulatory instruments for the management of mercury and mercury-containing wastes have been developed in the Philippines, along with programs and activities to continuously monitor anthropogenic sources of mercury releases. However, these instruments lack the cohesiveness aspect considering the life cycle of mercury and mercury-containing wastes. Further, legal instruments on the management practices on handling mercury wastes have been focused on interim measures, with little emphasis on terminal or permanent storage of mercury wastes.

- ***Ineffective implementation of mercury waste management in the local level***

Aside from the insufficient coverage of the existing legal instruments in the Philippines on the management of mercury and mercury-containing wastes, one of the major issues identified is the implementation of these regulations in the local level. This issue needs to be addressed considering that a significant percentage of mercury wastes come from residential sources, which are currently not regulated and controlled.

- ***Lack of national information on the types and quantities of mercury-and mercury-containing wastes***

The initial inventory conducted in the country using the UNEP Toolkit provided information on the estimated releases of mercury in the environment and identified key sources of these releases. However, it does not provide information on the types and quantities of mercury and mercury-containing wastes generated by the sectors of concern. The current information contained by the regulatory agencies (EMB Central and Regional Offices) are limited to spent laboratory chemicals and busted mercury-containing lamps. Although there is an on-going effort to inventory mercury and mercury-containing wastes from health care facilities and institutions, it is limited to facilities owned/managed by the Department of Health (DOH) and only to the Luzon area.

- ***Lack of institutional controls and infrastructure to manage the end-of-life (EOL) of products containing wastes***

Due to lack of inventory and national information for other sources of mercury and mercury-containing wastes, the necessary institutional controls and infrastructure to manage these wastes are still lacking. The existing accredited treatment, storage, and disposal (TSD) facilities have capabilities limited only to addressing spent mercury solutions and providing pre-treatment to busted mercury-containing lamps. There are no existing authorized facilities to handle wastes that contain elemental mercury.

- ***No program for assessing levels of mercury in products***

Mercury-containing products that enter into the country are not monitored and consequently mercury content for these products is not established. The existing product standards are focused on product quality and limited only to certain products (i.e. lamps).

- ***Lack of monitoring program for releases from mercury and mercury-containing wastes***

There are required monitoring programs for water discharges and air emissions, but inclusion of mercury in these programs is very limited (or none at all). In addition, there is no monitoring program for releases in soil; hence, there is no standard/guideline for mercury in soil.

- ***Lack of public participation***

Aside from the lapses in legal instruments and its implementation in the local level, another issue identified is the lack of public participation, which can be linked to the insufficient efforts for public education and awareness. Effective implementation of management programs to address mercury and mercury-containing wastes in the country depends on the pro-active stance that the people from the smallest unit take.

These issues are further discussed in the succeeding sections and consequently became the bases for the National Action Plan on Mercury and Mercury-containing Wastes Management discussed in Section 3 of this Report.

2.0 COUNTRY BASELINE

This section presents a profile of the Philippines as well as the existing management and assessment of the policies, programs, and activities on mercury and mercury containing wastes.

2.1 PROFILE OF THE PHILIPPINES

The Philippines is an independent republic in the southeast rim of Asia with a land area of 300,400 square kilometers (km^2). It is an archipelago of over 7,000 islands, of which only 400 are permanently inhabited, lying about 966 km off the southern coast of Asia. The archipelago is bounded by the Pacific Ocean, South China Sea, Sulu Sea, and Celebes Sea.

The islands are grouped into three geographic regions, namely: Luzon, Visayas, and Mindanao. Figure 2-1 shows the map of the Philippines.

Figure 2-1 Philippine Map

Based on the 2000 Census of Population and Housing, the total population of the Philippines is 76.5 million while it was recorded at 68.6 million in 1995 (based on the 1995 Mid-Decade Census). The population is at 88.6 million as of 2007, and is steadily increasing. Large populations are centered in major cities especially in the Metro Manila Area, which is the center for education, industry, and commerce.

2.1.1 Political and Economic Profile

The three geographic regions of the country are Luzon in the north, Visayas in the middle, and Mindanao in the south. The Philippines has 17 political regions, 79 provinces, 115 cities, 1,495 municipalities, and 41,956 barangays or villages.

Executive authority is vested on the President of the Philippines, legislative authority is vested on the Congress of the Philippines, and judicial authority is vested on the Supreme Court and such lower courts as may be established by law.

Gross domestic product (GDP), at constant prices, expanded by 5.4 percent in 2006 while gross national product (GNP) grew by 6.2 percent as net factor income from abroad went up 15.4 percent due to the robust OFW remittances. Nonetheless, these were below the GDP and GNP Medium Term Plan targets of 6.3-7.3 percent and 6.5-7.5 percent, respectively. Growth was primarily driven by the agriculture, fishery, and forestry sectors which exceeded the full year projection, as well as by the services sector with significant expansions in all its subsectors.

The country's unemployment rate has barely moved from its 2005 level and remained high at more than 7 percent as the number of jobs generated has not been sufficient to absorb the influx of labor entrants. However, inflation was a source of good news as it has remained benign during the last two years. The 91-day Treasury bill rate also stayed within target, notwithstanding the fiscal deficit owing to the below-target inflation rate. The fiscal deficit continued to be a major macroeconomic concern among policy makers.

The combination of fiscal weakness, modest recovery in exports due to the rebound in the global information technology industry, and deterioration in foreign direct investment resulted to a gradual deterioration in the external accounts position and to current account balances that were below targets. The country's gross international reserves though, are at a level that could sufficiently cover external debt payments over the next 12 months.

In terms of sources of growth, the difference between 2005 and 2006 was hardly noticeable. This implies that no significant policy changes were introduced during the period. Economic growth of the country in large part continued to be consumer-led rather than investment-driven.

2.1.2 Affected Economic Sector Profile

The sectors that are potentially considered as sources of mercury and mercury-containing wastes in the country and are therefore deemed as possible beneficiaries of any strategy that may be included in this report are discussed in this section. Some of these sectors are major elements of the national economy while others are activities or even side effects of certain industrial and non-industrial processes. As such, the economic profiling was carried out at those levels where the pollution

source was assumed and where the socio-economic impact could be described or estimated in certain way. Table 2-1 presents the economic profile of these sectors.

Table 2-1. Economic Profiles of Sectors Affected by Mercury and Mercury-containing Wastes

Affected Sector	Economic Profiles
Extraction and Use of Fuels/Energy Sources	
Power Generation	• Philippines generated 60,821 GWh of electricity in 2008 (*Source: DOE*) – 15,749 GWh (25.9%) from coal-fired thermal power plants – 4,868 GWh (8%) from oil-based thermal power plants – 19,576 GWh (32.2%) of electricity from natural gas-fired power plants – 10,723 GWh (17.6%) from geothermal power plants • 89,425 persons employed under the electricity, gas, and water sector in 2008 (*Source: DOLE*)
Petroleum Refining	• Two major oil refining companies: Petron and Pilipinas Shell (*Source: DOE*) • 943 persons employed under petroleum refineries in 2003 (*Source: NSCB*) • Total revenue in 2003: PhP 267.7 Billion (*Source: NSCB*)
Primary (Virgin) Metal Production	
Mining	20,732 persons employed in mining and quarrying in 2008 (*Source: DOLE*)
Copper	Three operating copper (with gold and silver) and 1 copper (with gold, silver, and zinc) mine in 2009 namely: Padcal Copper Project, Canatuan Mining Project, Toledo Copper Project, and Rapu-Rapu Polymetallic Project (*Source: MGB*)
Gold	• Eight operating gold (with silver) mines in 2009 namely: Victoria Gold Project, Teresa Gold Project, Paracale Gold Project, Acupan Contract Mining Project, Banahaw Gold Project, Apec Maco Operation, Masbate Gold Project and Diwalwal Direct State Development Project (*Source: MGB*) • Artisanal and small scale gold mining (ASGM) in more than 30 provinces employing about 200,000 to 300,000 miners (*Source: Ban Toxic*)
Metallurgical Chromite	One operating metallurgical chromite (ore and concentrate) mine in 2009: Dinagat Chromite Project (*Source: MGB*)
Nickel	10 operating nickel mines in 2009 namely: Cagdianao Nickel Project, Tagana-an Nickel Project, Rio Tuba Nickel Project, Claver Nickel Project, Berong Nickel Project, Sta. Cruz-Candelaria Mining Project, Cagdianao Nickel Project, ACT Nickel Project, Carrascal Nickel Project, and SR Metal Project (*Source: MGB*)
Production of Other Minerals and Materials with Mercury Impurities	
Cement Production	• 13 cement manufacturers employing 3,677 employees in 2003 (*Source: NSCB*) • Total revenue in 2003: PhP 30.1 Billion (*Source: NSCB*)
Pulp and Paper Production	• Based on the 2006 report of Pulp and Paper Manufacturers Association, Inc. (PULPAPEL), there are 35 paper mills in the country where eight are located in Region 3, 14 in Metro Manila, 11 in Region 4, and one each in Cebu and Surigao del Sur • 165 paper and paper products manufacturers employing 20,863 employees in 2003 (*Source: NSCB*) • Total revenue in 2003: PhP 38.6 Billion (*Source: NSCB*)

Affected Sector	Economic Profiles
Lime Production and Light weight Aggregate Kilns	• Negros Integrated Industries Corporation operates four lime production plants in the country at the following areas: – Cansilayan, Guimaras – Pontevedra, Negros Occidental – Malaybalay, Bukidnon – Montevista, Davao del Norte • Total capacity is estimated at 3,000 tons/month
Mining (Coal)	• 13 operating coal mines with Coal Operating Contracts in 2007 (*Source: DOE*) • 22 active small-scale mining permittees in 2007 (*Source: DOE*) • Total production in 2005: 2.828 million metric tons
Quarrying (Limestone)	26 commercially operating limestone quarries, which are mostly used for cement production in 2009 (*Source: MGB*)
Intentional Use of Mercury in Industrial Processes	
Chlor-alkali production with mercury technology	• Mabuhay Vinyl Corporation (MVC) is the sole producer of caustic soda in the country • Mercury-cell process stopped production since 1993 and the facility was decommissioned in 2001 (*Source: MVC*)
Vinyl-chloride-monomer (VCM) production with mercuric dichloride ($HgCl_2$) as catalyst	No existing VCM production using the mercuric dichloride process in the Philippines
Acetaldehyde production with mercury-sulfate ($HgSO_4$) as catalyst	No existing acetaldehyde production using the mercury sulfate process in the Philippines
Other production of chemicals and polymers with mercury compounds as catalysts	No data
Waste Deposition/Landfilling and Wastewater Treatment	
Waste Processing Facilities	Based on the 2009 data from the National Solid Waste Management Commission (NSWMC), there are: • 838 open dumpsites • 396 controlled disposal facilities • 6,141 material recovery facilities (serving 6,742 barangays) • 72 sanitary landfills (42 undergoing construction but with Environmental Compliance Certificate, ECC) • 7 eco-parks
TSD Facilities	13 registered hazardous wastes processing facilities nationwide that handle and treats mercury and mercury-contaminated wastes in 2005
Waste Collectors	No data
Informal Sectors	No data
Crematoria and Cemeteries	
Crematoria	No data
Cemeteries	No data

Affected Sector	Economic Profiles
Other Sources	
Hospitals	• 701 government and 1,080 private hospitals registered in 2007 *(Source: DOH)* • 145,235 persons employed under the health and social work sector in October 2005 (*Source: DOLE*) • Reported health expenditure in 2004 was PhP 165.2 Billion (*Source: NSCB*) • Share to GNP is 3.2% (*Source: NSCB*)
Dental Clinics	No data
Schools	Based on the 2009 data from the Department of Education, there are: • 44,691 elementary schools of which 37,607 are public and 7,084 are private • 10,066 secondary schools of which 5,359 are public and 4,707 are private
Colleges and Universities	Based on the SY 2004-2005 data from the Commission on Higher Education (CHED) there are: • 382 State Universities and Colleges • 50 Local Universities and Colleges • 1 CHED Supervised Institution • 9 Other Government Schools • 5 Special Schools • 340 private sectarian • 1,103 private non-sectarian
Abandoned Mine Sites	No data

2.1.3 Environmental Overview

This section provides a snapshot of the environmental condition of the Philippines. It describes the climate, mineral resources, water resources, water quality, air quality, and the issues on solid and hazardous wastes management in the country.

Climate

The climate of the Philippines is tropical and maritime, characterized by relatively high temperature, high humidity, and abundant rainfall. It is similar in many respects to the climate of the countries in Central America. Temperature, humidity, and rainfall, which are discussed hereunder, are the most important elements of the country's weather and climate.

Based on the average of all weather stations in the Philippines, excluding Baguio, the mean annual temperature is 26.6°C. The coolest month is January with a mean temperature of 25.5°C, while the warmest month is May with a mean temperature of 28.3°C. Latitude is an insignificant factor in the variation of temperature while altitude shows greater contrast in temperature. Thus, the mean annual temperature of Baguio with an elevation of 1,500 meters is 18.3°C. This makes the temperature of Baguio comparable to those with temperate climate and because of this, it is known as the summer capital of the Philippines. The difference between the mean annual temperature of the southernmost station in Zamboanga and that of the northernmost station in Laoag is insignificant. In other

words, there is essentially no difference in the mean annual temperature of places in Luzon, Visayas, or Mindanao measured at or near sea level.

Humidity refers to the moisture content of the atmosphere. Due to high temperature and the surrounding bodies of water, the Philippines has a high relative humidity. The average monthly relative humidity varies between 71 percent in March and 85 percent in September. The combination of warm temperature and high relative and absolute humidity give rise to high sensible temperature throughout the archipelago. It is especially uncomfortable during March to May, when temperature and humidity attain their maximum levels.

Rainfall distribution throughout the country varies from one region to another, depending on the direction of the moisture-bearing winds and the location of the mountain systems. The mean annual rainfall of the Philippines varies from 965 to 4,064 millimeters annually. Baguio City, Eastern Samar, and Eastern Surigao receive the greatest amount of rainfall, while the southern portion of Cotabato receives the least amount of rain. At General Santos City in Cotabato, the average annual rainfall is only 978 millimeters.

Using temperature and rainfall as bases, the climate of the country can be divided into two major seasons: (1) rainy season, from June to November; and (2) dry season, from December to May. The dry season may be subdivided further into (a) cool dry season, from December to February; and (b) hot dry season, from March to May.

Mineral Resources

The Philippines is one of the world's richly endowed countries in terms of mineral resources. It has ranked among the world's top 10 in the production of chromites, copper, gold, and nickel. For much of the last quarter of the 20th century, mining was slowed by the effects of low international metal prices accompanied by high operating and production costs, low foreign investment, political instability, labor problems, and natural disasters. Nevertheless, the Philippines was estimated to rank second to Indonesia in the Asia-Pacific region in terms of mineral prospectivity and resources. The Philippines has substantial resources of copper, gold, nickel, and silver, along with other mineral commodities.

Although the Philippines was an energy importer, domestic energy resources included amounts of coal, natural gas, oil, and hydroelectric power. Coal was the Philippines' largest source of fossil energy production in 2000. Geothermal power accounted for the country's largest share of indigenous energy production, followed by hydropower, coal, oil and gas.

Water Resource and Water Quality

The country is endowed with rich water resources. These include inland freshwater (rivers, lakes, and groundwater) as well as marine water (bays, coastal and oceanic waters). The Philippines has sufficient water supply but not enough in highly populated areas, especially during the dry season.

Water pollution affects the fresh, marine, and groundwater resources of the country. Surface water quality can be assessed by using dissolved oxygen and

biochemical oxygen demand as parameters. The environmental and public health dimensions of the water quality situation are as follows:

- 36 percent of the river sampling points have been classified as public water supply sources
- 60 percent of the country's population live along coastal areas and contribute to discharge of untreated domestic and industrial wastewater from inlands
- 58 percent of groundwater supplies intended for drinking water are contaminated with total coliform and would need treatment
- 31 percent of illnesses from 2001 to 2005 were water-related diseases

Water classifications are arranged in order of degree of protection required, with Classes AA and SA having the most stringent water quality requirements, and Classes D and SD having the least stringent requirements.

Rivers and Lakes occupy 1,830 km^2 (0.61 percent of the total area). The Philippines has 421 principal river basins in 119 proclaimed watersheds. Of these, 19 are considered major river basins and were included in the Water Quantity Scorecard. On the other hand, there is no updated inventory of lakes, but a recent study has placed the number of lakes at 72.

Bays and Coastal Waters cover an area of 266,000 km^2, oceanic waters cover 1,934,000 km^2, and coastline length spans 36,289 km. The Philippine coastline is irregular, with numerous bays, gulfs, and islets. About 60 percent of Philippine municipalities and cities are coastal, with 10 of the largest cities located along the coast. These coastal cities and municipalities are inhabited by about 60 percent of the total population.

Of the 77 coastal and marine waters in the country, only three are regularly monitored by EMB for mercury. These are Dupon and Matlang Bays in Leyte and Murcielagos Bay in Zamboanga del Norte. The annual concentrations of mercury for the three water bodies are 0.30, 0.34 and 0.73 milligram per liter (mg/L), respectively, which are way above the criterion of 0.002 mg/L.

Groundwater is replenished or recharged by rain and seepage from rivers. The recharge or extraction potential is estimated at 20.2 billion cubic meters (m^3) per year. Groundwater contributes 14 percent of the total water resource potential of the Philippines. It is used for drinking by about 50 percent of the people in the country. Based on the water rights granted by the National Water Resources Board (NWRB) since 2002, 49 percent of groundwater is consumed by the domestic sector, and the remaining shared by agriculture (32%), industry (15%), and other sectors (4%). About 60 percent of the groundwater extraction is without water right permits, resulting in indiscriminate withdrawal. A high percentage (86%) of piped-water supply systems uses groundwater as a source.

In terms of sectoral demand, agriculture has a high demand of 85 percent, while industry and domestic sectors have a combined demand of only 15 percent.

Air Quality

It is widely acknowledged that air pollution is a serious problem in the Philippines. Particulate matter smaller than 10 microns (PM_{10}) is now considered the priority air

pollutant. Ambient monitoring from 1997 to 1999 at the main road of the central business district in Baguio City, showed TSP levels that ranged from fair to poor. In 1999, TSP levels were above the national guideline values having 24-hour TSP levels from 246 microgram per normal cubic meter (µg/NCM) to 341 µg/NCM.

Limited monitoring in Cebu City and Mandaue City in 1999 indicated excessive 24-hour TSP levels in several locations-238 µg/NCM in Banilad, Mandaue City, 276 µg/NCM in Talisay, Cebu, 262 µg/NCM in Pardo, Cebu, municipalities and 239 $\mu g/m^3$ in Minglanilla, Cebu, and municipalities within 20 kms from Cebu City.

Sulfur dioxide, nitrogen oxides, ozone, and carbon monoxide levels all remain within the national standards. Ambient levels of lead have dropped significantly because of the phase-out of leaded petrol. Ambient level of mercury is not monitored because the DENR has not yet set a standard for mercury.

Solid and Hazardous Wastes

Solid and hazardous waste generation has risen significantly and its widening dispersion to the environment is a growing threat to the quality of air, water, and land. This is compounded by the lack of environmentally sound waste treatment and disposal facilities.

The national average solid waste generation rates per capita are estimated to be 0.3 kilogram (kg)/capita/day or about 22,500 tons/day (8.2 million tons/year). Metro Manila alone generates about 5,400 tons/day of solid waste. In urban areas, the range is from 0.50 to 0.70 kg/capita/day.

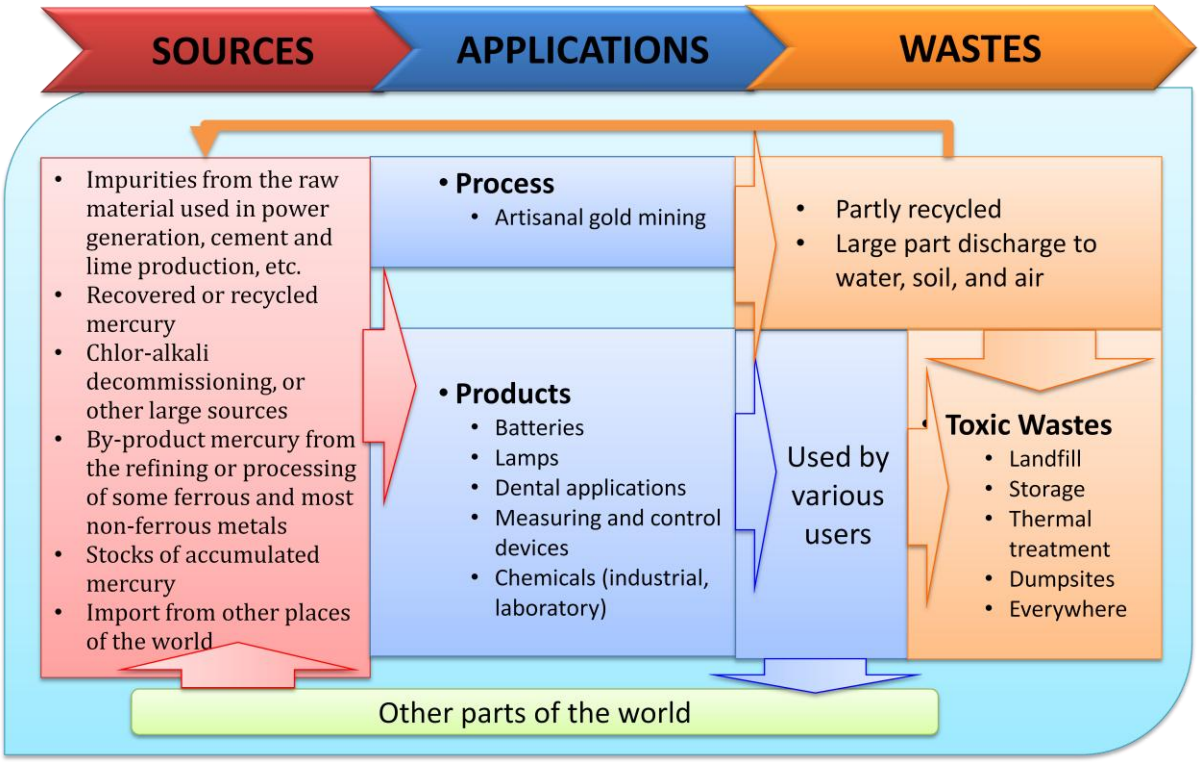
In Metro Manila, only six percent of waste is recycled, another six percent is disposed of by the residents themselves, 73 percent is collected, while the rest is illegally dumped. Organic waste predominates in household wastes. There is no special collection system for domestic waste while industrial waste disposal is inadequately regulated.

About 142 local government units (LGUs) in the country are implementing integrated waste management programs, which include waste reduction, composting, recycling, and re-use. The manufacturing sector in Metro Manila and adjacent provinces (from Bataan in the north to Batangas in the south) generated nearly 168,000 metric tons of serious toxic and hazardous wastes in 1999. The four main producing sectors of toxic and hazardous wastes are chemicals, food and drink, textiles, and engineering.

2.2 ASSESSMENT OF MERCURY AND MERCURY-CONTAINING WASTES IN THE PHILIPPINES

In determining and assessing the releases of mercury from wastes, it is important to look at the life cycle (sources and flow) of mercury as shown in Figure 2-2. As indicated, mercury and mercury-containing wastes in the Philippines are generated from unintentional releases in the artisanal gold mining and from the EOL of products containing mercury.

Figure 2-2 Sources and Flow of Mercury and Mercury-containing Waste in the Philippines



2.2.1 Inventory of Mercury and Mercury-containing Wastes and Assessment of Mercury Releases into the Environment

In the Philippines, a mercury inventory assessment was undertaken using the UNEP Toolkit. Results showed that mercury comes mostly from the energy and mining sectors. The overall mercury emissions are distributed mainly to air (45%), land (19%), water (18%), and the rest to general waste and others. The top three principal subcategories releasing mercury are primary virgin metal production (32%), extraction and use of fuel and energy resources (20%), and other intentional uses (20%). The rest of the mercury comes from wastewater, intentional uses of mercury in consumer products, and in crematoria.

While the initial inventory provided an overview to provide estimates of the amount of mercury emissions in the country, it does not provide any information on the types and quantities of mercury and mercury-containing wastes generated by relevant sectors.

Annex 1 presents the typical wastes generated that may potentially contain mercury. It presents the sources of mercury and mercury-containing wastes, existing management, and applicable legal requirements. As noted, no amounts are available. The estimated mercury releases came from the inventory previously conducted.

In summary, the following are the critical issues identified in the inventory:

- Centralized database or information network on the types and quantities of mercury and mercury-containing wastes is not available

- Initial inventory gives estimate on the levels of mercury releases but not on the amount and type of wastes generated from process, product, or use of such product
- Data on other uses of crude oil such as in the polymerization process or in the manufacture of plastic products are not considered
- Data on mercury emissions due to mining of metals are limited only to gold, silver, copper, and lead
- Calculation for the thermometers needs refinement because the initial calculation was based only on the number of hospitals and schools
- Data on the importation and production of thermometers in the country is not available
- Data on the production and importation of mercury to verify the validity of the total consumption of mercury in the country is not available
- Levels for chlor-alkali production are under the assumption that the existing process uses mercury cell technology, which in fact is not the case
- Double accounting of mercury emissions in pulp and paper production because its emission source is due to the production of one of its primary raw material – caustic soda, which is already accounted for in the chlor-alkali production
- Other potential sources of mercury that were not considered:
  - Other coal combustion
  - Mineral oil extraction, refining, and use
  - Other fossil fuels extraction and use
  - Biomass fired power and heat production
  - Coal Mining
  - Limestone quarrying
  - Other production of chemicals and polymers with mercury compounds as catalysts
  - Batteries containing mercury
  - Biocides and pesticides containing mercury
  - Mercury in paint
  - Pharmaceuticals for human and veterinary uses containing mercury
  - Rituals and folklore medicine
  - Recycled mercury production (secondary production)
  - Recycled ferrous metals production (iron and steel)
  - Other recycled metals production
  - Incineration was not considered in the inventory because of the "incineration ban" but some hospitals were given permit for medical wastes incineration
  - Informal local disposal of industrial production waste
  - Informal general waste dumping

2.2.2 Assessment of Future Sources of Mercury Wastes

Present information suggest that future sources of mercury in the Asian region including the Philippines will include primarily mercury recovered as a by-product from various mining and smelting activities, from the cleaning of natural gas, from the closure or conversion of mercury cell chlor-alkali plants, and from other significant sources such as EOL products.

In the short-term, substantial sources of mercury wastes may come from mercury-containing products in the healthcare system that has been mandated by the DOH to be phased out. These include mercury thermometers, sphygmomanometers, gastrointestinal tubes, dental amalgams, barometers, batteries, cleansers and soaps, electrical relays, laboratory chemicals, laboratory manometers, pharmaceutical products, switches, thermostat probes, and thermostats.

Another significant source of mercury wastes that will be generated in the future are busted mercury-containing lamps resulting from the energy efficiency program of the Philippines. Part of the program is the shift to energy efficient lightings (EELs), which replaces all incandescent lamps, except in those sectors/areas where the use of incandescent lamps is critical. As more sectors, including households, shift to EELs, it is expected that the generation of busted mercury-containing lamps will increase.

2.3 INSTITUTIONAL AND REGULATORY FRAMEWORK

This subsection presents the relevant legal, regulatory, and institutional mechanism for managing mercury and mercury-containing wastes in the country.

2.3.1 Policy and Legislative Framework

The Philippines is one of the 173 parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal which took force in 1992 and the DENR–EMB was designated as the country's Focal Point and Competent Authority to the Convention.

Article II, Sections 15 and 16 of the 1987 Philippine Constitution calls for the government to protect and preserve the right to health of Filipinos, and the right of the people to a balanced and healthful ecology. This policy paved the way for the enactment of various environmental policies, one of them is to address the management of toxic and hazardous wastes.

2.3.2 Existing Regulations Addressing Mercury and Mercury-containing Wastes

The Philippines has enacted and is implementing several laws and regulations designed to protect public health and the environment. A number of these legal and regulatory requirements have relevant and specific provisions for managing mercury and mercury-containing wastes. These are discussed subsequently.

Republic Act (RA) 6969: Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990

To respond to the increasing problems associated with the management of toxic substances and hazardous and nuclear wastes, the Philippine Congress enacted RA 6969 in 1990. This law mandates the control and management of importation, manufacture, process, distribution, use, transport, treatment, and disposal of toxic substances and hazardous and nuclear wastes in the country. The objectives of this Act related to the management of toxic and hazardous wastes include:

- Monitoring and regulating the importation, manufacture, processing, handling, storage, transportation, sale, distribution, use, and disposal of

chemical substances and mixtures that present unreasonable risk or injury to health or to the environment in accordance with national policies and international commitments
- Informing and educating the populace regarding the hazards and risks attendant to the manufacture, handling, storage, transportation, processing, distribution, use, and disposal of toxic chemicals and other substances and mixtures
- Preventing the entry, even in transit, keeping or storage, and disposal of hazardous and nuclear wastes into the country for whatever purpose

RA 6969 defines hazardous wastes as substances that are without any safe commercial, industrial, agricultural, or economic usage, and are shipped, transported, or brought from the country of origin for dumping or disposal into or in transit through any part of the territory in the Philippines. The management of mercury and mercury compounds follows the provisions for the generation, transport, treatment, and disposal of hazardous wastes in general. RA 6969 further elucidates provisions on pre-manufacturing and pre-importation requirements, testing of chemicals, exemptions, prohibited acts as well as fines and penalties.

To support RA 6969, several implementing rules and regulations (IRRs) in the form of DENR Administrative Orders (AOs) were issued. Some of these legislations provided more detailed provisions and regulatory requirements for the management of mercury and mercury-containing wastes. These include:

- DENR AO 1992-29: IRR of RA 6969
- DENR AO 1997-38: Chemical Control Order (CCO) for Mercury and Mercury Compounds
- DENR AO 2004-36: Amending Title III of DENR AO 1992-29

DENR AO 1992-29: IRR of RA 6969

DENR AO 1992-29 otherwise known as the IRR of RA 6969 was enacted to provide the detailed implementation requirements for RA 6969. It was constructed to provide rules and regulations to carry out the national policy to regulate, restrict, or prohibit the importation, manufacture, processing, sale, distribution, use, and disposal of chemical substances and mixtures that present unreasonable risk and/or injury to health or the environment; to prohibit the entry, even in transit, of hazardous and nuclear wastes and their disposal into Philippine territorial limits for whatever purpose; and to provide advancement and facilitate research and studies on toxic chemicals and hazardous and nuclear wastes. Among its declared policies, DENR AO 1992-29 clearly indicates that it is the policy of DENR to encourage the proper management of hazardous wastes generated within the country by promoting, in order of preference:

- Minimization of the generation of hazardous waste
- Recycling and reuse of hazardous waste
- Treatment of hazardous waste to render it harmless
- Landfill of inert hazardous waste residues

While RA 6969 only provided an all-encompassing definition of hazardous wastes, Title III of DENR AO 1992-29 categorically defined mercury and mercury

compounds as hazardous wastes under the category "inorganic chemical wastes" with waste number D407. Facilities and entities with these substances are considered as hazardous waste generator and must comply with all requirements that include:

- Regular notification of the type and quantity of hazardous wastes generated
- Submission of comprehensive emergency contingency plans to mitigate and combat spills and accidents involving chemical substances and/or hazardous wastes
- Keeping well-trained personnel and staff on the implementation of the emergency plan as well as the hazard posed by the improper handling, storage, transport, and use of chemical substances and their containers

More importantly, a generator of mercury and mercury-containing wastes continues to own and is responsible for the hazardous waste generated or produced in the premises until the hazardous wastes have been certified by the waste treater as properly treated, recycled, reprocessed, or disposed.

As stipulated in DENR AO 1992-29, hazardous waste transporters shall be duly permitted by the DENR. DENR is likewise responsible for maintaining a register of hazardous waste transporters and treaters. In addition, DENR AO 1992-29 prescribed the following categories of hazardous waste treatment premises, to which hazardous waste may be treated:

- Premises that conduct on-site disposal of hazardous waste generated or produced at the premises through industrial or commercial processes and activities other than disposal via sewer
- Commercial or industrial hazardous waste incinerators
- Landfills, dumps, or pits that accept hazardous waste for disposal
- Premises that recycle or reprocess hazardous waste which were not generated or produced at that premise
- Premises that immobilize, encapsulate, polymerize, or treat hazardous wastes that were not generated or produced at that premise
- Premises that store hazardous wastes, which were not generated or produced at that premise for periods exceeding 30 days

DENR AO 1992-29 also stipulates the requirements for waste storage and labeling, which applies to all waste generators, transporters, and/or treaters. More importantly, it requires the use of a manifest system during the transport of hazardous wastes.

DENR AO 1997-38: CCO for Mercury and Mercury Compounds

Title II Section 20 of DENR AO 1992-29 provides that, should DENR determine that the use, storage, transport, process, manufacture, import, or export of any new substance or a priority chemical poses an unreasonable risk or hazard to public health or the environment, a CCO may be issued to address one or more of the following:

- Prohibit the use, manufacture, import, export, transport, process, storage, possession, or sale of the chemical substance;

- Limit the use, manufacture, import, export, transport, process, storage, possession, or sale of the chemical substance; and
- Place such controls or conditions on the use, manufacture, import, export, transport, process, storage, possession, or sale of the chemical substance to abate or minimize risks or hazards posed by the chemical substance on public health and environment.

DENR promulgated DENR AO 1997-38 or the CCO for Mercury and Mercury Compounds to control the use and dispersion of mercury into the environment thereby avoiding its adverse consequences. DENR AO 1997-38 covers the importation, manufacture, processing, use, and distribution of mercury and mercury compounds. It likewise covers the treatment, storage, and disposal of mercury-bearing or mercury-contaminated wastes in the Philippines. DENR AO 1997-38 aims to:

- Reduce hazards to health and the environment from the use, handling, management, transport, and disposal of mercury, and from subsequent release and the exposure to mercury;
- Establish requirements and procedures for importation (for use in commerce), transport, manufacturing, labeling, re-labeling, spill handling, emergency procedures, and proper treatment, storage, and disposal of mercury and mercury compounds as well as mercury-contaminated containers and mercury-bearing or mercury-contaminated wastes;
- Establish limitation on the use of certain mercury and mercury-containing substances;
- Control and regulate the disposal of mercury-contaminated wastes and establish requirements so that access to, use, and disposal of any mercury and mercury-containing materials will be limited to persons who have the expertise and facilities to handle these substances with minimum discharge to the environment; and
- Establish a registration, monitoring, and compliance program to enforce the tenets and covenants of the CCO.

DENR AO 1997-38 reinforces the requirements and procedures in DENR AO 1992-29 in that the CCO provides more specific requirements to address sound management of mercury and mercury-containing wastes. Entities that use or purchase mercury for industrial purposes are required to secure license from DENR-EMB's Chemical Management Section (CMS), while importers of mercury are required to secure Importation Clearance. Consistent with the requirements of DENR AO 1992-29, treatment, transport, storage, and disposal of mercury requires the securing of registration from DENR-EMB. Further, as part of the registration process, the CCO requires the development and submission of a Mercury Management Plan, which should provide the detailed process in managing mercury, ensuring that mercury is managed to minimize, if not eliminate the risks to public health and to all environmental media. The Mercury Management Plan is also an assurance that the facilities using mercury and generating mercury waste have the appropriate and effective mechanisms in handling mercury used as raw materials or produced as waste. Aside from proper management, mercury waste minimization programs are likewise reflected in the Mercury Management Plan to be submitted to DENR-EMB.

Limitations and restrictions on the use and disposal of mercury and mercury compounds are more specific in the CCO. The use of mercury and mercury

compounds is strictly limited to the following end-users as stipulated in Section 7 of the CCO:

- 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

DENR AO 1997-38 requires a strict implementation and keeping of required reports and records. Specified forms, frequency of submission, and records of transactions including quantity of product supplied and wastes produced are detailed in the requirements of DENR AO 1997-38.

Lastly, DENR AO 1997-38 presents provisions on the information, education, and communication (IEC) as well as training requirements. The CCO specifies the collaborative effort among government agencies, industry associations, non-governmental organizations (NGOs), professional organizations, and the academe for the promotion of public awareness on the beneficial use of mercury and mercury compounds along with the accompanying hazards and risks involved in the use of the chemical.

DENR AO 2004-36: Procedural Manual for Title III of DENR AO 1992-29

From the time DENR AO 1992-29 was promulgated, systems and procedures, especially in handling hazardous wastes, have already evolved. In 2004, DENR-EMB issued DENR AO 2004-36 or the Procedural Manual for Title III of DENR AO 1992-29, which was designed to serve as guide for DENR-EMB staff; existing and prospective waste generators, transporters, and treaters; environmental units of government agencies, local government officials, non-government or people's organization; and other stakeholders in the implementation of proper hazardous waste management. It provided a clearer and updated coverage and definition of hazardous wastes as well as technical standards and requirements for hazardous waste generators, transporters, and premises/facilities involved in the treatment, storage, recycling, reprocessing, and disposal of hazardous wastes in the Philippines. DENR AO 2004-36 amends the provisions of Title III in DENR AO 1992-29.

One of the major updates in DENR AO 2004-36 was the inclusion of quantitative criteria for determining if mercury and mercury-containing wastes are considered hazardous wastes or not. Under DENR AO 2004-36, mercury and mercury compounds were still classified under wastes with inorganic chemicals, with waste number D407. However, mercury and mercury-containing wastes were quantitatively defined as wastes with a total mercury concentration of >0.2 mg/L based on analysis of an extract, which also includes organomercury compounds. This new categorization of mercury-containing waste requires a quantitative determination of mercury concentration through the application of a Toxicity

Characteristic Leaching Procedure (TCLP). Under DENR AO 2004-36, not all mercury and mercury-containing wastes are immediately considered hazardous, unless such wastes contain the specified total mercury concentration.

Aside from the quantitative criteria for identifying mercury and mercury-containing wastes, the requirements for the Waste Transport Record or the Manifest System were likewise expounded in DENR AO 2004-36. The transfer of documents among the generator, transporter, and treater were made more specific. In addition, requirements for generators, transporters, and treaters described in DENR AO 1992-29 were expounded in DENR AO 2004-36.

In 2007, DENR AO 2004-36 was reviewed and revised accordingly. Certain provisions concerning the management of mercury and mercury-containing wastes were revised. However, the revised DENR AO 2004-36 is still under the policy review process and is yet to be approved by the DENR Secretary. Among the pertinent revisions are as follows:

- Quantitative classification of mercury and mercury-containing wastes (D407) were re-classified as those that have a total mercury concentration of >0.1 mg/L based on analysis of extract
- Unused mercury-containing products such as busted mercury-containing lamps, waste electronic and electrical equipment (WEEE) were specified as hazardous wastes with specific category

- Large and small hazardous waste generators were delineated according to the volume and type of hazardous waste generated
- Online tracking of registered hazardous waste generators, transporters, and treaters was introduced as well as online hazardous wastes manifest system

These revisions were made to have a more effective and efficient management of hazardous wastes including mercury and mercury-containing wastes.

Joint DOH-DENR AO 2005-02: Policies and Guidelines on Effective and Proper Handling, Collection, Transport, Treatment, Storage, and Disposal of Health Care Wastes

The management of biological and hazardous wastes generated from health care facilities is intensified in the Joint DOH-DENR AO (JAO) 2005-02. JAO 2005-02 presents the Policies and Guidelines on Effective and Proper Handling, Collection, Transport, Treatment, Storage, and Disposal of Health Care Wastes. It clearly defines the jurisdiction, authority, and responsibilities between DOH and DENR and their respective Bureaus. More importantly, JAO 2005-02 aims to harmonize the efforts of DOH and DENR on proper health care waste management.

Handling, collection, storage, and treatment of mercury-containing health care wastes are in accordance with the requirements of RA 6969, RA 8749 Philippine Clean Air Act of 1999, RA 9003 Ecological Solid Waste Management Act of 2000, and the DOH Health Care Waste Management Manual.

DOH AO 2008-21: Gradual Phase-out of Mercury in all Philippine Health Care Facilities and Institutions

DOH promulgated DOH AO 2008-21, which pertains to the Gradual Phase-out of Mercury in all Philippine Health Care Facilities pursuant to the provisions of RA 6969, DENR AO 1992-29, DENR AO 1997-38, RA 9275, and other relevant laws. This AO is applicable to all health care facilities defined to include hospitals, infirmary, birthing homes, and clinics: In this context, clinics may mean one of the following: medical ambulatory, dialysis, health care centers and dispensaries, surgical, alternative medicine, dental, or other medical facilities that require license/certification/accreditation from DOH.

DOH AO 2008-21 sets forth the stoppage of the distribution of mercury thermometers to patients as part of the hospitals admission/discharge kits. It also requires all hospitals to follow the guidelines for the gradual phase-out of mercury in health care facilities.

For new health care facilities, DOH AO 2008-21 requires the submission of an inventory of all mercury-containing devices to be used and a corresponding mercury elimination program. All health care facilities other than hospitals are also required to make a Mercury Minimization Program based on a set of guidelines set by AO.

DOH AO 2008-21 also requires the designation of the Mercury Management Team under the Hospital Waste Management Committee in all health care facilities. The Mercury Management Team in each health care facility shall have accomplished the following for the first six months of their inception:

- Conduct a Mercury Audit of their facility, including assessment of costs of switching to alternative devices;
- Develop and manage a Mercury Minimization Program;
- Draft and implement a purchasing policy requiring vendors to sign a mercury-content disclosure agreement that covers products intended for purchase and communicate to suppliers the eventual mercury-free purchasing policy;
- Conduct a facility-wide information campaign and employee education on the consequences of mercury-use as well as the accomplishment of personnel training on preventing and proper handling of mercury spills; and
- Identify and remove unnecessary practices that promote the use and distribution of mercury-containing medical devices.

DOH AO 2008-21 sets a clear timeline on the implementation of the phase-out program. It provides that 24 months from its effectivity, all hospitals should have accomplished the following:

- Full implementation of the Mercury Minimization Program;
- Switch from mercury-containing devices to alternatives;
- Development and implementation of waste segregation and recycling program to further reduce mercury waste stream for cases where no alternative products exist (e.g. mercury-containing batteries and fluorescent light bulbs);
- Identification of a mercury collection area within the facility;
- Development of proper temporary mercury storage room in the facility that is not accessible to the public;

- Incorporation of mercury management module in the training program for new personnel; and
- Display of information materials on mercury for the benefit of the patients and the general program.

RA 8749: Philippine Clean Air Act of 1999 and DENR AO 2000-81: IRR of RA 8749

The management of mercury releases into the atmosphere is covered by the provisions of RA 8749 and its IRR (DENR AO 2000-81). RA 8749 defined provisions for a healthful ecology through the management of air quality by controlling mercury emissions from stationary sources and non-burn technologies.

Article 3, Section 19 of RA 8749 provided the emission standard for mercury emissions from stationary sources. This emission standard is based on mass rate emission for all stationary sources, where a limit of 5 milligram per normal cubic meter (mg/NCM) was set as the maximum allowable limit for mercury existing as elemental mercury in each identified stationary source.

Aside from setting a maximum allowable limit for the release of mercury from stationary sources, Article 3, Section 20 presents provisions on the banning of incineration an activity which significant percentage of mercury emissions originate. Based on the 2008 Mercury Assessment for the Philippines using the UNEP Inventory Toolkit, 45 percent of the mercury output distribution is accounted for as releases into the atmosphere. Banning the incineration of municipal, bio-medical, and hazardous wastes is one of the initiatives under RA 8749 to minimize if not eliminate release of mercury into the atmosphere. Further, RA 8749 mandates the LGUs to promote, encourage, and implement a comprehensive ecological waste management that includes waste segregation, recycling, and composting. This is one way to encourage non-burn practices for the disposal of solid wastes.

In lieu of the banned incineration practices to treat municipal, bio-medical, and hazardous wastes, the requirements for the use of non-burn treatment technologies were provided in DENR AO 2000-81. A maximum value of 0.05 mg/NCM was set for mercury compounds emitted from non-burn technologies.

RA 9275: Philippine Clean Water Act of 2004, DENR AO 2005-10: IRR of RA 9275, DENR AO 1990-34: Revised Water Usage and Classification, and DENR AO 1990-35: Revised Effluent Regulations of 1990

The management of toxic and hazardous pollutants in water bodies is covered by the provisions of RA 9275 or the Philippine Clean Water Act of 2004 and its IRRs such as DENR AO 2005-10, DENR AO 1990-34, and DENR AO 1990-35.

DENR AO 2005-10 provides for the detailed implementation of RA 9275. Both DENR AOs 1990-34 and 1990-35 are interim regulations until the revised Water Quality Guidelines (WQG) and General Effluent Standards (GES) are promulgated. Table 2-2 shows the existing guideline values and effluent standards specific for mercury per type of receiving water body.

Table 2-2. Water Quality Criteria and Effluent Standards

Water Classification/ Beneficial Use	Water Quality Criteria (DENR AO 1990-34) mg/L	Effluent Standards (DENR AO 1990-35) mg/L
Class AA Public water supply requiring minimal disinfection	0.002	No discharge allowed
Class A Public water supply requiring complete treatment	0.002	0.005
Class B Recreational with skin contact	0.002	0.005
Class C Recreational (non-contact), fishery, and industrial use (manufacturing)	0.002	0.005
Class D Agriculture, irrigation, livestock watering, industrial supply (cooling), navigational	0.002	No value
Class SA Propagation of shellfish for commercial purposes and tourist zones/national marine parks/reserves and coral reef parks/reserves as designated by law and concerned authorities	0.002	No discharge allowed
Class SB Recreational (contact), and fishery (spawning areas for *Chanos chanos* or "Bangus" and similar species)	0.002	0.005
Class SC Recreational (non contact), fishery (commercial and sustenance fishing), marshy and/or mangrove areas declared as fish and wildlife sanctuaries	0.002	0.005
Class SD Industrial supply (e.g. cooling, etc.) and other coastal and marine water, by their quality, belong to this classification.	Not considered necessary	0.01

In a more recent revision of the WQG and GES, these limits for mercury were revised based on the new Philippine National Standards for Drinking Water (PNSDW) as well as new studies on the health and environmental impacts of mercury. In addition, the classification and beneficial uses for some water bodies were changed. The revised WQG and GES are presented in Table 2-3.

Table 2-3. Revised WQG and GES* for Mercury

Water Classification/ Beneficial Use	Water Quality Criteria (DENR AO 1990-34) mg/L	Effluent Standards (DENR AO 1990-35) mg/L
Class AA	0.001	No discharge

Water Classification/ Beneficial Use	Water Quality Criteria (DENR AO 1990-34) mg/L	Effluent Standards (DENR AO 1990-35) mg/L
Public water supply requiring minimal disinfection		allowed
Class A Public water supply requiring complete treatment	0.001	0.002
Class B Recreational with skin contact	0.001	0.002
Class C Recreational (non-contact), fishery, and industrial use (manufacturing), agriculture, irrigation, livestock watering,	0.002	0.004
Class D Industrial supply (cooling), navigational	0.004	No value
Class SA Propagation of shellfish for commercial purposes and tourist zones/national marine parks/reserves and coral reef parks/reserves as designated by law and concerned authorities	0.001	0.002
Class SB Recreational (contact), and fishery (spawning areas for *Chanos chanos* or "Bangus" and similar species)	0.001	0.002
Class SC Recreational (non-contact), fishery (commercial and sustenance fishing), marshy and/or mangrove areas declared as fish and wildlife sanctuaries	0.002	0.004
Class SD Industrial supply (e.g. cooling, etc.) and other coastal and marine water, by their quality, belong to this classification.	0.004	0.008

The revised GES also identified significant effluent parameters for each industry. Based on this, the following sectors are required to comply with the effluent standards for mercury:

- Gold ore mining and processing
- Copper ore mining and processing
- Chromite ore mining
- Coal mining
- Publishing
- Extraction of crude petroleum and natural gas
- Manufacture of inorganic acids, alkalis, and chlorine
- Manufacture of organic acids and organic compounds
- Manufacture of fertilizer and nitrogen compounds
- Pesticides and other agro-chemical products
- Manufacture of paints and paint products, varnishes, and similar coatings, printing inks, and mastics

- Manufacture of pharmaceuticals, medicinal/chemicals, and botanical products
- Manufacture of rubber products
- Manufacture of basic iron and steel
- Gold and other precious metal refining
- Non-ferrous smelting and refining, except precious metals
- Non-ferrous rolling, drawing, and extrusion mills
- Manufacture of pipe fittings of nonferrous metal
- Manufacture of basic precious and non-ferrous metal
- Non-ferrous metal casting such as aluminum, copper, and zinc alloys
- Manufacture of office, accounting & computing machinery; electrical machinery and apparatus; computers and peripherals; electric motors, generators, transformers including primary cells and batteries; medical and optical instruments
- Manufacture of motor vehicles, trailers, and semi trailers
- Manufacture of other transport equipment including ship building, repairing, and dismantling
- Manufacture and repair of furniture
- Manufacture of jewelry and related articles
- Generation, collection, and distribution of electricity
- Sewage and refuse disposal sanitation and similar activities
- Solid waste management facilities
- Scrubbing of flue gases from firing systems

RA 9003 Ecological Solid Waste Management Act of 2000 and DENR AO 2001-34: IRR of RA 9003

RA 9003 or was enacted to address the growing concerns on the management of solid wastes in the country, particularly those from the household and commercial sectors. The relevant provisions of this law are the requirements on the management of household "special wastes".

Under RA 9003 and its IRR, "special wastes" include household hazardous wastes such as paints, thinners, household batteries, lead-acid batteries, spray canisters, and the like. These include wastes from residential and commercial sources that comprise of bulky wastes, consumer electronics, white goods, yard wastes that are collected separately, batteries, oil, and tires. These wastes are usually handled separately from other residential and commercial wastes and are the possible sources of mercury.

RA 9003 mandates the local government to include in their Solid Waste Management Plan the handling and disposal for special waste or household hazardous wastes.

DOH AO 2007-12: Philippine National Standards for Drinking Water (PNSDW)

To protect public health, the Philippines has established the PNSDW, which sets the quality criteria for the county's drinking water. The set limits are intended to minimize the risk of infecting the public, and by doing so, prevent deleterious health repercussions that result from lifelong exposure to these impurities through the consumption of water.

In 2007, the DOH amended the PNSDW in response to the amendment of the World Health Organization. Based on DOH AO 2007-12, the new maximum limit for mercury in drinking water is 0.001 mg/L, and must be analyzed through Cold Vapor Atomic Absorption Spectroscopy (CV-AAS) or Inductively Coupled Plasma-Mass Spectrometry (ICP-MS).

RA 7160: Local Government Code of 1991

The Local Government Code of 1991 epitomizes the constitutional policy on local autonomy and decentralization of functions in the government. The Code requires LGUs to endeavor being self-reliant and continue exercising the powers and discharging the duties and functions currently vested on them. The Code also requires LGUs to discharge the functions and responsibilities of national agencies and offices devolved to them as well as those that are necessary, appropriate, or incidental to the efficient and effective provision of the basic services and facilities enumerated under the law. The basic services mentioned include solid waste collection.

To effectively and efficiently deliver the basic services and facilities, an ordinance enacted by the Sangguniang Bayan is necessary to implement the solid waste management plans of LGUs. Further, the LGU, through the ordinance, can impose fines of not exceeding two thousand five hundred pesos (PhP 2,500.00) or imprisonment for a period not exceeding six months, at the discretion of the courts.

RA 7394: Consumer Act of the Philippines

In 1991, RA 7394 or the Consumer Act of the Philippines declared the policy of the state to protect the interest of the consumer, promote his general welfare, and establish standards of conduct for business and industry. Although no specific provision pertains to the management of mercury-containing products, RA 7394 mandates the State to implement measures to achieve protection against hazards to health and safety in connection with the use of consumer products and services. RA 7394 also mandates the protection of the public against unreasonable risks to injury associated with consumer products. Further, RA 7394 regulates or bans goods that are hazardous or unsafe.

AO 183 Directing the Use of Energy Efficient Lighting/Lighting Systems (EELs) in Government Facilities

AO 183 provides the mandatory use of EELs in all department, bureaus, offices, agencies, and instrumentalities of the Philippine Government, including National Government Agencies, State Universities and Colleges, Government Owned and Controlled Corporations, Government Financial Institutions, and other government entities. An indirect impact of this AO is the subsequent generation of mercury-containing lamps.

RA 7942: Philippine Mining Act of 1995

Through the promulgation of RA 7942 or the Philippine Mining Act of 1995, the State was mandated to promote the rational exploration, development, utilization, and conservation of mineral resources through the combined efforts of the government and the private sector. This shall be done to enhance national growth

in a way that effectively safeguards the environment and protects the rights of affected communities.

RA 7942 does not have specific provisions on the management of mercury wastes. The Terms and Conditions of the Financial and Technical Assistance Agreement under RA 7942 only broadly requires the proponent to effectively use appropriate anti-pollution technology and facilities to protect the environment and to restore or rehabilitate mined areas and other areas affected by mine tailings and other forms of pollution or destruction.

RA 7076: People's Small Scale Mining Act of 1991 and DENR AO 1997-30: Small-Scale Mine Safety Rules and Regulations

In 1991, RA 7076 was promulgated to promote, develop, protect, and rationalize viable small-scale mining activities to generate more employment opportunities and provide equitable sharing of the nation's wealth and natural resources. Small-scale mining is one of the leading sources of mercury emissions and discharges. The law requires the designation of mining areas that can be utilized, and registration of small-scale miners. RA 7076 does not have provisions to address mercury releases produced in the mining process.

DENR AO 1997-30 or the Small-Scale Mine Safety Rules and Regulations focused on the safety precautions and measures that operators of small-scale mines must take. It required reporting and record-keeping of accidents, including exposure to toxic substances. To address safety of workers, DENR AO 1997-30 set 0.10 mg/m^3 as the allowable limit of mercury in dusts. Aside from this, no other measures to address mercury-related incidents were included.

2.3.3 Management Responsibilities of Mercury and Mercury-containing Wastes

DENR through EMB is the primary regulatory agency mandated by law for the proper management of mercury and mercury-containing wastes in the Philippines. EMB is tasked to implement the provisions and requirements of the primary regulations that address the management of mercury and mercury-containing wastes; including RA 6969, its IRR and related DENR AOs, RA 9275, RA 8749, and RA 9003. These regulations govern the management of mercury from its source on to its release to different environmental media, where the enforcement and compliance monitoring is decentralized to the EMB Regional Offices (EMB ROs).

The policy making and overall monitoring of the mandates are vested on the EMB Central Office (CO) through the following divisions:

- **Environmental Impact Assessment and Management.** Mandated to implement the Philippine Environmental Impact Statement System through the issuance of ECC for new and proposed development including modifications, enhancement of existing projects. This tool is critical as requirements for environmental management and monitoring for all projects can be defined as early as this stage of the business operations.

- **Environmental Quality.** Mandated to implement the policy and planning component of the major environmental regulations through the following sections:

- Air Quality Management – Tasked to implement RA 8749 and its IRRs
- Water Quality Management – Tasked to implement RA 9275 and its IRRs
- Chemical Management – Tasked to implement Title II of RA 6969 including the CCOs
- Hazardous Waste Management – Tasked to implement Title III of RA 6969 and its IRRs. This section maintains the nationwide registration of TSD service providers.

- **Research and Development.** Mandated to formulate, develop, coordinate, and implement short-term and long-term research programs at the national and regional levels. They implement the Laboratory Recognition process of EMB for environmental monitoring laboratories.

The management of mercury and mercury-containing wastes involves a lot of government agencies considering the life cycle of these wastes. Table 2-4 presents the interaction of the government agencies mandated in the management of mercury and mercury-containing wastes, from the source to its disposal, including the monitoring aspect of the environmental media and the populace.

Table 2-4. Roles of Agencies in the Management of Mercury and Mercury-containing Wastes

Mercury Life Cycle Level	Responsible Agency
Mercury Use	
Industrial use	
Storage	EMB-CMS
Importation	Department of Trade and Industry (DTI) Bureau of Customs (BOC) EMB-CMS
Manufacture/Processing/Use/Distribution	EMB-CMS
Use in lamps	DTI-Bureau of Product Standards Department of Energy
Use in health care facilities	Department of Health
Use in mining	Local Government
Mercury-Containing Wastes	
Generation	EMB-Hazardous Waste Management Section (HWMS)
Storage	
Transport	
Treatment	
Release into the environment (air, water, land)	• EMB [HWMS, Air Quality Management Section (AQMS), Water Quality Management Section (WQMS), NSWMC] • LGUs
Inventory and monitoring	EMB-HWMS
Other Functions	
Gradual phase-out of mercury-containing health care devices	DOH EMB-HWMS
Research and development	EMB-HWMS EMB-CMS
Public health concerns	DOH
IEC and advocacy	EMB, DOH, Department of Science and Technology (DOST), NGOs

2.3.4 Current Enforcement Requirements Relevant to Mercury and Mercury-containing Wastes

The management of mercury and mercury-containing wastes in the Philippines is a collaboration of various agencies and sections within a government agency. One key approach applied in the Philippines is following the trail of mercury emissions throughout the various environmental media. This way, the fate of mercury in the environment is covered by regulatory and monitoring requirements.

Table 2-5 summarizes the enforcement requirements for each aspect affected by mercury and mercury-containing waste.

Table 2-5. Summary of Enforcement and Monitoring Requirements

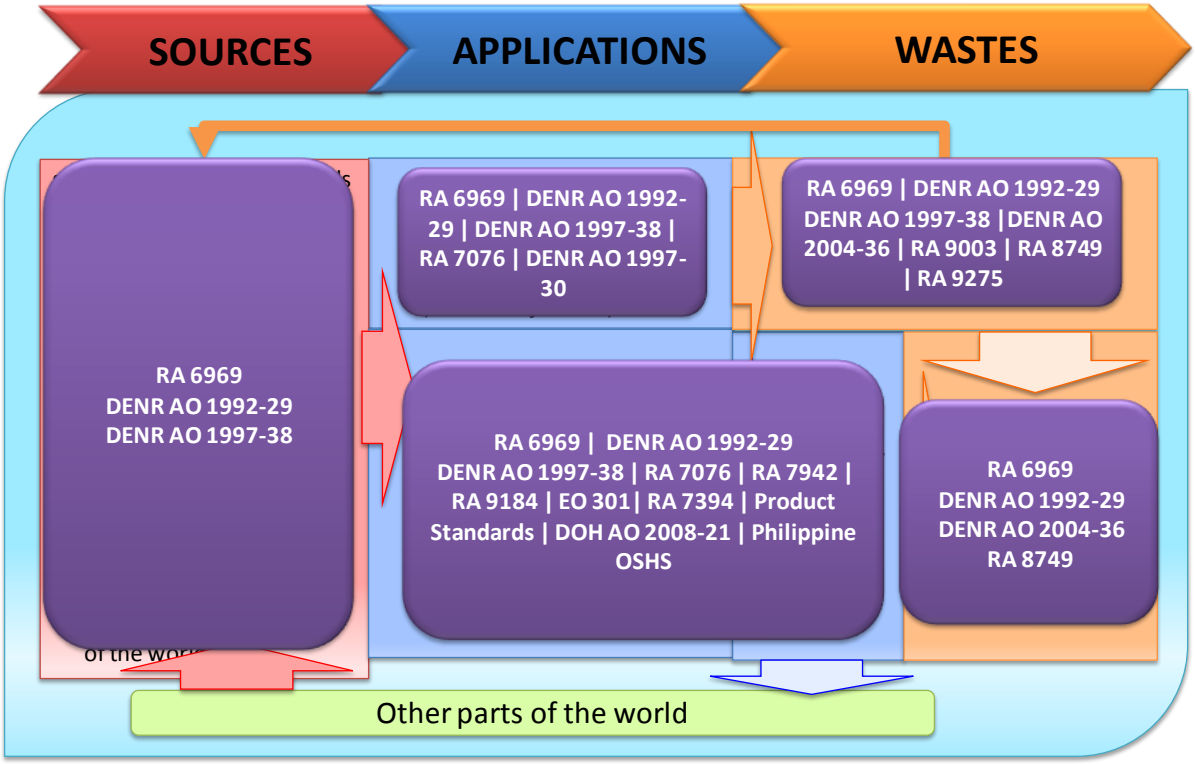
Aspect	Applicable Legal and Other Regulations	Responsible Agency	Requirements
Management of mercury and mercury-containing wastes	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB HWMS, CMS	• Wastes may be considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
Air emissions	RA 8749, DENR AO 2000-81	DENR-EMB AQMS	• Mercury-containing air emissions must comply with the National Emission Standards for Source-Specific Air Pollutants, NESSAP (5 mg/NCM) and the standards for non-burn technologies (0.05 mg/NCM) • Secure Permit to Operate or Permit to Construct for new source • Submission of Self-Monitoring Report (SMR) to governing EMB RO to include emission rates and status of compliance with standards
Effluent discharges	RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB WQMS	• Compliance with a limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body

Aspect	Applicable Legal and Other Regulations	Responsible Agency	Requirements
			• Securing/Renewal of Discharge Permit • Quarterly submission of SMR
Mercury-containing health care wastes	DOH AO 2008-21	DOH	• Conduct of Mercury Audit • Development and implementation of Mercury Minimization Program
	Joint DOH-DENR AO 2005-02	DOH DENR-EMB HWMS	• Following the conditions of DENR AO 2004-36, mercury-contaminated health care wastes may be considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • Registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
Solid wastes	RA 9003, DENR AO 2001-34	DENR-EMB NSWMC, LGUs	• RA 9003 applies to mercury-containing "special wastes" which are from domestic and commercial sources. Depending on concentration of mercury, the requirements of RA 6969 shall apply. • Development and Implementation of Solid Waste Management (by LGUs)

2.3.5 Summary and Assessment of the Institutional and Regulatory Framework

In summary, the Philippines has in-placed policy, legal, and regulatory framework for managing mercury and mercury-containing wastes. As shown in Figure 2-3, almost all aspects of the life cycle of mercury and mercury-containing wastes are covered by legal requirements.

Figure 2-3 Summary of Legal and Regulatory Requirements for Mercury and Mercury-containing Wastes



Despite the number of legal and regulatory tools for managing mercury and mercury-containing wastes, there are still a number of critical issues anchored on the weakness of the legal and regulatory policies. These may be attributed to the following:

- Management of mercury and mercury-containing wastes are contained in several laws and regulations and are therefore managed or enforced by different agencies. This in turn resulted to the lack of cohesiveness in the entire management aspect of these wastes.
- Laws and regulations are quite outdated having been promulgated as early as 1990. These need to be updated in consonance with the international trend in mercury and mercury-wastes management.
- Provisions in these laws and regulations are not specific enough to facilitate effective identification and categorization of mercury and mercury-containing wastes
- Resources are insufficient among the implementing agencies resulting to poor compliance as shown by the following:
  - Not all generators of mercury and mercury-containing wastes have registered
  - Not all sources of mercury and mercury-containing wastes are reported
  - Performance standards on handling and TSD are generally not followed
- Interface among concerned government agencies is weak as their specific management roles and responsibilities are not clearly defined

2.4 MONITORING PROGRAMS AND SUPPORTING INFRASTRUCTURE RELEVANT TO RELEASES OF MERCURY RESULTING FROM MERCURY AND MERCURY-CONTAINING WASTES

This subsection presents the existing monitoring programs, infrastructure for these activities, and assessment in terms of the required program and infrastructure for effectively monitoring the impacts of mercury and mercury-containing wastes.

2.4.1 Existing Monitoring Programs

The dispersal of mercury into the atmosphere, water supply, and soil caused by improper management of mercury and mercury-containing wastes is quite significant and warrants appropriate action. Concurrent to the regulatory requirements discussed in Section 2.3 of this Report are the monitoring activities. Annex 2 presents the existing programs for monitoring mercury and mercury-containing wastes as required by laws and regulations and the corresponding agencies/organizations tasked for such activity.

2.4.2 Infrastructure for Mercury Monitoring

Monitoring of mercury in different environmental media and in humans and animals is essential given that elemental (Hg^0) and oxidized (Hg^{2+}) mercury are persistent in the environment for extended periods that could last a number of years. Several methods are available to analyze mercury, but the analytical instrumentation technique widely used in the country is CV-AAS. However, the acceptable samples for mercury analysis as well as their corresponding sample preparation/digestion methods depend largely on the media from which samples were taken. Table 2-6 lists the entities that have the capacity to analyze mercury in the country and the standard methods of analysis they employ.

Table 2-6. Entities that Analyze Mercury

Agency/Office	Samples	Standard Method of Analysis
Bureau of Fisheries and Aquatic Resources (BFAR)	Fish and fishery products; Water	American Public Health Association (APHA) Standards; Association of AOAC International (AOAC) Standards; CV-AAS
DENR Mines and Geosciences Bureau (DENR-MGB)	Ground and surface water; Rocks, minerals, soils, stream sediments, and similar materials	CV-AAS
DOH National Reference Laboratory	Water	Standard Methods for the Examination of Water and Wastewater (SMEWW); ICP-MS; CV-AAS
Department of Energy (DOE) Geo-scientific Research and Testing Laboratory	Coal; Water (geothermal); Soil and sediments (geothermal)	CV-AAS
Food Development Center	Fish and fishery products	APHA Standards; AOAC Standards; CV-AAS
Philippine Institute of Pure and Applied Chemistry	Food (tuna, fish, and other seafood products); Biological	APHA Standards; AOAC Standards; SMEWW; CV-

Agency/Office	Samples	Standard Method of Analysis
	samples (blood, serum, urine, and hair); Soil; Water (deepwell, drinking, spring, geothermal, lake/river, and waste); Sludge (geothermal origin); Trace metals	AAS
Chempro Analytical Services Laboratories, Inc.	Biological Samples (blood, serum, urine, hair, and nail); Fish and fishery products; Water; Soil/sediments; Air filters (air monitoring); Plants	AOAC Standards; SMEWW; CV-AAS
SGS Philippines, Inc.	Air samples (gas bags and adsorption tubes); Soil (soil, sludge, and water bottoms); Waste (hazardous waste, industrial waste); Water (wastewater, groundwater, process water, drinking water); Fish and fishery products	APHA Standards; AOAC Standards; SMEWW; CV-AAS

In addition to the use of CV-AAS as the method of choice for all samples, ICP-MS is used by the DOH although mercury is not listed as an analyte for such instrumentation. ICP-MS can offer very impressive detection limits; however, an ICP-MS unit costs a lot more than CV-AAS. Moreover, advanced technologies employ High-performance Liquid Chromatography coupled with ICP-MS (HPLC-ICP-MS) which allows separation of mercury compounds at ambient temperature without prior derivatization and easy automation. In spite of this alternative, the HPLC-ICP-MS instrumentation system is not used in the analysis of mercury in the Philippines.

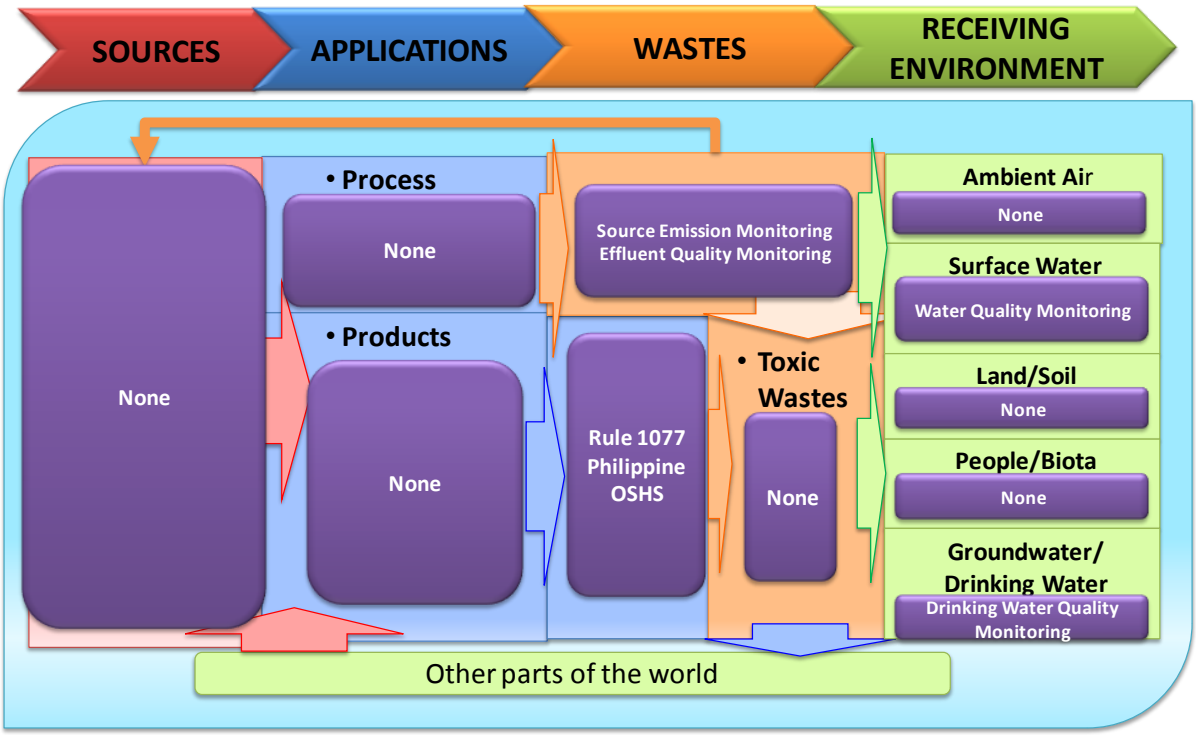
The different agencies tasked to monitor mercury in different media generally have the capability to perform such duties in terms of accessibility to equipments and reagents. However, a lot still needs to be done to strongly implement the existing legislation on mercury monitoring, including more comprehensive monitoring programs for ambient air, soil, groundwater, and solid wastes.

2.4.3 Summary and Assessment on Mercury and Mercury-containing Wastes Monitoring Programs

The existing monitoring programs for mercury are embodied in the environmental laws and regulations. The existing infrastructures are therefore complementary only to what is required by these laws and regulations. As shown in Figure 2-4, the monitoring programs are available only for:

- Surface water quality as mandated by DENR AO 1990-34
- Effluent quality as mandated by DENR AO 1990-35
- Source emission as mandated by DENR AO 2000-81
- Workers' exposure as mandated by Rule 1077 of the Philippine Occupational Safety and Health Standards (OSHS)
- Drinking water quality as mandated by DOH AO 2007-12

Figure 2-4 Existing Monitoring Programs for Mercury and Mercury-containing Wastes Along its Life Cycle



There are no monitoring programs for mercury in:

- **Products**. Toxic substances in products, including mercury are generally not regularly tested as this aspect is not integrated in the product standards development process of the Bureau of Products Standards (BPS). Currently, the BPS together with the DOE is expanding the product standards for EELs, which include disclosure of mercury content. Corollary to this, a regular program for validating the disclosed mercury content in lamps has to be established. Other products that may possibly have mercury like cosmetics need to have the same process of setting product standards.

- **Solid/Hazardous Wastes**. Solid/hazardous wastes including sludge require no regular monitoring. The conduct of TCLP is a one-time process just to establish the mobility of toxic substances in the solid material. This is not a required regular activity.

- **Ambient Air, Soil, Groundwater**. There are no monitoring programs for mercury in ambient air, soil, and groundwater and this can be attributed to the lack of criteria or guideline values. Consequently, infrastructures to support these activities are not yet established in the country.

- **People**. There is no established program to monitor people that are potentially at risk from mercury exposure due to handling of mercury and mercury-containing wastes. Although there are laboratories that can handle this process, the activity is not regulatory-driven and as such is being done only in response to an incident.

- **Biota**. Mercury monitoring in fish and other biota is not being conducted on a regular basis but mostly as a result of incidents, complaints, or investigative studies.

2.5 KNOWLEDGE AND AWARENESS LEVEL

The government and several NGOs have exerted efforts to increase the awareness of the people regarding the toxicity of mercury and mercury-containing products. Table 2-7 shows the existing IEC activities of some agencies to enhance understanding of the dangers associated with mercury.

Table 2-7. IEC Activities of Various Agencies

Agency/NGO	Goals/Activities
DENR	Hosted the Inception Workshop on the Strategic Planning for Artisanal and Small Scale Gold Mining (ASGM) on January 19-21, 2010. The workshop aimed to minimize and eliminate mercury uses and releases in the ASGM sector.
DOE	Created the Procedural Guideline on Mercury-Containing Lamp Waste Management to provide instruction for the environmentally sound TSD procedures for lamp wastes in the country
DOH	• Released a memorandum on 12 February 2007 to all regional/hospital directors regarding the guidelines for handling elemental mercury spills at homes, schools, and medical facilities • Released AO 2008-21 requiring the phase-out of mercury containing products in all government hospitals and health care facilities by September 2010
Ban Toxics!	• Conducted a) several workshops to increase awareness in schools and universities in the Philippines to promote a mercury-free school program; and b) a national forum on mercury waste and storage • Released a brochure on Mercury-Free Schools to educate young people on mercury toxicity. The brochure contains basic facts about mercury, its sources, uses, and toxicity, and the Mercury Cycle. • Produced a Mercury Alternative Handbook specifying available alternatives to mercury-containing products and emergency procedures in case of spills • Published in 2009 the Terminal Storage Options for Mercury Wastes in the Philippines which: – Investigated the various options for the terminal storage of mercury – Provided insights on the environmentally sound options for the terminal storage of mercury ensuring permanent retirement of mercury from use and commerce – Presented necessary information to aid understanding the consequences of improper mercury waste disposal and the need for ESM of mercury waste – Enhanced awareness at the regional/international level of the challenges faced by a developing country, such as the Philippines, in the disposal of mercury waste – Provided a roadmap for other countries with similar challenges
Health Care without Harm	• Supporting and conducting campaign on eliminating mercury-containing products in Health Care facilities and institutions

Agency/NGO	Goals/Activities
	• Conducting and soliciting support on the Philippine countdown for Philippine Mercury Watch Countdown to 2010
Eco-waste Coalition	• Published and currently distributing IEC materials on the proper management of mercury-containing lamp wastes • Implementing advocacy programs on mercury exposures and the corresponding ill-health effects

In general, there is limited knowledge and low awareness among the people regarding mercury and the hazards associated with it. Considering that the current dissemination of information on mercury and mercury-containing wastes only utilizes limited media (e.g. brochures, pamphlets, and posters), part of the action plan may consider the use of an approach that would reach a bigger percentage of the stakeholders.

2.6 RESEARCH AND DEVELOPMENT ON ESTABLISHING BEST AVAILABLE TECHNIQUES (BAT) AND BEST ENVIRONMENTAL PRACTICES (BEP)

The DOST is the research and development arm of the Philippines. Within this department, the Industrial Technology and Development Institute (ITDI) has specific mandates on providing research and development programs and support for environmental initiatives.

Other agencies that have mandates to perform research and development are:

- Ecosystems Research and Development Bureau of DENR
- Research and Development Division of DENR-EMB
- Bureau of Agricultural Research of the Department of Agriculture (DA)
- Food and Drug Administration (FDA) of DOH
- Metals Industry Research and Development Center of DOST

Currently, there are no existing research and development programs pertaining to mercury and mercury-containing wastes, specifically on applicable BAT and BEP. The country is relying on initiatives and programs by the developed countries.

One aspect that the country is dependent on to the developed countries is on the alternatives for mercury-containing products. Table 2-8 gives the alternatives to mercury-containing products that are available in the Philippine market.

Table 2-8. Available Alternatives to Mercury-Containing Products

Sources of Mercury	Available Alternatives
Mercurial thermometers	Digital thermometers
Sphygmomanometers	Aneroid sphygmomanometers (mechanical dial) and electronic blood pressure monitors
Dental amalgam as fillers for cavities	Composite resins, glass ionomer cement, or porcelain
Light sources with mercury	Light-emitting diode (LED) lamps
Manometers and gauges	Needle/bourdon gauge, aneroid manometer, and digital manometer
Relays with mercury	Dry magnetic reed relay, solid state relays, other electro mechanical relays, and silicon-controlled rectifiers

Sources of Mercury	Available Alternatives
Batteries containing mercury	Lithium miniature batteries, cylindrical alkaline batteries, and solar-powered products
Mercuric chloride (used as a reagent in laboratory tests and experiments)	Nitric acid

Apart from the items listed in Table 2-8, many other alternatives have been devised while others are currently developed to ensure consumers are not exposed to toxic mercurial products.

Considering the open market and the lack of barriers in terms of having access to the current and emerging BAT and BEP for mercury and mercury-containing wastes, this aspect may not be as critical in terms of the overall management of these wastes.

3.0 GOALS, STRATEGIES, AND ACTION PLANS

The National Action Plan on Mercury and Mercury-containing Wastes Management requires inter-agency and multi-sectoral participation. The characteristic of the life cycle of mercury and mercury-containing wastes in the country necessitates the engagement of several government agencies, institutions, and NGOs. This in turn calls for an effective inter-agency mechanism to facilitate collaboration and a strong and well-resourced coordinating agency to have oversight responsibility.

It is therefore necessary to establish a Steering Committee composed of Department Secretaries, whose composition may be patterned after the Interagency Technical Advisory Council, which is composed of the following agencies:

- DENR
- DOH
- DTI
- DOE
- DOST
- Department of Labor and Employment (DOLE)
- Department of Finance (DOF)
- DA
- Representative from NGOs on health and safety

To support the Steering Committee, a Technical Working Group (TWG) has to be established to do the following:

- Secure commitment/approval from corresponding agencies/organizations
- Implement the action plans
- Monitor and review progress of implementation
- Address gaps when needed
- Provide feedback to stakeholders

The TWG activities will still be guided by the Steering Committee, which will regularly meet to review progress reports on the implementation of the Action Plan.

3.1 OVERARCHING GOAL AND OBJECTIVES

The National Action Plan on Mercury and Mercury-containing Wastes Management consists of several specific strategies and action plans geared towards achieving the set overarching goal of **"Minimizing and, where feasible, eliminating mercury releases to air, water, and land from mercury wastes by adopting Environmentally Sound Management (ESM) of these wastes (following a lifecycle management approach)."**

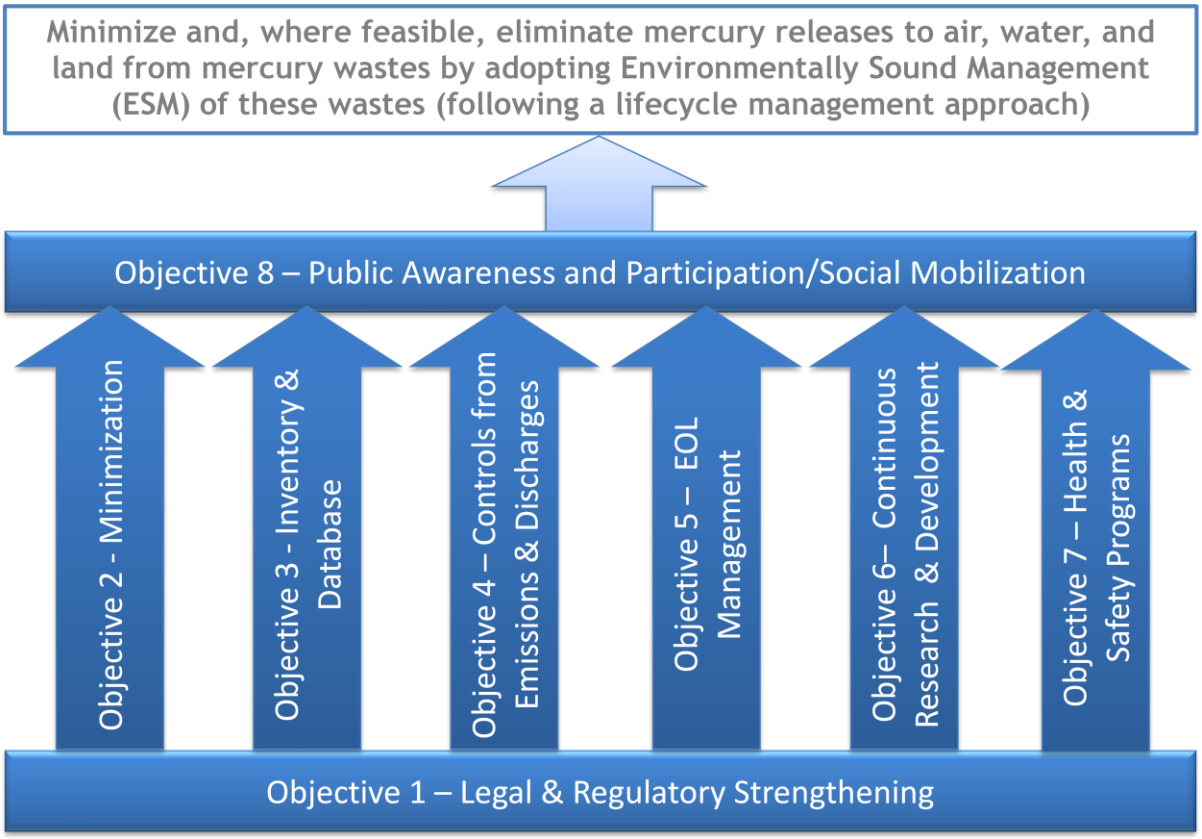
These action plans are designed for a 5-year full implementation. It is expected that an annual review of the Action Plan will be conducted by the TWG and the Steering Committee, particularly towards the set period of the International Convention on Mercury.

The following Strategies and Action Plans define objectives and key actions proposed for the Philippine National Action Plan on Mercury and Mercury-containing Wastes Management:

- Objective 1 – Strengthen legal and regulatory instruments pertaining to mercury and mercury-containing wastes (including mercury-contaminated materials/sites)
- Objective 2 – Minimize if not prevent the use of mercury in products and processes
- Objective 3 – Establish a national inventory and database of mercury and mercury containing wastes (including mercury-contaminated sites)
- Objective 4 – Establish effective controls for mercury removal from waste streams (air, water, sludge, soil)
- Objective 5 – Develop and implement EOL management of mercury and mercury-containing wastes
- Objective 6 – Conduct continual studies on mercury and mercury wastes reduction measures
- Objective 7 – Establish health and safety program for handling mercury and mercury-containing wastes in workplaces
- Objective 8 – Strengthen public participation and IEC on mercury and mercury-containing wastes

A general framework for the National Action Plan on Mercury and Mercury-containing Wastes Management is shown in Figure 3-1.

Figure 3-1. Framework for the National Action Plan on Mercury and Mercury-containing Wastes Management



3.2 STRATEGIES AND ACTION PLANS

Table 3-1 presents the specific strategies and action plans in addressing the issues on mercury and mercury-containing wastes management.

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal:

Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)

Tasks	Implementing Agency	Specific Activity	Project Cost (US$ 1,000)			Proposed Schedule of Costs																			
						Year 1				Year 2				Year 3				Year 4				Year 5			
			Internal	External	Total	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Establish Technical Committee (or use the existing Technical Working Group) to: - Secure commitment/approval from corresponding agencies/organization - Implement the action plans - Monitor and review progress of implementation - Address gaps when needed - Provide feedback to stakeholders	EMB-HWMS	Facilitate the preparation and signing of an inter-agency Memorandum of Agreement (MOA) and Special Order for the creation of the Technical Committee Act as technical secretariat, organize meetings, and prepare documentation requirements (e.g. minutes of meetings)	5		5																				
	DOH, DOE, DOST, DTI, DA	Nominate Department representative, attend meetings, and actively pariticipate in all activities of the Technical Committee																							
Objective 1 - Strengthen Legal and Regulatory Instruments Pertaining to Mercury and Mercury-containing Wastes (including Mercury-contaminated Materials/Sites)																									
Facilitate the amendment of Republic Act (RA) 6969 or the approval/signing of the proposed Bill on Hazardous and Nuclear Wastes Management	DENR-EMB	Work with the Committee on Ecology for the review/approval of the pending Bill Ensure that ESM requirements are embodied in the proposed Bill	50	200	250																				
Finalize, approve, and implement the revised Hazardous Waste Management Guideline, amending DENR AO 2004-36 (with incoporation of the Hazardous Waste Manifest System Database)	DENR-EMB	Work with DENR Policy and Planning for the final review and approval of the revised DENR AO by the Secretary Conduct re-orientation to the EMB ROs for the implementation of the revised DENR AO Inform the public and the regulated community about the revised DENR AO	30	100	130																				
Revise/amend the CCO on Mercury and Mercury Compounds to incoporate ESM requirements of mercury wastes and strengthen its linkage with the Hazardous Waste Management Guideline (DENR AO 2004-36 or its amended version); also include the gradual phase-out / banning of mercury-containing consumer products	DENR-EMB	Work with other government agencies in identifying current products, assessing product life cycle for appropriate timing of gradual phase-out / banning Work with DENR Policy and Planning for the final review and approval of the revised CCO by the Secretary Conduct re-orientation to the EMB ROs for the implementation of the revised CCO Inform the public and the regulated community about the revised CCO	20	300	320																				
	DTI/DOH/DOE	Identify industry sectors/subsectors that are using mercury or have products/supplies containing mercury and develop scheme for gradual phase-out / banning																							

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal: **Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)**																									
Tasks	**Implementing Agency**	**Specific Activity**	**Project Cost (US$ 1,000)**			**Proposed Schedule of Costs**																			
						Year 1				**Year 2**				**Year 3**				**Year 4**				**Year 5**			
			Internal	**External**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Develop and implement local legislations (municipal/city ordinances) on mercury and mercury-containing wastes management to address the domestic sources of these wastes	EMB-NSWMC	Facilitate the development/approval of MOA among the League of Municipalities, Cities, and Provinces of the Philippines (LMP, LCP, LPP), local government, Department of the Interior and Local Government (DILG) for the nationwide implementation Prepare/draft guide ordinance for domestic sources of mercury and mercury containing wastes	10	50	60																				
	DILG LGU	Adopt and implement city/municipal/provincial ordinance on domestic sources of mercury and mercury-containing wastes	20	100	120																				
Develop and implement soil standards and cleanup guidelines	DENR-EMB	Conduct study for the development of standards and guidelines Coordinate with various agencies Work with DENR Policy and Planning for the final review and approval of the standards and guidelines by the Secretary Conduct orientation to the EMB ROs for the implementation of the standards and guidelines Inform the public and the regulated community about the standards and guidelines	30	70	100																				
Review other related regulations such as RA 7394 - Consumers Act of the Phils., Executive Order 301 Government Green Procurement Act and assess how they can be enhanced to complement other regulations on mercury and mercury-containing wastes management	DTI	Assess how these regulations can be anchored on to make the CONSUMER STANDARD for manufacturers, distributors, and importers extend up to end-of-life (EOL) of the product as it affects the consumers	20	50	70																				
	DTI/DOE	Include in the Philippine National Standards for Lighting Products the requirement on mercury content Determine how the same process can be applied to other products containing mercury	20	20	40																				

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal: **Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)**																													
Tasks	**Implementing Agency**	**Specific Activity**	**Project Cost (US$ 1,000)**			**Proposed Schedule of Costs**																							
						Year 1				**Year 2**				**Year 3**				**Year 4**				**Year 5**							
			Internal	**External**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**				
Objective 2 - Minimize if not Prevent the Use of Mercury in Products and Processes																													
Establish a management program where source reduction (using alternative materials or alternative process not requiring mercury), waste minimization (efficient use of mercury in the process), and/or emission reduction/treatment are the critical components	EMB-RDD	Work with private laboratories to search for alternative methods for chemical oxygen demand (COD) analysis; instead of using COD vials that contain mercuric thiocyanate or mercuric sulfate	20	20	40																								
	DOH	Work with the manufacturers/distributors of non-mercury-containing health care instruments to have a better competitive price for the general consumers benefits	10		10																								
	DOH DENR-EMB	Implement to all health care facilities and institutions nationwide, private and public, the DOH AO 2008-21 Gradual Phase-out of Mercury in all Philippine Health Care Facilities and Institutions	100		100																								
	DOH-FDA	Work with suppliers of vaccines to find alternative for thimerosal (sodium ethylmercuric thiosalicylate) as preservative	10	50	60																								
Develop mechanisms whereby manufacturers/distributors will make the following available in the Philippine market: - Products that have less mercury content - Products that have longer life - Products that are made of sturdy material to prevent unintended releases (breakdown, spill, or leak)	DOE	Work with the lighting products industry for the ongoing development of lamps that contain less mercury or have longer product life and have these products available in the market	10	50	60																								
	DTI	Establish product standards for other mercury-containing products, which include disclosure of mercury content	50	100	150																								
	DOF-BOC	Strengthen the control over entry of mecury-containing products to prevent illegal entry of mercury-containing products	50		50																								
Ensure that alternative products, processes, or input materials do not pose greater risk than mercury considering the overall life cycle of the materials, products, or processes	DOST-ITDI	Prepare the required Environmental Technology Evaluation / Environmental Technology Verification (ETE/ETV) studies	50		50																								
	DTI	Check/review substitute materials, products, or processess if these have the appropriate ETE/ETV before introducing in the Philippine market	50		50																								

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal: **Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)**																																	
Tasks	**Implementing Agency**	**Specific Activity**	**Project Cost (US$ 1,000)**			**Proposed Schedule of Costs**																											
						Year 1				**Year 2**				**Year 3**				**Year 4**				**Year 5**											
			Internal	**External**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**								
Objective 3 - Establish a National Inventory and Database of Mercury and Mercury-containing Wastes (including Mercury-contaminated Sites)																																	
Set-up system/network for the national database on mercury and mercury-containing wastes (can be linked with the Hazardous Wastes Manifest System Database once operational)	DENR-EMB	Procure services for the development and establishment of the national database (online)	10	50	60																												
Using the results of the initial inventory, expand further by requiring all establishments governed by existing regulations to submit in detail the types and quantities of mercury and mercury-containing materials/products that they use and/or generate; and the existing waste management practice	EMB-CO	Develop user-friendly with internet interface survey/inventory form for mercury and mercury-containing wastes Collate and input into the database	10	100	110																												
	EMB-RO, NSWC, MGB, DOE, DOH, DA, DepEd, CHED, DILG	Distribute and collect all survey forms from the regulated communities	10	50	60																												
Strengthen the monitoring requirements for mercury in wastewater/effluents and source emissions for those establishments that have the potential to generate mercury in their waste streams. This should be part of the permit renewal/ application.	EMB-RO LLDA	Issue memo to all regulated communities to include and submit in their SMR monitoring results for mercury Submit summary results to EMB CO for entry into the database	50		50																												
Gather/collect sampling and analysis data of mercury from existing and abandoned sites	EMB, MGB DA-FPA, DOH	Identify sites that use or have used mercury in their process, conduct sampling and analysis, and submit results to EMB CO for consolidation in the database	20	100	120																												

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal: **Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)**																									
Tasks	**Implementing Agency**	**Specific Activity**	**Project Cost (US$ 1,000)**			**Proposed Schedule of Costs**																			
						Year 1				**Year 2**				**Year 3**				**Year 4**				**Year 5**			
			Internal	**External**	**Total**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**	**Q1**	**Q2**	**Q3**	**Q4**
Objective 4 - Establish Effective Controls for Mercury Removal from Waste Streams (Air, Water, Sludge, Soil)																									
Strictly enforce the guideline for mercury wastes management as stipulated in the CCO and the Hazardous Wastes Management Guideline (and their amended versions)	EMB RO	Review the submitted SMRs, conduct regular inspection, and subject the violators to fines and penalties	50		50																				
	DOH	Conduct regular inspection to all DOH-owned hospitals Require other hospitals to submit latest copy of SMR with EMB receipt as part of the renewal process of hospital permits. Laiase with PHILHEALTH for the enforcement of these requirements Impose penalties to Health Care Facilities violating the joint DOH-EMB AO and the DOH AO on Mercury Wastes Management	100	100	200																				
Encourage the treatment of wastes from combustion and industrial processes and pollution-control operations to recover, stabilize, or retire mercury in the waste where there is a risk of mercury being released to the environment through any subsequent waste storage, transfer, or disposal operation	EMB RO	Include in the review/assessment of the permitting process the assessment of the controls implemented to reduce/control emissions of mercury	50		50																				
	EMB-EIAMD	Ensure that these requirements are integrated into the EIA process as part of the envionmental mitigation plan of the proponent	50		50																				
Develop pollution prevention policies and programs aimed at reducing the amount of mercury entering wastewater treatment facilities	DENR-EMB	Establish protocols for identifying, analyzing, and reducing these sources of mercury to wastewater treatment facilities Encourage the development of appropriate management techniques to reduce the release of mercury from biosolids or effluents from wastewater treatment facilities	20	100	120																				
	EMB-EIAMD	Ensure that these requirements are integrated into the EIA process as part of the envionmental mitigation plan of the proponent	20	100	120																				
Strict evaluation and monitoring of TSDs for mercury and mercury-containing wastes	DENR-EMB	Use of standardized inspection protocols and checklists Conduct regular inspection Ensure that all manifests are complete Ensure that the Certificates of Treatment (COTs), manifests, and the information submitted in the SMRs are aligned Stricly implement the submission of COT to EMB	20	100	120																				

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal:

Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)

Tasks	Implementing Agency	Specific Activity	Project Cost (US$ 1,000)			Proposed Schedule of Costs																			
						Year 1				Year 2				Year 3				Year 4				Year 5			
			Internal	External	Total	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Objective 5 - Develop and Implement EOL Management of Mercury and Mercury-containing Wastes																									
Developing and enforce legal commitments among producers/importers/distributers of mercury-containing products to take responsibility for EOL Management of these products	DENR-EMB	Assess the feasibility of enforcing EPR to applicable mercury-containing products	20	100	120																				
	DENR-EMB DOE	Conduct study on the implementation of extended producers responsibility (EPR) for lighting and other products including the appropriate collection system and financial mechanisms	20	200	220																				
Prepare and implement short and long term EOL storage/disposal plans for the phased-out mercury-containing products considering the life cycle of these products	DENR-EMB DOH/DOE	Conduct feasbility study on the appropriate EOL management options: 1) long-term storage; 2) interim storage and off country disposal; 3) combination of interim storage with initial mercury recovery for internal consumption; 4) combination of interim storage with initial mercury recovery, and off country disposal	50	300	350																				
	DENR-EMB DOH/DOE	Implement the best management options per type of products for mercury-containing wastes	100	500	600																				
Develop short- and long-term strategy for sites contaminated with mercury	DENR-EMB LGU of concerned	Implement immediate site control to prevent exposure while looking at long-term site remediation or rehabilitation	200	500	700																				

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal:

Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)

Tasks	Implementing Agency	Specific Activity	Project Cost (US$ 1,000)			Proposed Schedule of Costs																			
						Year 1				Year 2				Year 3				Year 4				Year 5			
			Internal	External	Total	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Objective 6 - Conduct Continual Studies on Mercury and Mercury-containing Wastes Reduction Measures																									
Promote the development of research into new reduction technologies	DOST-ITDI	Conduct studies on the available and emerging technolgies, processess, and products that can or can potentially reduce mercury and mercury-containing wastes	50	100	150																				
	DOST	Include in the short- and long-term science and technology plans and programs the support for alternative solutions to processes/products that use mercury	5		5																				
Promote incentives to encourage adoption of emerging technologies for reduction of mercury releases	DTI-BOI	Include in the Investment Priorities Plan the alternative process, technology for mercury-containing product	5		5																				
	DTI DOF	Provide fiscal and other incentives for the adoption of new technology	5		5																				
Promote research on remediation of mercury-contaminated sites	DENR-EMB	Conduct studies and link with international organization for the research and development on cleanup technologies/techniques	50	100	150																				
Objective 7 - Establish Health and Safety Program for Handling Mercury and Mercury-containing Wastes in Workplaces																									
Promote employee awareness on the Health and Safety Programs for handling mercury and mercury-containing wastes in the workplace	DOLE-OSHC DENR-EMB	Develop a standard Health and Safety Program training manual for handling mercury and mercury-containing wastes in the workplace	10	50	60																				
	DOLE-OSHC	Develop training programs to effectively implement mercury waste processing and ensure safety against mercury exposure when processing mercury wastes	10	50	60																				
	DOLE-BWC	Strengthen implementation of personal protective equipment requirements	50		50																				
Establish an Emergency Reponse Program on dealing with accidental release of mercury in the workplace area	DOLE-OSHC DENR-EMB	Develop guidelines in responding to mercury spills/releases in the workplace and in the environment	10	50	60																				
	DOLE-BWC	Enforce the requirements on developing emergency preparedness and response programs and conducting drills to all establishments	50		50																				

Table 3-1. Specific Strategies and Action Plans in Addressing the Issues on Mercury and Mercury-Containing Wastes Management

Goal:

Minimize and, where feasible, Eliminate Mercury Releases to Air, Water, and Land from Mercury Wastes by Adopting Environmentally Sound Management (ESM) of These Wastes (following a Lifecycle Management Approach)

Tasks	Implementing Agency	Specific Activity	Project Cost (US$ 1,000)			Proposed Schedule of Costs																			
						Year 1				Year 2				Year 3				Year 4				Year 5			
			Internal	External	Total	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Objective 8 - Strengthen Public Participation and IEC on Mercury and Mercury-containing Wastes																									
Develop and implement program to increase awareness and understanding of the health and environmental risks of mercury and mercury-containing wastes	DENR-EMB	Set-up databank/library on mercury as source of information for continuous public dissemination	5	50	55																				
	DENR-EMB DOH, DOE, LGU, NGOs	Produce and disseminate IEC materials based on documented testimonials and popularized technical reports and risk studies	20	100	120																				
	DENR-EMB DOH, DOE, LGU, NGOs	Conduct series of seminars and lectures to various organizations both formal and non-formal organizations	20	100	120																				
	DENR-EMB	Initiate media coverage through: * Writing and placement of regular news releases * Conduct of regular press conference * Radio-television guestings by government officials * Use of existing radio and television government programs * Tapping of public affairs programs	50	100	150																				
Create and implement educational programs in all levels	DENR-EMB DepED/CHED	Coordinate with DepED and CHED to integrate awareness on mercury and its health and environmental impacts	10		10																				
	DepED/CHED	Conduct National Orientation seminar and training of potential trainors among teachers and student leaders from different schools nationwide	10	50	60																				
	DepED/CHED	Require schools to have as one of its Outreach Program, the conduct of orientation seminars of the environmental and health effects of mercury and mercury-containing wastes in their respective communities	10		10																				
Build and sustain network information exchange and communication	DENR-EMB	Survey partner stakeholders to establish common interest and preferred communication mechanisms	10	50	60																				
		Maintain regular coordinative meetings, including reporting on updates and the activities with partners (government agencies, NGOs, private sectors) and other stakeholders	50		50																				
		Participate in local, national, and international forums on mercury and mercury-containing wastes management	100		100																				
		Present during regular meetings of business associations	50		50																				
		TOTAL	**1,935**	**4,210**	**6,145**																				

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ANNEX 1
SOURCE OF MERCURY AND MERCURY-CONTAINING WASTES, EXISTING MANAGEMENT, AND APPLICABLE LEGAL REQUIREMENTS

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
1. Extraction and Use of Fuels/Energy Sources					
1.1. Coal combustion in power plants	Air emissions	• Combustion of natural mercury impurities in raw materials • Accumulation in solid incineration residues and flue gas cleaning residues	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
	Residue, ashes		RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
1.2. Other coal combustion	Flue gas cleaning residues, ashes, slag	• Combustion of natural mercury impurities in raw materials • Accumulation in solid incineration residues and flue gas cleaning residues	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					• If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
1.3. Extraction, refining, and use of mineral oil	Incineration residues, refinery products/byproducts, various process wastes, sludge	• Combustion of natural mercury impurities in raw materials • Accumulation in solid incineration residues and flue gas cleaning residues	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	<u>Air Quality Management</u>: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
1.4. Extraction, refining, and use of natural gas	Gas cleaning residues, condensates	• Combustion of natural mercury impurities in raw materials • Accumulation in solid incineration residues and flue gas cleaning residues	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
1.5. Extraction and use of other fossil fuels	Combustion residues, ashes	• Combustion of natural mercury impurities in raw materials • Accumulation in solid incineration residues and flue gas cleaning residues	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
1.6. Biomass fired power and heat production	Ashes, residues	• Combustion of natural mercury impurities in raw materials • Accumulation in solid incineration residues and flue gas cleaning residues	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	<u>Air Quality Management</u>: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
1.7. Geothermal power production	Air emissions	• Combustion of natural mercury impurities in raw materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	<u>Air Quality Management</u>: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
		• Accumulation in solid incineration residues and flue gas cleaning residues			• Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
2. Primary (Virgin) Metal Production					
2.1. Primary extraction and processing of mercury	Air emissions	Pyrometallurgy of mercury ore	No existing mercury mine in the Philippines		
2.2. Metal (aluminium, copper, gold, lead, manganese, mercury, zinc, primary ferrous metal, other non-ferrous metals) extraction and initial processing	Tailings, extraction process residues, exhaust gas cleaning residues, wastewater treatment residues	• Industrial processing • Thermal treatment of ore • Amalgamation	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			RA 9275, DENR AO 2005-10, DENR AO	DENR-EMB Water Quality Management	Water Quality Management • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
			1990-35	Section	• Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.3. Cement production	Process residues, exhaust gas cleaning residues, sludge	Pyroprocessing of natural mercury impurities in raw materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
2.4. Pulp and paper production	Process residues, exhaust gas cleaning residues, sludge	Combustion of natural mercury impurities in raw materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
2.5. Lime production and light weight aggregate kilns	Process residues, exhaust gas cleaning residues, sludge	Calcination of natural mercury impurities in raw materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					• Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
2.6. Coal mining	Air emissions	Emission of natural mercury impurities in raw materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
2.7. Limestone Quarrying	Air emissions	Emission of natural mercury impurities in raw materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
2.8. Chlor-alkali production with mercury-technology	Air emissions	• Mercury cell • Mercury recovery units (retort)	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
	Solid waste contaminated with mercury, elemental mercury, process residues		RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
	Wastewater effluents		RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	<u>Water Quality Management</u> • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.9. Vinyl-chloride-monomer (VCM) production with mercuric dichloride ($HgCl_2$) as catalyst	Process residues	Mercuric chloride process	No existing VCM production using the mercuric dichloride process in the Philippines		
2.10. Acetaldehyde production with mercury-sulfate ($HgSO_4$) as catalyst	Wastewater	Mercury-sulfate process	No existing acetaldehyde production using the mercury sulfate process in the Philippines		
2.11. Other production of chemicals and polymers with mercury compounds as catalysts	Process residues, solid waste, wastewater	Mercury catalyst process	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	<u>Air Quality Management</u>: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					• Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	<u>Water Quality Management</u> • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.12. Thermometers and other measuring devices with mercury	Used, obsolete, or broken products	Liquid mercury	DOH AO 2008-21	DOH	<u>Gradual Phase-out of Mercury</u> • Conduct of Mercury Audit • Development and implementation of Mercury Minimization Program
			Joint DOH-DENR AO 2005-02	DOH DENR-EMB Hazardous Waste Management Section	<u>Health Care Waste Management</u>: **Joint DOH-DENR AO only covers mercury in thermometers and other measuring devices from health care facilities. Used/broken thermometers and other measuring devices from domestic sources are not included and are likewise not clearly covered under "special wastes" in RA 9003. • Mercury from thermometers and other measuring devices are elemental in form and are therefore >0.2 mg/L in concentration and is considered as hazardous waste • Registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					• Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
2.13. Electrical and electronic switches, contacts, and relays with mercury	Used, obsolete, or broken products	Liquid mercury	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
2.14. Light sources with mercury (7.5 mercury·mg/unit on average)	Used, obsolete, or broken products	• Vapour-phase elemental mercury • Divalent mercury adsorbed on the phosphor powder	RA 9003, DENR AO 2001-34	DENR-EMB National Solid Waste Management Commission LGUs	Solid Waste Management (for Special Wastes) **Light sources with mercury from residential and commercial sources may be considered "special wastes" under RA 9003. Depending on concentration of mercury, the requirements of RA 6969 shall apply. • Development and Implementation of Solid Waste Management (by LGUs)
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					• Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
2.15. Batteries containing mercury	Used, obsolete, or broken products	Mercury oxide	RA 9003, DENR AO 2001-34	DENR-EMB National Solid Waste Management Commission LGUs	<u>Solid Waste Management (for Special Wastes)</u> **Batteries containing mercury from residential and commercial sources may be considered "special wastes" under RA 9003. Depending on concentration of mercury, the requirements of RA 6969 shall apply. • Development and Implementation of Solid Waste Management (by LGUs)
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
2.16. Biocides and pesticides	Stockpiles (obsolete pesticides), soil, and solid waste contaminated with mercury	Mercury compounds (mainly ethylmercury chloride)	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: RA 6969 may be applied to stockpiles of obsolete biocides and pesticides. However, no standards exist for management of contaminated soil. • Considered as hazardous waste if

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
2.17. Paints	Stockpiles (obsolete paints), solid waste contaminated with mercury, wastewater treatment residues	Phenylmercuric acetate and similar mercury compounds	RA 9003, DENR AO 2001-34	DENR-EMB National Solid Waste Management Commission LGUs	<u>Solid Waste Management (for Special Wastes)</u> **Paints and used paint containers from residential and commercial sources may be considered "special wastes" under RA 9003. Depending on concentration of mercury, the requirements of RA 6969 shall apply. • Development and Implementation of Solid Waste Management (by LGUs)
			RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
2.18. Pharmaceuticals for human and veterinary uses	Stockpiles (obsolete pharmaceuticals), medical waste	• Thimerosal • Mercuric chloride • Phenyl mercuric nitrate • Mercurochrome	Joint DOH-DENR AO 2005-02, RA 6969, DENR AO 2004-36, DENR AO 1997-38	DOH DENR-EMB Hazardous Waste Management Section	<u>Health Care Waste Management</u>: **Joint DOH-DENR AO covers pharmaceutical wastes from health care facilities. • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			DOH AO 2008-21	DOH	<u>Gradual Phase-out of Mercury</u> • Conduct of Mercury Audit • Development and implementation of Mercury Minimization Program
2.19. Cosmetics and related products	Stockpiles	• Mercury iodide • Ammoniated mercury	RA 6969, DENR AO 2004-36, DENR AO 1997-38, DOH AO 2002-90 (Current Good Manufacturing Guidelines for Cosmetic Products)	DOH DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: DOH AO 2002-90 requires the proper handling of recalled and rejected products that may contain hazardous substances. However, the AO only mentioned disposal "according to appropriate procedures", which were not elaborated on. Likewise, the CCO on Mercury and Mercury Compounds does not specify inclusion of cosmetics and related products as part of its application and coverage.

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
2.20. Dental mercury-amalgam fillings	Stockpiles, wastewater treatment residues	Alloys of mercury, silver, copper, and tin	Joint DOH-DENR AO 2005-02, RA 6969, DENR AO 2004-36, DENR AO 1997-38	DOH DENR-EMB Hazardous Waste Management Section	Health Care Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			DOH AO 2008-21	DOH	Gradual Phase-out of Mercury • Conduct of Mercury Audit • Development and implementation of Mercury Minimization Program
2.21. Manometers and gauges	Used, obsolete, or broken products	Liquid mercury	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
2.22. Laboratory chemicals and equipment	• Stockpiles, wastewater treatment residues, laboratory wastes • Spent, expired, or spilled standard solutions and samples containing mercury	• Liquid mercury • Mercury chloride • Mercuric thiocyanate	RA 6969, DENR AO 2004-36, DENR AO 1997-38, Joint DOH-DENR AO 2005-02	DENR-EMB Hazardous Waste Management Section	<u>Hazardous Waste Management</u>: **Mercury-containing wastes from laboratory chemicals and equipments used for medical/ health care related purposes are covered under the Joint DOH-DENR AO, which essentially follows the requirements of RA 6969 and related DENR AOs • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	<u>Water Quality Management</u> • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
			DOH AO 2008-21	DOH	<u>Gradual Phase-out of Mercury</u> **Health care facilities with laboratories are covered by DOH AO 2008-21 • Conduct of Mercury Audit • Development and implementation of Mercury Minimization Program

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
2.23. Mercury metal use in religious rituals and folklore medicine	Solid waste, wastewater treatment residues	Liquid mercury	RA 6969, DENR AO 2004-36, DENR AO 1997-38, Joint DOH-DENR AO 2005-02	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: **Mercury-containing wastes from practice of alternative medicine are covered under the Joint DOH-DENR AO, which essentially follows the requirements of RA 6969 and related DENR AOs • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system • Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	Water Quality Management • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.24. Miscellaneous product uses, mercury metal uses, and other sources	Stockpiles, wastewater treatment residues, solid wastes	• Infra red detection semiconductors with mercury • Bougie and Cantor tubes • Educational uses	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	Hazardous Waste Management: • Considered as hazardous waste if concentration based on analysis of extract is >0.2 mg/L • If considered as hazardous waste, registration as generator as well as use of accredited transporter and treater are required • Registration of transporter and TSD facility • Compliance with the manifest system

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
					• Quarterly reporting to DENR-EMB on the type and quantity of waste generated, produced, and transported • Development and submission of Mercury Management Plan
			RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	<u>Water Quality Management</u> • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.25. Production of recycled mercury (secondary production)	Extraction process residues, exhaust gas cleaning residues, wastewater treatment residues	• Dismantling of chlor-alkali facilities • Recovery from mercury meters used in natural gas pipelines • Recovery from manometers, thermometers, and other equipment	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	DENR AO 2004-36 covers facilities that are involved in the recycle of hazardous wastes. However, it is not clear in the application and coverage of the CCO for Mercury and Mercury Compounds if recycling is included or if the production of recycled mercury is considered part of the metallurgical industry. Wastes due to the secondary production of mercury-containing products may be covered by the DENR AO on the Management of Hazardous Waste (DENR AO 2004-36).
2.26. Production of recycled ferrous metals (iron and steel)	Extraction process residues, exhaust gas cleaning residues, wastewater treatment residues	• Shredding • Smelting of materials containing mercury	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	DENR AO 2004-36 covers facilities that are involved in the recycle of hazardous wastes. However, it is not clear in the application and coverage of the CCO for Mercury and Mercury Compounds if recycling is included or if the production of recycled ferrous metals is considered part of the metallurgical industry. Wastes due to the secondary production of mercury-containing products may be covered by the DENR AO on the Management of Hazardous Waste (DENR AO 2004-36).

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
2.27. Production of other recycled metals	Extraction process residues, exhaust gas cleaning residues, wastewater treatment residues	Other mercury-containing materials or products / components	RA 6969, DENR AO 2004-36, DENR AO 1997-38	DENR-EMB Hazardous Waste Management Section	DENR AO 2004-36 covers facilities that are involved in the recycle of hazardous wastes. However, it is not clear in the application and coverage of the CCO for Mercury and Mercury Compounds if recycling is included.
2.28. Incineration of municipal/ general waste 2.29. Incineration of hazardous waste 2.30. Incineration of medical waste 2.31. Sewage sludge incineration	Exhaust gas cleaning residues, wastewater treatment residues	• Intentionally used mercury in discarded products and process waste; • Natural mercury impurities in high volume materials (plastics, paper, etc.) and minerals; • Mercury as a human-generated trace pollutant in high volume materials	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Section 20 of RA 8749 bans the incineration or burning of municipal, bio-medical, and hazardous wastes as it emits toxic or hazardous fumes. DENR shall promote the use of state-of-the-art, environmentally-sound, and safe non-burn technologies for the handling, treatment, thermal destruction, utilization, and disposal of sorted, unrecycled, uncomposted municipal, bio-medical, and hazardous wastes.
2.32. Informal waste incineration					LGUs are mandated to promote, encourage, and implement in their respective jurisdiction a comprehensive ecological waste management that includes waste segregation, recycling, and composting. DENR shall promote the use of state-of-the-art, environmentally-sound, and safe non-burn technologies for the handling, treatment, thermal destruction, utilization, and disposal of sorted, unrecycled, uncomposted municipal, bio-medical, and hazardous wastes.
2.33. Controlled landfills/deposits	Exhaust gas cleaning residues, wastewater treatment residues, solid waste contaminated or mixed with mercury	• Intentionally used mercury in spent products and process waste • Natural mercury impurities in bulk materials (plastics, tin cans, etc.) and	RA 9003, DENR AO 2001-34	DENR-EMB National Solid Waste Management Commission, LGUs	RA 9003 does not have specific provisions that address management of mercury in controlled landfills. The following however may be applicable measures to manage mercury-containing wastes: • Leachate collection and removal system to minimize leachate build-up • Monitoring of surface water and groundwater quality and gas emissions

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
		minerals • Mercury as an anthropogenic trace pollutant in bulk materials	RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	Water Quality Management • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.34. Diffuse deposition under some control	Exhaust gas cleaning residues, wastewater treatment residues, solid waste contaminated or mixed with mercury	• Intentionally used mercury in spent products and process waste • Natural mercury impurities in bulk materials (plastics, tin cans, etc.) and minerals • Mercury as an anthropogenic trace pollutant in bulk materials.	RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	Water Quality Management • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
			RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Air Quality Management: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
2.35. Informal local disposal of industrial production waste 2.36. Informal dumping of general waste			RA 9003, DENR AO 2001-34	DENR-EMB National Solid Waste Management Commission LGUs	RA 9003 prohibits dumping of waste matters in public places, such as roads, sidewalks, canals, esteros, or parks; and establishment or causing or permitting the same.
2.37. Wastewater system/ treatment	Wastewater treatment residues, slurry	• Intentionally used mercury in spent products and process waste • Mercury as an anthropogenic trace pollutant in	RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	Water Quality Management • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR

Source of Mercury Waste	Types of Mercury Waste	Causal Factors of Mercury Waste	Applicable Legal & Other Regulations	Governing Agency/ Institutions	Specific Legal Instrument (Permitting, Reporting, Testing)
		bulk materials			
2.38. Crematoria	Exhaust gas cleaning residues, wastewater treatment residues	Dental amalgam fillings	RA 8749, DENR AO 2000-81	DENR-EMB Air Quality Management Section	Gas emissions from crematoria are not included in the prohibited incineration activities. <u>Air Quality Management</u>: • Compliance with NESSAP (5 mg/NCM) • Securing of Permit to Operate or Permit to Construct for new source • Submission of SMR to governing EMB RO to include emission rates and status of compliance with standards
			RA 9275, DENR AO 2005-10, DENR AO 1990-35	DENR-EMB Water Quality Management Section	<u>Water Quality Management</u> • Limit of 0.005 mg/L for discharges into Class A, B, SB, C, and SC water bodies; 0.05 mg/L and 0.01 mg/L for Class SD water body • Securing/Renewal of Discharge Permit • Quarterly submission of SMR
2.39. Cemeteries	Soil contaminated with mercury		No legal reference for mercury contaminated soil	N/A	N/A
2.40. Abandoned mine sites	Tailings, soils, equipment, etc.	Cessation of operations	RA 7942 DENR AO 1996-40	DENR-MGB	Submission of Final Mine Rehabilitation and/or Decommissioning plan five years before the final decommissioning of the contract/mining area to include financial requirements up to post-decommissioning over a 10-year period

ANNEX 2
EXISTING PROGRAMS FOR MONITORING MERCURY AND MERCURY-CONTAINING WASTES

Mercury Contamination Sources	Types of Monitoring	Purpose of Monitoring	Governing Regulations	Criteria	Implementing Agencies	Established Method of Analysis
Water Resources (Rivers, Seas, Lakes, Groundwater)						
• Erosion of mercury-contaminated soil into adjacent water systems • Precipitation of Hg^{2+} from the atmosphere to surface terrestrial and aquatic systems • Urban sources such as road construction and domestic sewage discharge • Discharge of process water used in mining activities	Ground Water Quality Monitoring	• Determine levels of mercury • As part of water classification • Part of environmental impact assessment preparation	No regulations covering the monitoring of mercury in groundwater	No available data on criteria used	• EMB-WQMS • Private companies as part of ECC Conditions	No available data on method used
	Surface Water Quality Monitoring		• RA 9275 • DENR AO 1990-34 (with pending amendment) • DENR AO 2005-10	0.002 mg/L (Classes AA, A, B, C, D, SA, SB, and SC)		CV-AAS
	Drinking Water Quality Monitoring	Ensure potable drinking water	• PD 856 • DOH AO 2007-12	0.001 mg/L	DOH	CV-AAS
Wastewater/Effluent						
By-products of production/business process	Effluent Quality Monitoring	• Mitigate pollution of water bodies • Determine and minimize impacts to human health and aquatic and other terrestrial life	• RA 9275 • DENR AO 1990-35 (with pending amendment) • DENR AO 2005-10	• Discharge and/or trade effluent is not allowed for Classes AA and SA • 0.005 mg/L (Classes A, B, C, SB, and SC) • 0.01 mg/L (Class SD)	• EMB-WQMS • Laguna Lake Development Authority • Private companies as required in the quarterly submission of SMRs (DENR AO 2003-27)	• CV-AAS
Land/Soil						
• Deposition of atmospheric mercury to the ground by wet or dry deposition • Use of pesticides and fungicides with mercury content	No available monitoring program	No available data	No regulations covering the monitoring of mercury in soils	No available data on criteria used	DA-Bureau of Soils and Water Management (BSWM)	No available data on method used

Mercury Contamination Sources	Types of Monitoring	Purpose of Monitoring	Governing Regulations	Criteria	Implementing Agencies	Established Method of Analysis
Ambient Air						
• Emissions from coal combustion • Waste incineration, including waste refuse, medical waste, and sewage sludge • Degassing from mercury mineral deposits and mercury-contaminated aquatic and terrestrial systems • Mercury emissions from amalgamation process used in mining activities	Ambient Air Quality Monitoring	Control mercury pollution in the atmosphere	• RA 8749 • DENR AO 2000-81	No criteria for mercury in the National Ambient Air Quality Guideline Values	EMB-AQMS	No available method for mercury monitoring in ambient air
Source Emission						
By-products of combustion of materials containing mercury	Source Emission Monitoring	Part of regulatory requirements	• RA 8749 • DENR AO 2000-81	• 5 mg/NCM as elemental Hg (NESSAP) • 0.05 mg/NCM (Treatment facilities using non-burn technologies)	• EMB-AQMS • Private companies as required in the quarterly submission of SMRs (DENR AO 2003-27)	CV-AAS
Solid Wastes						
• By-products of production/business process • Unintended releases • Contamination with mercury-containing materials	TCLP	Determine mobility of mercury in wastes	• RA 6969 • DENR AO 1992-29 • DENR AO 1997-38 • DENR AO 2004-36	0.0002 mg/L	EMB-HWMS	US EPA Method 7471a

Mercury Contamination Sources	Types of Monitoring	Purpose of Monitoring	Governing Regulations	Criteria	Implementing Agencies	Established Method of Analysis
Work Environment						
• Unintended releases during work production • Occupational exposure to mercury (such as in production of batteries, switches, and fluorescent light bulbs)	Work Environment Monitoring	Workers health and safety program	Philippine OSHS (PD 442)	No mercury exposure is allowed for an 8-hour workday and a total of 48 hours work per week	OSH Center (DOLE)	No prescribed method of analysis
Human Exposure						
• Consumption of seafood contaminated with methyl mercury (MeHg) • Vapor from mercury-silver amalgams used to fill dental cavities • Inhalation of volatilized mercury	No available monitoring program but there is capability for testing (blood, urine, serum, hair, and nails)	Ensure safety of people from harmful effects of mercury	No regulations covering the monitoring of mercury in humans	No available data on criteria used	DOH (Environmental Health Program)	CV-AAS
Animals						
Bioaccumulation through the food chain, causing high levels of mercury contamination in fish	Fish Products Monitoring	Ensure safety of fish products for human consumption	Food Regulations Standard Applied to Fish (FAO Circular No. 825)	0.5 ppm	BFAR	No available data
	Thermally Processed Fish Monitoring	Ensure safety of fish products for human consumption	PNS-BFAD 2006-06	0.1 mg/kg (calculated as MeHg)	FDA	No prescribed method of analysis